Chapter 2

REVIEW OF LITERATURE
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The desire of innovation in man has contributed to pollution in the life and ecology of plants, fishes and other animals and microbes. Increased demand for food and other useful material has led to the chemicalization of agriculture and we have reached on such a stage that modern agriculture is dependent on high yielding varieties, which can only be grown under the influence of fertilizers and pesticides. Pesticides are the man made chemicals which are being used to produce enough cheap food. In India, 90,000 millions of technical grade pesticides are used annually to control pests and plant diseases. The steady flow of agricultural effluent discharge into water bodies increases the range of pollutants, which becomes evident when considering toxic pollution (Dhilon S. S., and Gupta A. K., 1983; Forstner U., and Prosi F 1989; Peakall D. 1992; Braunbeck T., 1994; Heath A. G. 1995; Mason C.F. 1996; Heath A. G. 1996; Das R. 2000; Santhakumar et al., 2000; Alam, M. N. and D. N. Sadhu 2001; Mishra et al., 2001; Lata S., et al., 2001; Singh S and D. N. Sadhu. 2001; Alam M. N., 2002; Patnail et al., 2002; Tilik 2005; Radha et al., 2005). Indiscriminate use of pesticides, careless handling, accidental spillage, or discharges of treated effluents into natural waterways have harmful effects on the fish population and other forms of aquatic life and may contribute long term effects in the environment. Water pollution is globally as a potential threat to both human and other animal populations (Verma S.R., et al 1990; Heath AG., 1995; Heath AG., 1996; Braunbeck, T., 1994; Mason C.F., 1996; Hruday et al., 1996). Pesticides have been the focus of interest for environmentalist because of their wide spread use, transport, distribution in the

Various types of phosphorus group are present in the major class of organophosphorus pesticides. Like as Phosphate group, $O$-alkyl phosphorothioate, phosphorodithioate, $S$-alkyl phosphorothioate, phosphoramidate etc. At least 100 organophosphorus pesticides have been reviewed by WHO for consideration as agents for the control of disease vectors. A large number have been reviewed by the FAO/WHO Joint Meetings on Pesticide Residues. Unlike many compounds scrutinized by the IPCS, these compounds are designed to be toxic for certain pests and are added deliberately to the environment (Gill et al., 1990; Benerjee G., and Rajendranath 1990; Balasubramanian S. and Ramaswami M. 1991; Gaur K Pandey Surendra D 1992; Chandrasekhar S and N., Natraj an 1993; Chaturvedi L.D., and Agrawal K., 1993; Chandrasekhar and S., Jayabalan 1993; Sadhu D.N., 1993; Bhattacharya Lata 1994; Gupta et al., 1995; Fryday et al., 1996; Kumar et al., 1997; Hemant and Gupta A.B., 1997; Jebakumar et al.. 1997; Benerji G., and Rajendranath 1999; Nath. Ravindra, Banerajee V. 1999; Armbrust K.L., 2000 Delor et al., 2000; Dhembare A.J. and Pondha G.M. 2000; Kamble G.B. and Muley D.V. 2000; Jhosi P. and Deep H. 2002; Medda et al., 2002; Noori et al., 2003; Ayoola S.O. 2008). Although the organophosphorus pesticides are used to control the insect, pests but they are harmful to other non target organism like fishes as they are continually added to water bodies. Several reports of the excessive use of organophosphorus pesticides and their toxicity on fishes and other aquatic animals are available (Charistoforides C., & Hedley-Whyte, J.1969; Blaxhall P. C.1972; Ranke B., and Rybicke 1975; Lone K.P. and M. Y. Javed; 1976 Ransfald K. D.1978; Agrawal S. J. and A. K.

Herbicides are also widely used for the control of water plants and weeds which may impede the flow of water during the summer; when sudden heavy rain can cause flooding (Annune et al., 1994). Harmful herbicides enter surface water with the discharge of agricultural wastes. It is biologically very reactive and hence gives rise to both acute and chronic poisoning toxic effects of pesticides on aquatic organism like fishes. Several workers have investigated the physiological disturbance caused by herbicides exposure on fishes (Brooker M. P. and Edwards R. W. 1975; Monsanto Company 1985;

Aquatic toxicologists traditionally have been interested in determining how much of the toxic chemicals, fishes (or other aquatic creators) can tolerate before they die. This is done by standardizing the tolerable concentrations of pesticides during acute toxicity experiments. One of the purpose of the toxicity studies is to conclude whether a potential toxicant harmful to aquatic life, and if so, to find out the relationship between toxicant and concentration and its consequence on aquatic animals (especially fishes). In this manner various bioresearches have been investigated the acute toxicity effects of pesticides, insecticides and herbicides on aquatic animals (Pandey et al., 1980; Jagdish et al., 1981; Goel et al., 1982; Grues et al., 1983; Mishra J., Shrivastava A. K. 1983; Natarajan G.M. 1983; Kulshrestha S.K. and Arora A.1984; Jai Nath et al., 1984; Dange A.D., 1986; Khangarot B.S., and P.K. Ray 1988e; Ghosh T. K., 1989; Mahesh et al., 1989; Gill et al., 1990 Benerjee G., and Rajendranath 1990;
The suitable biomarker tests that cover all the biological activities and functions of the organism and that can make it possible to judge which of the functions were abnormal, when the organism has been exposed to toxicants. These are blood parameters which considered pathophysiological biomarkers of the whole body (Silbergeld E.K., 1974; Adams S.M., 1990; Peakall D. 1992; Stein, J. E., et al., 1992; De La Torre et al., 2000; Vander et al., 2003). Several works have been carried out on hematological and biochemical parameters to determine the affected biological activities on test organism because the blood parameters are the best biomarkers to investigate the hazardous effect of pollution cause by various toxicants (Bhatia H.L. 1972; Blaxhall P. C. 1972; Mahajan C. L., and Juneja S. 1979; Pandey et al., 1980; Jagdish Mishra and Anil K. Shrivastava 1981; Sastry K.V and K. Sharma 1981; Goel et al., 1982; Bhaskar B.R., and K.S. Rao 1985; Kori-Siakpere O. 1985; Casillas, E. and L.S Smith 1987; Sastry et al., 1988; Mahesh et al., 1989; Birendra Kumar and Banerjee V. 1991; Kori-Siakpere O. 1991; Sastry K.V. and A. Gupta 1994; Gupta et al., 1995; Khattak I. U. D., Hafeez, M. A. 1996; Kori-Siakpere O, Egor V.E. 1999; Nath. Ravindra, Banerajee V.
Glyphosate, Phosphamidon, Metasystox and Imidacloprid are four toxicants studied in this toxicological study because they are widely used in all over world and Bundelkhand region, but very scanty informations are available regarding Glyphosate, and Imidacloprid intoxication of fish haematology. Several workers have been carried out in phosphamidon and metasystox intoxicated fishes in India except Bundelkhand region. (Comes et al., 1976a; Rueppel et al., 1977; Roy et al., 1977; Folmar et al., 1979; Mahajan and Juneja 1979; Sullivan, T. P., and D. S. Sullivan. 1979; Hildebrand et al., 1980; Roslycky E. B. 1982; Natrajan G.M., 1983; Morrison et al., 1984; Newton M. et.al. 1984; Monsanto and Company 1981; Monsanto Company, 1985; Hildebrand et al., 1986; Mitchell et al., 1987; Servizi et al., 1987; Jhon P.J., Rathor. And A. Prakash 1989 ; Roy et al., 1989b; Santillo et al., 1989a; Anton et al. 1993; E.P.A. 1993; Liu et al., 1993; Marrs, et al., 1993; Roberts R.O. and S.G. Berk. 1993; Minaxi Das and Shambhu Prasad 1994; Giesy 2000; Feng et al., 1990; Nagata 1996; Neskovic. et.al. 1996; Shekhar P., and I., Christy 1996; Matsuda et al., 1998; Linz et al., 1999; Tomizawa M. and Casida J. E. 2000; Williams et al., 2000; Anand Kumar 2001; Sheetset al., 2001; Josif Jhon P. 2007).

Aannd kumar et al., (2001) reported decreased level of Hb%, TEC and PCV after both acute and chronic exposure to phosphamidon.
Ravindra Nath and V., Vanerjee (1999) reported decreased TEC, Hb% and PCV% but TLC was increased significantly in lethal and sub lethal toxicity of rogar pesticide with in 24, 96 hours and 7 days exposure. Anju kumari and A.pandey (1990) reported the decrease in Hb content TEC and PCV in Clarius batrachus intoxication of teficide and butachor follow acute toxicity of 48 hours according to Chandshekhar S. and N., Jayabal an (1993) Hb % and PCV decreased after exposed to sublethal concentration of endosulphan for different period used like as 7, 14 and 21days. The decrease level in Hb %, TEC, PCV and increase in TLC were reported by several workers using organophosphorus pesticides and other toxicant in acute toxicity bioassay experiment in fishes (Mukhopadhyay and Dahadrai 1980; Jagdish Mishra and Anil K. Shrivastava 1981; Kori-Siakpare 1985; Chakraporti P. 1986; Homechaudhuri 1986; Anju kumari and A.pandey 1990; Mishra B. K. 1993; Nath. Ravindra and Banerajee V., 1999; Kori et al., 2008; Ajani F. 2008). Similar responses of Hb %, TEC and PCV were also observed by many authors in chronic cases using organophosphorus pesticides and other toxicants in fishes (Sastry K.V. and K., Sharma 1982; Natraj an G.M. 1983; Pandey 1984; Shastry et al., 1984; Shastry et al., 1984; Gill T.S. and Pant J.C. 1985; Rajeshwari et al., 1989; Mala and Shreak 1990; Ruparel ia et al., 1991; Patel S.K. and P.G. Parmer 1993; Chandshekhar S. and N. Jayabal an 1993; Mughal et al., 1993; Verma G.P. and Pranamita Panighari 1998; Alkaham et al., 1998; Kori-Siakpare et al., 1999; Nath. Ravindra, Banerajee V. 1999; Anand Kumar 2001; Muhammad Atamanalp and Telat Yanik 2002;

Minaxi das and Shambhu Prasad (1994) reported increase level of TEC (total erythrocytes count) and Hb% (haemoglobin percentage) using metasystox during 48 hours exposure on *Heteropeistes fossilies*. Increased parameters like as TEC and Hb% which originate in this case have also been reported earlier by Mahajan and Juneja 1979; Dhilon and Gupta 1983 ; Mishra and Shrivastava 1985; Ghosh and Chaterjee; 1989 during acute toxic exposure. G.M. Natrajan (1983) also reported the increase in total RBC count, PCV, and Hb% in *Heteropeistes fossilies* following chronic toxicity with 30 days exposure of metasystox. Similar results of haematological effects on fresh water fishes using different pesticides have also been established prior (Valicre E.J., and Stickhey C.J., 1999; Kumar B.K., 1991; Lavin 1992; Kuruppasamy et al., 2005). Few workers are reported the

Malla et al., (2009) reported increased value of ESR after acute exposure of 24, 48, 72, and 96 hours intoxication of chloropyrifos on *Channa punctatus*. Similar reports have also been done by copious bio-researchers using different toxicant in both acute and chronic toxicity (Kumar B., and Banerjee V. 1990; Singh S., and Bhati DPS. 1991; Chaturvedi L.D., and Agrawal K.1993; Bala Sashi et al., 1994; Goel K.A., and Maya 1996; Nath. Ravindra and Banerajee V. 1999). Nuri at al., (2003) reported the MCHC decreased with increase cypermethrin concentrations, but MCV level increased and MCH was not affected with exposure of deferent cypermethrin concentrations (Van Vuren, J.H.J. 1986). The various alterations in values of MCH, MCHC and MCV were also carried out during acute and chronic toxicity bioassay investigated by many workers (Verma et al., 1979; Jagdish Mishra and Anil K. Shrivastava 1981; Natrajan G.M. 1983; Pandey 1984; Gill and Pant 1985; Kori-Siakpere O. 1985; Chakraporti P. 1986; Homechaudhuri 1986; Bielinska 1987 Ramawamy M. and G.T. Reddy 1988; Bradury and Coats 1989; Rajeshwari et al., 1989; Anju kumari and A.pandey 1990; Mala and Shreek 1990; Singh H.S. and Reddy T.V. 1990; Ruparelia et al., 1991; Mishra B. K., 1993; Patel S.K. and P.G. Parmer 1993; Alkaham et al., 1998;Verma G.P. and Pranamita Panighari 1998; Sopinska and Guz 1998; Kori-Siakpere 1999; Nath Ravindra, Banerajee V. 1999; Das and Mukherjee 2000; Muhammad Atamanalp and Telat Yanik 2002; Nuri et al., 2003;
Svobodova et al., 2003; Atef M. Al. Atter 2005; Prashanth et al., 2005; Vutukuru S.S. 2005; Dobsikova et al., 2006; Velisek et al 2006 a;b 2007; Ajani F. 2008; Khalid et al., 2008; Velisek et al., 2009).

Kumar Hemant and A.B., Gupta (1997) reported the increased level of glucose after acute and chronic exposure of glyphosate and metasystox in *Heteropneustes fossilis* (Verma G.P. and Pranamita Panighari 1998; Khalid et al., 2008).


Temperature of aquatic environment is important for ensuring survival, distribution and normal metabolism of fishes (Forghally et al., 1973). O₂ level, Salinity or other environmental factors also caused disturbance in hormones, metabolic pathways, enzymes and behaviors of fishes (Gubbins et al., 2000). Haematological parameters are also valuable tools for monitoring the health of fishes and they are affected by many endogenous and exogenous factors (Coutant C.C., 1972; Connors et al., 1978; Wilson R.W. and Taylor, E.W. 1993; Howerton R., 2001).

Numerous bioresearchers have been reported the seasonal variations on blood parameters in fishes and other animals (Charistoforides, C. & Hedley-Whyte, J., 1969; Bridges, D. W., et al.,