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Email: info.ssdck@gmail.com

Website : www.ssdckanpur.org

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IMPACT OF BGA AS BIOFERTILIZER ON MINERAL COMPOSITION OF BARLEY (*HORDIUM VULGARE*, L. VAR. RD-2552) PLANTS

Anoop K. Mishra, N.B. Shakya* and N. Mohan**

Department of Botany, D.A-V. College, Deharadoon.

*Department of Botany, D.A-V. College, Kanpur.

**Principal, Shri Shakti Degree College, Shankahari, Ghatampur, Kanpur..

ABSTRACT

Barley (*Hordium vulgare*, L. Var. RD-2552) plant raised in soil-pot culture condition with different doses nil (control), 25, 50, 75, 100, 125, 150, 175 and 200 g bga/kg soil. As compared to control, 125 g bga/kg soil showed highly significant ($P=0.01$) increase in calcium of tops of 30 days, tops of 90 and grains of 100 days at 150 g and leaves of 90 days at 200 g bga/kg soil, potassium content in tops 30 days at 125 g and both tops and leaves at 90 days and grains of 100 days old plants showed highly significant ($P=0.01$) increase at 200 g bga/kg soil over control. Magnesium content in tops of 30 days at 175 g bga/kg soil and both tops and leaves of 90 days and at 200 g bga/kg soil and grains of 100 days old plants showed maximum values at 100 g bga/kg soil. Maximum values for nitrogen and iron content were observed between 175 to 200 g bga/kg soil level and these values were highly significantly ($P=0.01$) higher than values at control.

KEY WORDS: Barley, bga, biofertilizer.

INTRODUCTION:

Since India's independence in 1947 till the mid eighties, spectacular development of agriculture took place, with the adoption of improved agriculture technologies by farmers leading to green revolution in food grain production and white revolution in milk production. Simultaneous it has given rise to population of nature in various ways, thus it is becoming in sustaining the crop production continuous imbalanced use of fertilizers has caused alarm regarding possible side effect in relation to environmental pollution. Repeated use of chemical fertilizer is causing the soil to become more and more hard and impervious to water (Kaushik, *et al.* 2005). Therefore bga as biofertilizer is used to boost up to the yield of crop sustainable basis without affecting environment.

In India, the benefits of blue green algal inoculation have been demonstrated in post as well as field trails by a number of workers in different soil conditions using different varieties which need high levels of nitrogenous fertilizers also respond to algal inoculation by increasing yield up to 10-15 percent, which has been attributed to the growth promoting substances secreted by blue green algae. The Indian work has shown that in areas where nitrogenous fertilizers are scarcely used, blue green algal inoculation can supply 25-30 kg N / ha of nitrogen need of the

rice crop. It is, however, possible that for various reasons, the introduced algae may not be able to establish where response to algal inoculation may be poor (Singh, 1961; Relwani and Subramanyam, 1963; Subramanyam *et al.*, 1964; Goyal and Venkataraman, 1971; Sankaram, 1971; Aiyar, *et al.*, 1972; Venkataraman, 1972)

METHOD:

Barley (*Hordium vulgare*, L. Var. RD-2552) plant raised in soil-pot culture condition. soil amendment with bga as biofertilizer were nil (control), 25, 50, 75, 100, 125, 150, 175 and 200 g bga/kg soil. Tops at 30 days, both tops and leaves at 90 days, and grains at 100 days were taken for estimation of tissue concentration of plants. The details of soil preparation with blue green algae (purchased from IFFCO, Phulpur, Allahabad) as biofertilizer, culture of plants and estimation of calcium, potassium, magnesium, nitrogen and iron, the details of procedure were same as described earlier by Mishra (2000).

RESULTS AND DISCUSSION: (TABLE 1)

Calcium content of barley plants increased with the increase in bga up to 125 g bga / kg soil level in tops of 30 days, up to 125 g bga / kg soil in tops of 30 days, up to 150 g bga / kg soil in tops of 90 and fruit of 100 days, and up to 200 g bga / kg soil in leaves of 90 days old plant. Beyond these level, further increase in bga supply decreased the calcium content of plants. As compared to control, all the level of bga supply tested showed a highly significant ($P=0.01$) decreased in calcium content of tops of 30 days, both tops and leaves of 90 days and grains of 100 days old barley plant.

Increase in potassium content was found to be highly significant ($P=0.01$) at 25 g bga / kg soil over control, 50 g bga / kg soil over 25 g bga / kg soil and 100 g bga / kg soil over 75 g bga / kg soil in tops of 30 days, both tops and leaves of 90 days and grains of 100 days, 75 g bga / kg soil over 50 g bga / kg soil, 125 g bga / kg soil over 100 g bga / kg soil in tops of 30 and both tops and leaves of 90 days at 150 g bga / kg soil over 125 g bga / kg soil and 175 g bga / kg soil over 150 g bga / kg soil in both tops and leaves of 90 days, and at 200 over 175 g bga / kg soil in leaves of 90 days old plants, and fails to reach the level of significance at 75 g bga / kg soil over 50 g bga / kg soil in grains of 100 days and 200 over 175 g bga / kg soil in tops of 90 days old plants.

Up to 100 g bga / kg soil in grains of 100 days, up to 175 g bga / kg soil in tops of 30 days, and up to 200 g bga / kg soil in both tops and leaves of 90 days old barley plants, increase in bga supply increased the magnesium content of plants. Beyond 175 g bga / kg soil in tops of 30 days and beyond 100 g bga / kg soil in grains of 100 days, further increase in bga supply decreased the magnesium content of plants.

Nitrogen content of barley plants increased with the increase in bga supply up to 175

g bga / kg soil in tops of 30 and grains of 100 days, and up to 200 g bga / kg soil in both tops and leaves of 90 days old plants. Beyond 175 g bga / kg soil in tops of 30 and grains of 100 days, further increase in bga supply decreased the nitrogen content of barley plants.

Maximum iron content was observed at 150 g bga / kg soil in tops of 30, 175 g bga / kg soil over 150 g bga / kg soil in leaves of 90 days and at 200 g bga / kg soil in tops of 90 and grains of 100 days old barley plants.

Generally, 170 to 200 g blue green algae per kg soil increased the tissue concentration of calcium, potassium, magnesium, nitrogen and iron content of tops, leaves and fruits of darley plants. This increase in tissue concentration of mineral nutrient elements is in conformity with the earlier findings of Mohan, *et al.* (2002, 2003, 2004, 2006), Mohan, (2004) and Singh *at al.* (2004).

Overall, blue green algae as biofertilizer, was found to be the best for qualitative and quantitative improvement of tomato plants. The above finding for biofertilizer is also supported by the observations made by Singh and Singh (1983), Singh and Bisoyi (1993), Pasricha *et al.* (1996) and Vaishampayan *et al.* (1998).

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Table : 1
Tissue concentration of Barley (*Hordium vulgare*, L. Var. RD -2552) plants as influenced by blue green algae as biofertilizer

Plants		g bga / kg soil									L.S.D. at	
Days	Part	Nil	25	50	75	100	125	150	175	200	P=0.05	P=0.01
Percent Calcium D.M.												
30	Tops	2.62	2.78	2.84	2.89	2.90	2.94	2.93	2.89	2.88	0.01	0.02
90	Tops	2.01	2.11	2.23	2.35	2.35	2.73	3.11	3.02	3.00	0.01	0.02
90	Leaves	1.24	1.42	1.55	1.74	1.77	1.79	1.89	2.33	2.36	0.02	0.03
100	Grains	0.45	0.50	0.55	0.65	0.67	0.68	0.71	0.68	0.66	0.01	0.02
Percent Potassium D.M.												
30	Tops	4.14	4.20	4.31	4.44	4.63	4.92	4.81	4.61	4.57	0.02	0.03
90	Tops	0.88	0.92	1.04	1.12	1.41	1.54	1.70	1.93	1.94	0.02	0.03
90	Leaves	1.12	1.32	1.44	1.57	1.72	1.82	1.95	2.05	2.08	0.02	0.03
100	Grains	0.51	0.62	0.74	0.75	0.79	0.63	0.60	0.57	0.55	0.01	0.02
Percent Magnesium D.M.												
30	Tops	0.91	0.95	0.96	0.99	1.03	1.08	1.14	1.18	1.12	0.01	0.02
90	Tops	0.67	0.72	0.75	0.84	0.85	0.86	0.88	0.90	0.92	0.02	0.03
90	Leaves	0.80	0.93	1.02	1.04	1.08	1.12	1.15	1.17	1.83	0.02	0.03
100	Grains	0.47	0.49	0.50	0.54	0.60	0.58	0.55	0.52	0.50	0.02	0.03
Percent Nitrogen D.M.												
30	Tops	2.58	2.61	2.63	2.74	2.75	2.78	2.89	2.98	2.83	0.02	0.03
90	Tops	1.07	1.11	1.27	1.35	1.38	1.44	1.55	1.64	1.73	0.02	0.03
90	Leaves	1.66	1.72	1.96	2.21	2.15	2.23	2.32	2.53	2.55	0.02	0.03
100	Grains	1.72	1.76	1.83	1.88	1.95	1.96	2.00	2.04	2.01	0.01	0.02
ppm iron D.M.												
30	Tops	244	264	272	288	342	357	382	379	376	20	28
90	Tops	107	125	137	147	151	155	158	176	190	6	9
90	Leaves	82	117	125	138	143	145	150	156	154	6	9
100	Grains	73	74	78	82	84	85	88	97	102	5	7

WATER VAPOUR NUCLEATION ON PARTIALLY WETTABLE AEROSOL PARTICLES

Dr. Devesh Dwivedi*

Physics Deptt. Shri Shakti Degree College,

Sankhahari, Ghatampur, Kanpur Nagar-209206

ABSTRACT

It has been assumed that nucleation takes place on partially wettable aerosol particles. In the classical model of drop condensation. The Gibb's free energy of the system is given by:

$$\Delta G_{\text{tot}} = \left[-\frac{4}{3}\pi r_w^3 \Delta G_{\text{vol}} + 4\pi r_w^2 \sigma_{w/v} \right] f(m_{w/v}) \quad (1)$$

Where $m_{w/v} = \cos \phi$, ϕ being the contact angle; r_w the radius of droplet; $\sigma_{w/v}$ the surface free energy of water in contact with water vapour; ΔG_{vol} the Gibb's free energy per unit volume per mole.

In presence of an ion of charge number Z , the Gibb's free energy is modified by an extra electrostatic term $3/5 (Ze)^2/r_w'$, where r_w' is the new radius of drop. The minimum size of drops is obtained by setting $\partial/\partial r_w (\Delta G_{\text{tot}})$ and $\partial/\partial r_w' (\Delta G_{\text{tot}}')$ each equal to zero. However the minimum size of the charged drop $r_w'^*$ could not be obtained directly. With increasing supersaturation r_w^* decreased very fast while $r_w'^*$ increases slowly. At a supersaturation ratio of about 5.5 both the sizes become equal. The ratio

$$R^* = J_w'/J_w = [r_w'^*/r_w^*]^2 \exp [(\Delta G_{\text{tot}}^* - \Delta G_{\text{tot}}'^*)/kT] \quad (2)$$

Where J_w is the nucleation rate in absence of ions while J_w' , in presence of ion; k , Boltzmann constant, T , the absolute temperature, ΔG_{tot}^* and $\Delta G_{\text{tot}}'^*$ the nucleation rates in absence and in presence of ions. The variation of R with contact angle for different values of supersaturation ratios shows that the rate of nucleation of charged drop is very high for low supersaturation ratios. The critical angle ϕ_c above which the value of $\ln(R)$ is positive increases with increasing supersaturation ratio.

INTRODUCTION

Mason (1971) has mentioned the water vapour condensation on ions.

Varshneya (1969), in an attempt to detect the ionizing radiation through

supercooled liquids, demonstrated that really the ice germ nucleation on ions was possible. Later he gave the theory of homogeneous condensation and ice nucleation on ions, Varshneya (1971). The surface kinetics process that can contribute to the growth behaviour of ice crystals from the vapour phase are revised and proposed by Levi and Nasello (2003).

An extensive amount of work has been done and is being on the phenomenon of solar terrestrial relationship. But to the authors knowledge no attempt has been made to explain correlation of annual rain and snow falls with sunspot numbers. The inertia effect among drops moving within a turbulent cloud on size distribution evolution and formation of rain has been discussed by Pinsky and Khain (1998). The present paper attempts to search a mechanism for the above correlation. Authors propose that the local heating due to solar radiation causes the uplift of moist air, thus forming the cloud, and the drop and hail formation takes place on atmospheric ions produced by galactic cosmic rays and solar wind particles. With decreasing of cosmic ray intensity caused by increasing of solar activity or in some short periods of Forbush-decreases, the intensity of secondary cosmic ray relativistic electrons decreases and the probability of formation of the thunderstorm clouds and discharges between clouds or between clouds and ground is also expected to decrease, Dormana & Dormanc (2005). Latitudinal variation of the kind of correlation has been explained in terms of the galactic cosmic rays by solar wind.

THEORY

Van, Eijk and Tranchant (2002) has mentioned that aerosol play an important role in a variety of process, in the marine boundary layer. They transfer water vapour, heat and matter, through the air sea interface, interact with the fields of temperature and humidity by evaporation and condensation and may act as condensation nuclei in the formation of clouds & fog. A volatile liquid wetting a substrate forms a thick, uniform film in equilibrium with a saturated vapor phase. We show that under evaporating conditions such a liquid is effectively non-wetting

i.e. stable as a droplet on top of a thin film. This is in agreement with recent observations proposed by Elbaum, Lipson and Wettlaufer (1995).

Gorbunov. et al. (2004) mentioned that in the case of partially wettable spherical insoluble core is considered. The theory links the interfacial free energies of the surfaces, the size of the insoluble core, and the chemical characteristics of the soluble substances with the ability of the aerosols to form water droplets. The theory is compared with Kohler theory and major differences in the equilibrium pressure of water vapour and nucleation rate were found. In the classical models of drop condensation the Gibb's function has been taken into consideration. However, Abraham (1968) has shown that the Helmholtz free energy is the proper thermodynamic potential and the Gibb's function is only its approximation.

For practical purposes, the resulting difference turns out to be negligible. The Helmholtz free energy of the system is given by Pruppacher and Klett (1978).

$$\Delta G_w = [-4/3\pi r_w^3 \Delta G_{vol} + 4\pi r_w^2 \sigma_{w/v}] f(m_{w/v}) \quad (1)$$

Where

$$f(m_{w/v}) = (2 + m_{w/v})(1 - m_{w/v})^2$$

and

$$\Delta G_w = \sigma_w RT \ln(S_{v/w})/M_w$$

Where

σ_w = density of the condensed phase (water); R = gas constant; T = Temperature in K; $S_{v/w}$ = Supersaturation ratio; M_w = molecular weight of water; $m_{w/v} = \cos \Phi$; and Φ = contact angle of the drop surface with the surface of the aerosol particles.

It the presence of an ion of charge number Z the Helmholtz free energy is modified by Varshneya (1971), and is given by -

$$\Delta G_i = [-4/3\pi r_i^3 \Delta G_{vol} + 4\pi r_i^2 \sigma_{w/v} + 3/5 (Ze)^2/r_i] f(m_{w/v}) \quad (2)$$

Where r_i is the new radius of the drop. If the size of the condensed drop is more than the above values of r 's, the drops increase in size, otherwise they evaporate. This minimum size of the drop is obtained by setting $\partial/\partial r_w (\Delta G)$ and $\partial/\partial r_i (\Delta G_i)$ each equal to zero. Thus the minimum size of the uncharged drops r for cloud nucleation is given by -

$$r = 2\sigma_{w/v}/\Delta G_{vol} \quad (3)$$

However the minimum size of the charged drop r_i could not be obtained directly. It has been obtained numerically. At a supersaturation ratio of about 5.5 both the sizes become equal. The Helmholtz free energy for minimum sizes of the drops is now given by -

$$\Delta G_w = [-4/3\pi r_w^3 \Delta G_{vol} + 4\pi r_w^2 \sigma_{w/v}] f(m_{w/v}) \quad (4)$$

and

$$\Delta G_i = [-4/3\pi r_i^3 \Delta G_{vol} + 4\pi r_i^2 \sigma_{w/v} + 3/5 (Ze)^2/r_i] f(m_{w/v}) \quad (5)$$

$$J_s = \left[\pi Z_s e_s r_w^2 / (2\pi m_w kT)^{1/2} C_s \exp(-\Delta G/kT) \right] \quad (6)$$

Corresponding rates of nucleation drops is given by-

$$J_{si} = \left[\pi Z_s e_s r_i^2 / (2\pi m_w kT)^{1/2} C_s \exp(-\Delta G_i/kT) \right] \quad (7)$$

Where k is the Boltzmann constant and T is the temperature at which nucleation takes place, Z_s is the Zeldovich factor for surface nucleation, which is a function of ΔG_i and the temperature at which nucleation takes place, C_s is the concentration of single water molecules adsorbed on the surface and e_s is the vapour pressure.

The pre-factor to the exponential term in eq. (6), (7). Fletcher (1962) estimated to be of the order of 10^{24} to $10^{27} \text{ cm}^{-2} \text{ sec}^{-1}$. However for our purpose we divide equation (6) and (7). Thus the ratio R of the rate of nucleation of charged to uncharged drop is given by -

$$R = J_{si}/J_s = \left(r_i / r_w \right)^2 \exp [(\Delta G - \Delta G_i)/kT] \quad (8)$$

Through the Zeldowich factor Z_s is function of $(\Delta G)^{1/2}$ we have not considered its variation with the state of ionization. For the practical purposes the influence on the value of R is negligible.

Result & Discussion

It is clear from the above theory that there is variation of R with the contact angle for different values of supersaturation ratio $S_{v/w}$. Thus the rate of nucleation of charged drops is very high for low supersaturation ratios. As the supersaturation ratio increases, the value of R decreases. At a supersaturation ratio of 2.5, $\ln(R)$ is positive only above a contact angle of 72° . Thus at $S_{v/w}=2.5$, the nucleation of charged drops is ineffective compared to the uncharged drops. However, above about $S_{v/w} = 2.5$, the value of R remains always less than 1 and the nucleation on uncharged drops is dominant.

The critical angle Φ_c above which the value of $\ln(R)$ is positive increases with increasing supersaturation ratio. Therefore Φ_c decreases with decreasing temperature. The calculations have been made for contact angles of 40° and 50° at the supersaturation of 1.7. At $\Phi = 50^\circ$, the value of R increases by 5 orders of magnitude for the temperature change from 0 to 40 K. At $\Phi=40^\circ$ this increase is only by a factor of 59.

Thus it is evident that the parameter $\ln(R)$ depends highly on the contact angle Φ . The value of Φ ranges from 0 for Cadmium Iodide to 110° - 117° for Teflon, Pruppacher & Klett (1978).

For good nucleating substances like Platinum, Silver Iodide, Silver Chloride, Quartz and Beach Sand it ranges from 9° to 50° .

Conclusion

The present study provides a basis to conclude that the rate of nucleation of charged drops is very high i.e. nucleation of charged drops is more effective at lower temperatures.

For positive value of $\ln(R)$ there is a linear relation between contact angle Φ_c and supersaturation ratio.

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BIOPESTICIDES

Dr. Bhawna Sharma (Associate Professor (Botany))

Shri Shakti Degree College

Sankhahari Ghatampur Kanpur -209206

Email-bhawnasharma2468@gmail.com

ABSTRACT

- Bio pesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. For example, canola oil and baking soda have pesticidal applications and are considered biopesticides. At the end of 2001, there were approximately 195 registered biopesticide active ingredients and 780 products. The most widely used microbial pesticides are subspecies and strains of *Bacillus thuringiensis*, or Bt. Each strain of this bacterium produces a different mix of proteins, and specifically kills one or a few related species of insect larvae. While some Bt's control moth larvae found on plants, other Bt's are specific for larvae of Plant-Incorporated-Protectants (PIPs) are pesticidal substances that plants produce from genetic material that has been added to the plant. For example, scientists can take the gene for the Bt pesticidal protein, and introduce the gene into the plant's own genetic material. Then the plant, instead of the Bt bacterium, manufactures the substance that destroys the pest. The protein and its genetic material, but not the plant itself, are regulated by EPA.
- Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Conventional pesticides, by contrast, are, in general, synthetic materials that directly kill or inactivate the pest. Biochemical pesticides include substances, such as insect sex pheromones, that interfere with mating, as well as various scented plant extracts that attract insect pests to traps. Because it is sometimes difficult to determine whether a substance meets the criteria for classification as a biochemical pesticide, EPA has established a special committee to make such decisions, flies and mosquitoes.

Green Energy

By- DR. Bhawna Sharma

(Associate Professor (Botany))

Shri Shakti Degree College ,

Sankhahari,Ghatampur,Kanpur-209206

Email-bhawnasharma2468@gmail.com

ABSTRACT

Green energy is a clean, sustainable approach to producing and using energy in Ontario. The agricultural sector is a natural focus for green energy initiatives since many farmers are generating renewable electricity through biogas, solar and micro-hydro systems. Green energy is a clean, sustainable .As global supply of oil, coal and natural gas shrink and as climate change becomes an increasingly important environmental concern, green energy is clearly the way of the future. The agricultural sector is a natural focus for green energy initiatives. Already, many farmers are generating renewable electricity through wind, biogas, solar and micro-hydro systems. Others are capturing energy from the ground and using it for heating and cooling, or growing energy crops that can be used to heat buildings or fuel vehicles. Green energy benefits all Ontarians by reducing air pollution and curbing the greenhouse gas emissions that are driving climate change, but there are also good business reasons to conserve energy or install a renewable energy system. Using less energy saves you money a direct benefit to your bottom line.

EMBEDDED SOFTWARE DEVELOPMENT BASED ON VIRTUAL FILE SYSTEM

VIVEK TRIVEDI

Asst. Professor (Computer Application)

Shri Shakti Degree College,Sankhahari,Ghatampur,Kanpur Nagar-209206

Abstract

We present an approach to simplify the software development process for embedded systems by supporting key development tasks such as debugging, tracing and configuration. The approach is based on the use of distributed file system abstractions; principal building blocks within an embedded system in the form of “systems on chip”(SoC) export file system abstractions that are composed together up the system hierarchy, and provide familiar file based interfaces with which to interact with the entire system. The central question addressed in this thesis is as to how the workstation centric idea of a distributed file system can be implemented and effectively applied to facilitate various software development tasks in the embedded domain. To this end, a primary contribution of our work is the realization of distributed file system implementations that are compatible with resource constrained embedded architectures. We demonstrate use of the file systems in enabling debugging and tracing in heterogeneous, multiprocessor environments, while addressing issues central to SoC based systems. The virtual file system model is also applied to facilitate us-age, configuration and deployment in a contrasting embedded application domain in the form of distributed sensor networks, thereby demonstrating the its adaptability.

Introduction

Embedded systems find application in diverse fields including consumer electronics, automobiles, aviation, industrial systems, and communication. At the core of these systems are one or more programmable processors concurrently executing software that support system functionality. This dissertation presents an approach to debug, trace, configure and interact with software executing within multi-processor embedded systems through the use of virtual file system abstractions.

The underlying tenet behind the presented work is that a scalable solution for supporting de-bugging and tracing of software in multi-processor embedded systems can be obtained using distributed file system abstractions. In using this approach,

individual building blocks within an embedded system export file system abstractions that are composed together up the system hierarchy, and provide familiar file based interfaces with which to interact with the entire system. Apart from supporting embedded software debugging and tracing, these file system abstractions are well-equipped to meet demands imposed by recent advances in system design, most notably the advent system-on-chip (SoC) based devices.

The central question addressed in this thesis is as to how the workstation centric idea of a distributed file system can be implemented and effectively applied to facilitate various software development tasks in the embedded domain. To this end, a primary contribution of our work is the realization of distributed file system implementations that are compatible with resource constrained embedded architectures .We demonstrate use of the file system architecture in enabling debugging and tracing in heterogeneous, multiprocessor environments, while addressing issues central to SoC based systems such as concurrent debugging, intellectual property (IP) concealment, and development of system level debug solutions. The file system model is also applied to facilitate usage, configuration and deployment in a contrasting embedded application domain in the form of distributed sensor networks, thereby demonstrating its adaptability.

Methodology

A fundamental technique used in this dissertation is to extend the conventional notion of a file from merely being a means to access data residing on a storage device (such as a hard disk) to an entity that provides a standard, familiar interface with which to access and control resources of various kinds .The model that we use to build file based abstractions comprises of file systems implemented by various building blocks within an embedded system, which are exported and accessed externally to interact with the system. The focus of this dissertation is the design of techniques that enable implementation of such file systems within embedded systems, and the illustration of their use for debugging, tracing, monitoring and configuration.

To illustrate use of file abstractions in the embedded domain, we describe how they can be used to facilitate various software development tasks such as debugging, configuration and monitoring for a network processor such as the Intel IXP2850[67].The core responsibility of such a device is to facilitate packet switching and content processing within networking devices such as routers.

The architecture of the IXP2850 broadly consists of a *control* and a *data* section, as shown in Figure 1.1, implemented respectively using an Intel X Scale processor and 16 multi-threaded 'micro engines '. Packets entering the network processor through the ingress port, flow through the *data plane* within the processor ,where they are progressively processed by various micro engines and directed out to the appropriate egress port. The X Scale processor enables control operations such as router table updates and micro engine control ,through an interface exported over a separate *control plane*.

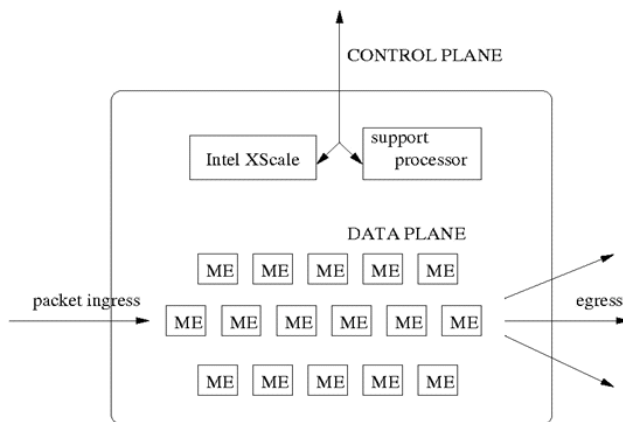


Figure 1.1: IXP2850 Network Processor Architecture

Software debugging support for such a device allows external debugging agents to access various constituent processors (Scale processor and micro engines) concurrently during execution. Using file system abstractions, software debugging can be supported by exporting from within the device a namespace with files to enable run control of each of the constituent processors. Listing 1.1 shows one such namespace wherein each processor has a separate directory with files to access Processor memory , registers, check status and control execution.

Monitoring allows various aspects of the network processor execution to be observed during its operation. It can be used to detect trends in device operation, observe its general well-being and to keep track of relevant metrics. Examples of operational data

that may be exposed through the file interface to facilitate monitoring include counts of packets discarded based on security (virus/spam) concerns, and 'data meters' representing volume of data routed to various domains, measured for purposes of billing. Configuration interfaces exposed through control files enable control of various aspects of the device operation, including routing, load balancing, and control of micro engine operation. Listing 1.2 depicts a possible file based monitoring and configuration interface for the network processor.

Listing 1.1: File system Namespace for NP debugging

```
\NPfs X Scale\ registers memory status ctl microeng1\ registers ..... microeng2\ .....
microeng16\
```

Listing 1.2: File system namespace for monitoring & configuration

```
/NPcounters/ dropped Packets meters/10 11 x12 1 x config/routectl micro eng ctl
```

The model used in our work implements file systems within embedded systems using a designated processor (called 'support processor') which are exported using available communication links. Clients access the exported file system by mounting them within their local operating system namespaces, after which the file system contents are largely indistinguishable from local files. An advantage of this approach is that a single exported file interface can simultaneously support several major software development tasks.

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VERMICOMPOST: A POWERFUL GROWTH PROMOTER FOR CROP PLANTS

J. Mohan, Pratibha Katiyar and *Shyam Narayan

Department of Botany, D.A-V. College, Kanpur

* Department of Botany, Patel Vidhyapeeth Mahavidhyalaya, Barore Kanpur

ABSTRACT

An experiment was conducted to study the effect of vermicompost on Tomato (*Lycopersicum esculantum*, mill. Var. Azad T₂) plants raised in soil-pot culture condition with different doses nil (control), 50, 100 and 200 g Vermicompost/kg soil. As compared to control, 200 g Vermicompost/kg soil showed highly significant (P=0.01) increase in dry matter yield of tops of 40 days, both tops and leaves of 80 days and fruits of 110 days old tomato plants. Chlorophyll content of leaves of both 40 and 80 days old plants showed highly significant (P=0.01) increase at 200 g Vermicompost/kg soil over control. Maximum values for catalase and peroxidase activities were also observed at 200 g Vermicompost/kg soil level and these values were highly significantly (P=0.01) higher than values at control.

Key words: Tomato, Vermicompost, biofertilizer.

INTRODUCTION:

Vermicompost (also called worm compost, Vermicast, worm casting, worm humus or worm manure) is the end product of the breakdown of organic matter by some species of earthworm. It is a nutrient rich, natural fertilizer and soil conditioner. **Small scale Vermicomposting is well suited to turn kitchen waste in to high quality soil, where space is limited. Together with bacteria, earthworms are the major catalyst for decomposition in healthy Vermicomposting system, although other soil also plays a contributing role: these include insects, other worms and molds.** Vermicompost is 100% pure eco-friendly organic fertilizer. This organic fertilizer has nitrogen phosphorus, potassium, organic carbon, sulphur, hormones, vitamins, enzymes and antibiotics which help to improve the quality and quantity of yield. It is observed that due to continuous misuse of chemical fertilizer soil losses its fertility and gets salty day by day. To overcome such problems natural farming is the only remedy and Vermicompost is the best solution. The process of producing Vermicompost is called Vermicomposting. The earthworm species most often used are Red Wigglers (*Eisenia foetida*) or Red Earthworm (*Lumbricus rubellus*). Vermicompost is richer in many nutrients than compost produced by other composting method.

Earthworm's vermicompost is proving to be highly nutritive organic fertilizer and more powerful growth promoter over the conventional composts and a protective farm input i.e. increasing the physical, chemical & biological properties of soil, restoring & improving its natural fertility against the destructive chemical fertilizers which has destroyed the soil properties and decreased its natural fertility over the years. Vermicompost is rich in NKP (nitrogen 2-3%, potassium 1.85-2.25% and

phosphorus 1.55-2.25%), micronutrients, beneficial soil microbes and also contain plant growth hormones & enzymes. It is scientifically proving as 'miracle growth promoter & also plant protector' from pests and diseases. Vermicompost retains nutrients for long time and while the conventional compost fails to deliver the required amount of macro and micronutrients including the vital NKP to plants in shorter time, the vermicompost does.

METHOD:

Tomato (*Lycopersicon esculantum*, Mill. Var. Azad T₂) plants raised in soil-pot culture condition. The details of soil preparation with Vermicompost as biofertilizer and culture of plants were same as described earlier by Mohan *et al.* (2007). Soil amendment with Vermicompost as biofertilizer were nil (control), 50, 100, and 200 g Vermicompost/kg soil. Tops at 40 days, both tops and leaves at 80 days, and fruits at 110 days were taken for estimation of dry matter yield, chlorophyll, catalase and peroxidase activities of plants. For estimation of dry matter yield and determination of chlorophyll, catalase and peroxidase activities the details of procedure were same as described earlier by Mishra (2000)

RESULT AND DISCUSSION (Table-1):

Dry matter yield of tomato plants increased with the increase in level of Vermicompost in tops of both 40 and 80, leaves of 80 and fruits of 110 days old tomato plants. As compared to control, all the treatment tested showed highly significant ($P=0.01$) increase in dry matter yield of tops of both 40 and 80, leaves of 80 and fruits of 110 days old plants.

A highly significant ($P=0.01$) increase in chlorophyll content was observed at all the levels of Vermicompost over its preceding levels in leaves of both 40 and 80 days old plants. Maximum chlorophyll content was observed in leaves of both 40 and 80 days old plants at 200 g / Vermicompost / kg soil level.

As compared to control, all the levels of Vermicompost tested showed highly significant ($P=0.01$) increase in catalase activities of tops of both 40 and 80 and leaves of 80

days old plants. A highly significant ($P=0.01$) increase in catalase activity was observed at all the levels of Vermicompost over its preceding levels in tops of both 40 and 80 and leaves of 80 days old plants.

Maximum peroxidase activity was observed at 200 g Vermicompost/kg soil in tops of 40 days and both tops and leaves of 80 days old tomato plants.

Dry matter yield of tomato plants increased with Vermicompost as biofertilizer, this increase in growth and yield is in conformity with the finding of Tharmaraj *et al.* (2011) with rice, Nath *et al.* (2009) with maize and okra, Gutierrez-Miceli *et al.* (2011) with radish Gutierrez-Miceli *et al.* (2008) with sorghum, Garcia-Gomez *et al.* (2008) with maize, Tejada *et al.* (2008) with tomato, Quaik *et al.* (2012a) with Indian Borage. Positive effects of Vermicompost have also been observed in forestry species such as acacia, eucalyptus and pine tree (Donald and Visser, 1989, Lazcano *et al.*, 2010a, 2010b). Increase in chlorophyll similar with the findings of Tejada *et al.* (2008) with tomato.

Significantly, Vermicompost works as a 'soil conditioner' and its continued application over the years lead to total improvement in the quality of soil and farmland, even the degraded and sodic soils. Experiments conducted in India at Shivri farm of 'U.P. Bhumi Sudhar Nigam' (U.P. Land Development Corporation) to reclaim 'sodic soils' gave very good results. Application of vermicompost @ 6 tons/ha resulted in reduction of 73.68 in sodicity (ESP) and increase of 829.33 kg/ha of available nitrogen (N) leading to significant improvement in soil quality (Sinha *et al.*, 2008).

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Table 1.

Growth and Composition of Tomato (*Lycopersicon esculantum*, Mill. Var. Azad T₂) plants as influenced by Vermicompost as biofertilizer

Plants		g Vermicompost/kg soil				LSD at	
Days	Part	Nil	50	100	200	P=0.05	P=0.01
g dry matter yield/plant							
40	Tops	0.071	0.108	0.125	0.136	0.004	0.006
80	Tops	10.08	10.50	11.77	12.27	0.06	0.09
80	Leaves	5.16	5.54	6.25	6.72	0.05	0.07
110	Fruit	1.26	1.73	2.08	2.13	0.03	0.05
mg Chlorophyll/100 g FM							
40	Leaves	93	120	122	134	3	5
80	Leaves	107	114	120	126	2	3
Unit catalase/100 g FM							
40	Tops	9.18	11.44	12.32	13.44	0.06	0.09
80	Tops	3.33	3.97	4.43	4.82	0.05	0.07
80	Leaves	4.16	4.86	5.27	5.72	0.06	0.09
? OD Peroxidase							
40	Tops	0.021	0.026	0.029	0.035	0.004	0.006
80	Tops	0.032	0.034	0.036	0.039	0.001	0.002
80	Leaves	0.026	0.028	0.031	0.034	0.001	0.002

ALGAL DIVERSITY OF KUSHMANDA DEVI TEMPLE TANK WITH REFERENCE TO PHYSICO-CHEMICAL CHARACTERISTICS

Shailendra Kumar Singh, *R.K. Gupta, *Anuj Bhadauria and **N. Mohan
D.P.D.S.P.G. College, Anoopshahar, Bulandshahar

*Department of Botany, D.V. College, Orai

**Principal, Shri Shakti Degree College, Shankahari, Ghatampur, Kanpur.

Abstract

The physic-chemical characteristics of Kushmanda Devi temple tank were found variable according to session. The qualitative estimation of algal flora belonging to various families in the pond at different surveyed sampling stations. The families which represented the algal flora were Myxophyceae (Blue-green algae), Chlorophyceae (Green algae), Bascillariophyceae (Diatoms) and Euglenophyceae. The increasing trend in the pond was Chlorophyceae > Myxophyceae > Bacillariophyceae > Euglenophyceae. Total 36 genera was found with dominant forms of *Cladophora* throughout the year.

Key words: Algal flora, Physic-chemical characteristics, Temple tank

INTRODUCTION:

Historically, algae have been responsible for few problems directly affecting humans but their toxicity capacity to impound water, retardation in growth of cultivated plants, increases loss of water, changes in colours, odour production, spread of allergenic disease and hindrance of aquatic sports and fisheries are well known. Algal role in oxygenation of water, binding and removal of certain toxic substance are crucial for water quality improvement. As such algae not only marvel significance as bioindicators but also have intrinsic value in biology of environments.

Fresh water is natural source of fundamental importance. Without water life is not possible. In many respects the property of water is unique. They seem to be especially designed for the living organisms; no other liquid can replace it. Pure water is an animating fluid while polluted water is a real curse for living beings. The rapid increase in population and speedy industrialization on large scale has placed an ever increasing demands on lakes, reservoirs, ponds and rivers for the provision of potable or drinking water, fish products and as well as depositories or store houses of wastes and sewage effluents. This has created several problems. An interesting aspect of these reservoirs in the drastic change due to seasonal variation resulting in water volumes, salt concentration, dissolved substances, gases and organic matter and these by in the plant life.

Human activity generates a tremendous amount of the waste materials. These are discharged in various component of the environment in which they bring about undesirable changes. The menace of pollution to our water resources is well known.

Water is indispensable for life and is an important constituent of all chemical and biochemical reactions. The expanding civilization, increasing pollution and rapid industrialization are putting much higher demand on water day by day. With the rapid advances in Science and Technology man has acquired the power to change the environment in countless ways. Man has modified the quality and quantity of water by over all exploitation, misuse, and wastewater disposal there by causing the undesirable effects on the hydrological cycle. Fresh water of adequate quality is becoming scarce day by day. Pollution and indiscriminate use threaten the world's most valuable resource.

The enormous amount of wastes, which our society generates, have strained and disturbed our natural ecosystems. Rivers, lakes and ponds are main resources of natural waters are getting polluted from various human activities and sewage disposal is an important cause. All aquatic systems have the ability to purify themselves and ecological equilibrium if the impose stress does not exceed a certain critical limit. But the current changes are so rapid and intense that the biological balance is upset land in some cases totally disrupted. As a result distorted ecological equilibrium fails to return to its original state.

MATERIAL AND METHODS:

Kushmanda devi temple tank is selected for the study, situated near Ghatampur is a Tehsil of district Kanpur Nagar. Maa Kushmanda Devi, fourth Goddess out of Nav Durga. The water samples were collected at 30 days intervals from the spot fixed all around the area from four sites of tanks. Water sample of four different sites were combined to get an integrated sample of water. The samples were collected in a wide mouth large plastic bottle (2.5 liter) between 8-10AM and bottled cork immediately and all the samples were brought to the laboratory and stored at 4°C temperature in a refrigerator till the analysis was completed. Care was taken to prevent under shaking of the samples and also against sun light while transporting them to the laboratory. The details of sampling and analysis of physic-chemical characteristics according to “Standard Methods for examination of water and waste water” published by American Public Health Association (1980) have been consulted. All chemical analysis was done in evening or on the following day. From the preserved sample, algal material were mounted on slides and examined in details and identified up to species level with standard literature.

RESULT AND DISCUSSION:

Range of temperature between 15.1°C to 33.9°C and total solids between 800 mg/l to 3650 mg/l both value minimum in the month December and higher in the month June. pH was found 7.1 to 8.3 in the month October and May respectively. Value of BOD and COD was maximum in the month January and minimum in May. Turbidity in the

range between 32 NTU to 70 NTU, maximum DO was found in the month February and minimum in May and June. Carbonate in the range between 2.25 mg/l to 2.95 mg/l and Bicarbonate between 0.10 mg/l to 1.00 mg/l. The value of Calcium and Chloride was found maximum in June and minimum in January and March respectively.

The quality and quantity of algal flora vary from season to season, the maximum numbers of species were observed during winter season while the maximum quantity of algae, occurred during the summer season.

During present investigation 36 genus was found belonging to Myxophyceae, Euglenophyceae, Bascillariophyceae and Chlorophyceae. Chlorophyceae forms was dominant amongst algal flora. Similar observation was made by Patrick (1950) and Rafter (1965). Hiremath and Shety (1988) pointed out that the members of Cyanophyceae are known to be highly adaptive and can colonize even the polluted water. Present study showed that the incidence of Myxophyceae in large number indicated by blooms of *Microcystis* species and *Oscillatoria* species pointed out some polluted condition of water.

Ecological distribution of Myxophyceae has been discussed by Fritsch (1907), Pearsall (1932), Prescott (1948), Gonzalves and Joshi (1946). Komarvosky (1953), Rao (1955) and Philipose (1959) concluded that Myxophyceae increase in algal population even when nitrates and phosphates were low. Hutchinson (1967) rightly points out that it is not clear as to what organic compounds are needed in the nutrition of Myxophyceae. The present data confirms the observations of Pearsall (1932) and Philipose (1959).

The algal flora of the Temple tanks shows a distinct periodicity and succession of algae. Among algal forms belonging to various classes some of them grew throughout the year, others during larger span of time or short- lived and only recorded sporadically. Algae exhibit preferences for periodicity and succession in different seasons. Despite seasonal preferences they may continue to thrive in the transitory periods of seasons.

Earlier somewhat similar results were also observed by Mohan *et al.* (2004), Dubey *et al.* (2003), Gupta *et al.* (2001) with sewage; Sarbhai *et al.* (2004) and Mohan *et al.* (1997, 2002, 2003) with industrial effluent using different algal species.

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DISTRIBUTION PATTERN OF ALGAL FLORA IN KUSHMANDA DEVI TEMPLE

TANK GHATAMPUR, KANPUR

S.No.	ALGAL- SPECIES	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	<i>Microcystis aeruginosa</i>	-	+	+	+	+	+	+	+	-	-	-	+
2	<i>Chroococcus minutus</i>	-	-	+	+	+	-	-	-	-	+	+	-
3	<i>Aphanocapsa montana</i>	+	-	+	+	+	-	-	-	+	-	+	-
4	<i>Spirulina subtilissima</i>	-	-	-	-	-	-	-	+	+	+	-	+
5	<i>Oscillatoria tenuis</i>	+	-	-	-	-	-	-	+	+	+	+	+
6	<i>Oscillatoria irrigua</i>	-	-	-	-	-	-	-	+	+	+	+	-
7	<i>Phormidium tenue</i>	-	-	-	-	-	-	+	+	+	-	+	+
8	<i>Phormidium ambiguum</i>	+	+	+	-	-	-	-	-	+	+	-	-
9	<i>Lyngbya contorta</i>	+	+	+	+	-	-	+	-	+	+	+	-
10	<i>Lyngbya majuscula</i>	+	+	+	+	-	+	-	-	+	-	-	-
11	<i>Nostoc muscorum</i>	+	+	+	+	-	-	-	+	+	+	+	-
12	<i>Nostoc commune</i>	+	+	+	-	-	-	-	+	+	+	+	+
13	<i>Gloeotrichia pisum</i>	-	-	-	+	+	+	-	+	+	+	+	-
14	<i>Euglena viridis</i>	-	-	+	+	+	+	-	+	+	-	-	-
15	<i>Phacus orbicularis</i>	-	-	-	+	+	-	+	+	+	-	+	+
16	<i>Cyclotella stelligera</i>	+	+	-	+	+	-	-	-	-	-	-	+
17	<i>Fragilaria crotonensis</i>	-	+	+	+	-	-	-	-	-	+	+	+
18	<i>Synedra ulna</i>	-	-	-	-	-	-	-	-	-	+	+	+
19	<i>Navicula viridula</i>	+	+	+	+	-	-	-	-	-	-	+	+
20	<i>Cymbella ventricosa</i>	+	+	-	-	-	-	-	-	-	-	-	+
21	<i>Amphora ovalis</i>	-	+	+	-	-	-	-	-	-	-	+	-
22	<i>Pandorina morum</i>	-	-	-	+	+	+	+	-	-	+	+	+
23	<i>Sphaerocystis schroeteri</i>	+	-	-	-	-	-	-	-	-	-	-	+
24	<i>Ulothrix zonata</i>	-	-	-	-	-	-	-	-	-	+	+	+
25	<i>Microspora floccosa</i>	-	-	-	-	-	-	-	-	-	+	-	-
26	<i>Stigeoclonium tenue</i>	-	-	-	+	+	+	-	-	-	-	-	-
27	<i>Chaetophora pisiiformis</i>	+	+	+	+	+	+	-	-	+	+	+	+
28	<i>Cladophora glomerata</i>	+	+	+	+	+	+	+	+	-	+	+	+
29	<i>Pediastrum duplex</i>	-	+	+	-	-	-	-	+	+	-	-	-
30	<i>Pediastrum tetras</i>	-	-	+	+	+	-	-	-	-	+	+	+
31	<i>Hydrodictyon reticulatum</i>	+	+	+	-	-	-	-	-	-	+	+	+
32	<i>Scenedesmus bijuga</i>	+	+	-	-	-	-	+	+	+	+	-	-
33	<i>Scenedesmus obliquus</i>	+	-	-	+	+	+	+	+	+	+	-	-
34	<i>Spirogyra nitida</i>	+	+	+	+	+	+	+	-	-	+	+	+
35	<i>Closterium parvulum</i>	+	-	-	-	-	-	-	-	+	+	+	+
36	<i>Cosmarium contractum</i>	+	+	+	+	+	-	-	-	+	+	+	+

ASSESSMENT OF PESTICIDE INDUCED GENOTOXICITY IN SOME FISH SPECIES

Satyendra Kumar Agnihotri

Department of Zoology
Shri Shakti Degree College
Sankhahari, Ghatampur, Kanpur (Nagar)

Abstract

Parathion is a widely used organophosphate insecticide throughout the world. However, the limited efforts have made the study its genotoxic effect in different fish tissues. The present investigation was aimed to assess the genotoxic potential of the pesticide to the freshwater fishes at the sublethal concentration using the micronucleus test. Initially, the commercial-grade parathion (50 % EC) was determined as 8 ppm in semistatic system. Based on LC_{50} , four test concentrations (sublethal I, sublethal II, sublethal III and sublethal IV) were determined to be 0, 2, 4, 6 and 8 ppm, respectively, and the fish specimen were exposed to these concentrations. Blood sampling was done on days 0, 3, 6, 9 and 12 of parathion exposure for assessment of the induction of micronuclei (MN) frequency. The MN formation in the peripheral blood cells was found to be significantly higher ($p < 0.05$) in the treated specimens in all sampling intervals compared to the control. The number of micro nucleated erythrocytes (MNEs) in per 1000 cells examined, for each species was highest ranging from 8 to 50 (8 ppm) in *Ctenopharyngodonidella*. The highest average percentage frequency of MNEs was in *C. idella* 2.7% which indicates that the fish was more sensitive towards parathion. On the contrary, *Lebeorohita* had lowest frequency of MNEs (1.6%) and seems to be less sensitive towards parathion as compare to the other species.

Key words: Pesticide, Parathion, fish, Genotoxicity.

Introduction

In the modern era of the development, different kinds of pesticides are thrown in the terrestrial and aquatic environments. About 15000 different pesticides are formulated and sold in the world market. These are used for integrated pest management (IPM) program in various countries. The term “pesticide” embraces an enormous diversity of products that are used in a number of different activities especially in agriculture. Beside agricultural applications, large amount of pesticides are used for maintaining urban planting, hygiene, control of vegetation along railways, roadways and for the control of mosquitoes and flies. These pesticides are washed off or slip downwards from crop fields to water bodies and pose a risk to aquatic life. Mostly, water bodies receive agriculture wastes, domestic wastes and industrial wastes etc. which contain substances varying from simple nutrients to highly toxic chemicals in our country where all the water bodies have become polluted.

Effluents of industrial processes and run off from agricultural fields contain highly toxic chemicals like heavy metals and pesticides that lead to the pollution of aquatic environments such as river, ponds, lakes, and so forth. The accumulation and persistence of these pollutants in the aquatic environment constitute a serious threat to biological life and to human beings indirectly through the food chain (Binelli and Provini, 2004). The majority of these effluents are mutagenic (Galloway *et al.*, 1987; Garaj-VrhovacZeljetic, 2000), either lead to the development of cancers (Leiss and Savitz, 1995) or

In India, the pesticide consumption was increased by more than fourfold during the post-green revolution era (1966-1999). However, during the last decade, the pesticide consumption exhibited a steady decline (Prajneshu, 2002).

Presently, over 100 organophosphorus compounds, representing a variety of chemical, physical, and biological properties, are being used for agricultural purpose. "Parathion" is one of the earliest developed organophosphate insecticides. It is a non-synthetic, broad spectrum, general- used pesticide that disrupts the nervous system function by inhibiting cholinesterase, an enzyme that normally terminates nerve transmissions by cleaving the neurotransmitter acetylcholine and resultant acetylcholine accumulation.

The pesticides, owing to their stability, contaminate the aquatic environment even at sub-lethal concentrations and tend to accumulate in tissues and blood of fishes (Anonymous, 2002; Garcia-Reyero and Denslow, 2006). In fact, the information pertaining to the genotoxicity effect of pesticide to fishes is scanty especially data pertaining to the long term genotoxicity effect in blood of fishes.

Fish is an important tool in the toxicity assessment of xenobiotics like pesticide. This system is useful for studying the effect and accumulation of toxicants in different parts and organs of the body and for evaluating the neurotoxicity of xenobiotics. The sub-acute and chronic toxicity are measured in fish test system by taking growth, physiology and reproduction. Fish test system has become essential, as there is wide spread contamination of aquatic ecosystem by environmental toxicant. The fish blood is used for evaluation of micronucleus, DNA damage and sister chromatid exchange in fish genotoxicity.

The present study was therefore aimed to investigate the parathion induced genotoxicity in different fish species collected from fresh water body.

Materials and Methods

For the present study, commercial- grade parathion (50%EC) was procured from the local market. Parathion, the agro-phosphate pesticide was selected because it is used by farmers into their fields and trapa forming ponds for the purpose of pest management.

Four live healthy, fresh water fishes belonging to different species weighing between 100-150 g with the help of fisherman from the ponds.

Fish aquarium was fabricated with 2 mm thick glass. The aquarium was having air blower and electric bulb with a dimension of length = 75 cm, width = 30 cm, and height = 60 cm.

The fish meal "Tokyu" brand was purchased from the local market. Tokyu is a floating type food which have necessary amount of amino acids to assist development of fish.

Parathion, the agro-phosphatepesticide was selected because it is used by farmers into their fields and trapa forming ponds for the purpose of pest management.

Application of pesticide

The test solution for fish treatment was prepared by dissolving "parathion" pesticide directly in tape water in different concentrations (0, 2, 4, 6 and 8 ppm). 0.00ml, 0.02 ml, 0.04 ml, 0.06 ml and 0.08 ml of the market grade parathion were dissolved to make a final volume of 10 liter of tape water. The test fishes were kept for 72 hours in each concentration.

Micronucleus test

The frequency of micro nucleated erythrocytes (MNEs) was evaluated by examining 1000 mature erythrocytes for each species and the percentage frequency (%) was expressed as follows:-

$$\text{Percentage frequency of (MNEs)} = \frac{\text{Total number of MNEs}}{\text{Total number of cells examined}} \times 100$$

Only isolated nuclear fragment followed by the morphological criteria described by Tates *et al.* (1980) was counted as micronucleus (MN) i.e. rounded or avoids shaped non-refractory particles with colors and structure similar to principal nucleus with a diameter of 1/3 to 1/5 of the main nucleus and clearly detached from it was interpreted as “micro-nucleus”.

Results and Discussion

Results of the present study are divided into two parts i.e. (i) identification of fishes and (ii) analysis of micro-nucleated erythrocytes (MNEs).

Identification of fishes

The collected fish species were identified by observing the morphological characteristics described by Lindberge (1971). Over all four fish species were collected from Supatal pond. There were identified as under

(i) *Ctenopharyngodonidella* Valenciennes, (**Grass crap**)

CLASSIFICATION

Phylum	-	Chordata
Group	-	Vertebrata
Sub-phylum	-	Gnathostomata
Class	-	Telestomi
Order	-	Cypriniformes
Division	-	Cyprini

(ii) *Labeo rohita* Hamilton, (**Rohu**)

CLASSIFICATION

Phylum	-	Chordata
Group	-	Vertebrata
Sub-phylum	-	Gnathostoma
Class	-	Telestomi
Order	-	Cypriniformes
Division	-	Cyprini

Body elongated with moderately rounded abdomen, brownish grey to black in color, scales large and orange reddish in center. Head prominent with blunt snout, mouth is transverse and semi-oval, with prominent upper lip.

(iii) *Channa striatus* Bloch, (**Bhunda**)

CLASSIFICATION

Phylum	-	Chordata
Group	-	Vertebrata
Sub-phylum	-	Gnathostomata
Class	-	Teleostomi
Order	-	Gonorhynchiformes
Division	-	Gonorhynchi

Scale large irregularly shaped a row of 18 - 20 predominal scales. Lateral line curves downwards below 12th dorsal ray. Color is dark grayish or blackish dorsally, yellowish beneath, cheeks and lower surface of the mouth spotted with grey. Transverse bands of gray of black decent from the side to the abdomen.

(iv) *Hetropneustes fossilis* Bloch (**Singhi**)

CLASSIFICATION

Phylum	-	Chordata
Group	-	Vertebrata
Sub-phylum	-	Gnathostomata
Class	-	Teleostomi
Order	-	Cypriniformes
Division	-	Siluri

Body is elongated and laterally compressed, skin without scales, head is flattened. Barbless are long and four pairs fin is elongated reaching up to the caudal fin.

Frequency of micro-nucleated erythrocytes (MNEs)

The MN assay results are depicted in Table. All test concentrations of parathion induced a significantly higher number of MN as compared to the control. Further, the MN induction increased significantly from day first (control) to 12th day. The MN test has been found to be a sensitive assay to evaluate genotoxic compound in fish under controlled condition as an index of cumulative exposure. Grisolia and Corbeiro (2000) inferred that MN test result may vary according to clastogen, test organisms, and the life cycle of the cells.

The number of micronucleated erythrocytes (MNE_s) in per 1000 cells examined, for each species was highest ranging from 8 (control) to 50 (8 ppm parathion) in *Ctenopharyngodonidella* Valenciennes (grass carp). The average percentage frequency of MNE_s was highest (2.7%) which indicates that fish was more sensitive towards parathion. On the contrary, *Labeorohita* Hamilton had lowest average frequency of MNE_s (1.6%) and seems to be less sensitive towards parathion as compared to other species.

The MNEs frequencies in the fishes of the control group were found to vary from 0.4% to 0.8%. The highest frequency of MNEs in the parathion treated fish was observed in *Ctenopharyngodonidella*, Valenciennes (**grass carp**) i.e. 1.8% to 5.0% while lowest frequency 0.5% to 3.0% was observed in *Labeorohita* Hamilton fish in all concentration.

Table summarizes the analysis of variance for the frequency of micro-nucleated erythrocytes under five different treatment groups (0, 2, 4, 6 and 8 ppm) is significantly different at 5% level of significance.

Table Frequencies of micro nucleated erythrocytes (MNEs) in fishes treated for different durations in various concentrations of parathion

S.NO	Fish species	Number of MNEs/1000 cells of control & parathion treated fish					Average number of MNEs	Frequency of MNEs (%)
		Control (0ppm)	3 rd day (2 ppm)	6 th day (4ppm)	9 th day (6ppm)	12 th day (8ppm)		
1	<i>Labeorohita</i>	05	11	14	20	30	16.0	1.6
2	<i>Hetrogneustes fossilis</i>	04	10	18	25	44	20.2	2.0
3	<i>Channa stratus</i>	07	15	22	30	38	22.4	2.2
4	<i>Ctenopharyngodonidella</i>	08	18	28	32	50	27.2	2.7
	<i>Total</i>	24	54	82	107	162		

Ppm = Part per million (fish exposure in different durations and concentrations of parathion).

The increasing environmental pollution and public awareness have forced scientists to study the direct and indirect effect of industrial domestic and other wastes on the aquatic environment. Also agrochemicals especially pesticides, bathing, washing clothes contribute much to the water pollution. The present study was therefore aimed to investigate the parathion induced genotoxicity in different fish species collected from pond. These pollutants may accumulate in the fishes and may cause genotoxicity.

The review of literature shows that fish can provide an excellent source of material for the assessment of the genotoxicity in the aquatic environment because they can metabolize, concentrate and store the genotoxins and waterborne pollutants. The literature also indicates that MN test is the best techniques for detecting genotoxicity in fishes.

Four fish species viz *Ctenopharyngodonidella*, *Labeorohita*, *Channa striatus* and *Hetrogneustes fossilis* were selected for this purpose. Fishes were kept in aquarium and fed with "Tokyu" meal 10:00, 14:00, & 18:00 hours in a day. These were treated with 0, 2, 4, 6 and 8 ppm parathion water for 72 hours in each concentration. The micronucleated erythrocytes stained by May-Grunwald's and Giemsa stains were scored for the assessment of genotoxicity.

The results show that number of micro nucleated erythrocytes (MNEs) in per 1000 cells examined, for each species was highest ranging from 8 to 50 (8 ppm) in *Ctenopharyngodonidella*. The highest average percentage frequency of MNEs was in *C. idella* 2.7% which indicates that the fish was more sensitive towards parathion. On the contrary, *Lebeorohita* had lowest frequency of MNEs (1.6%) and seems to be less sensitive towards parathion as compare to the other species.

The test fishes collected from the pond were already having genotoxicity as reveled by MN test. Genotoxicity in all the test fishes was positively related to the increasing concentration of the parathion. Further studies are needed to explore the biological consequences of DNA damage in aquatic organisms after parathion exposure and to formulate the future strategies for safe guarding aquatic organisms and environment.

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Format for Research Paper

Nine Steps for writing a Research Paper in science. To actually writing the paper, you need to develop a strong topic idea, find relevant research organize your information. You can simplify the process by following some very simple steps.

1. **Choose a topic :** The first steps in researching your paper is to choose a topic.
2. **Confirmation a topic :** Find intriguing references for further exploration and to get a general overview of your chosen topic.
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5. **Write the Outline research paper :** Writing a good outline can make the writing process much easier, so do not skip this important step. Start by creating a rough outline that include of following steps :
 - (i) **Abstract :** Difference between summary and Abstract : Abstract is the brief of summary. The abstract needs to be set up in a special way, starting with an introduction, a short part about what you are writing about in Journal, then the general information (what you have discovered in your analysis) and then you finish off with a short conclusion to your subject. A summary is just a short version of whatever is written above in your article. Abstract is written in the beginning of the article whereas summary is written at the end of the article.
 - (ii) **Introduction :** Here the basic concept of all the independent and dependent variables listed in the tittle of the project is discussed with the help of references collected so far. Then the lacuna in the concerned previous studies is written on the basis of which statement of the problem is cited. Statement of the problem is followed by the Objectives and Hypothesis framed and Limitations of the present study.

- (iii) **Methodology** : Methodology includes the subjects selected for the study, their inclusion in the Experimental Design, the tool used for measuring the dependent variables and the process of administering the tools for collecting data
 - (iv) **Results** : Presentation of results in form of figures (Polygon/histograms)
 - A. Summarization of results in form of central tendencies, variance etc.
 - B. Analysis of results in the form of analysis of variance, t-test and coefficient of correlation.
 - (v) Discussion of Results in the light of other studies by including sub-sections relative to each argument, idea or category.
 - (vi) Conclusion of results in the form of possible answers for the postulates derived from each hypothesis
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