A Preliminary Report on the Toxicity of Butachlor (A Major Weedicide Used in Rice Fields) on Scale Carp, *Cyprinus carpio communis*

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Keywords: Butachlor, toxicity, Scale Carp

The green revolution accomplished by the modern man has not only been possible by the culture of better varieties of food grains with the help of chemical fertilizers but also due to the application of a number of pesticides, including the herbicides and weedicides. But it is now an established fact that many of these fertilizers and biocides are creating environmental problems, which are rather difficult to solve. For example, after application to the paddy, most of the weedicides dissipate in the paddy water and are adsorbed on the soil (Beestman et al, 1974) and minor amounts of weedicides have been detected in paddy drainage water even several weeks after application (Chiang et al, 1987). Butachlor (2-chloro-2,6-diethy-N(butoxymethyl acetanilide) belongs to chloroacetanilide group of pesticides and is a known pre-emergent weedicide used in the rice fields in Kashmir valley. It is a hydrophobic compound (Pal & Vanjara, 2001) and has been reported to be readily absorbed by fish (Kuo-Hsuing et al, 1996). Since large quantities of this weedicide are used in paddy fields of the valley, most of which lie in the close vicinity of flatland lakes of Kashmir, like Dal, Wular, Anchar, etc., there is every possibility that a significant quantity of the weedicide finds its way into these water bodies.

An attempt was made to assess the toxicity of this important weedicide to the scale carp, *Cyprinus carpio communis*, an important food fish of the flatland lakes of Kashmir (Yousuf, 1996). *C. c. communis*, weighing 26.6±5g, were collected from the Dal Lake and maintained in glass aquaria containing thoroughly aerated (dissolved oxygen c. 9.2mg/l) tube well water (pH 7.9) maintained at c. 18°C with the help of heater. The fish were fed on autoclaved minced sheep meat and maintained in accordance with standard maintenance procedure (Clesceri *et al*, 1998), and acclimatized for 10 days before use. They were not fed any food during the period of exposure.

Technical grade (90.03% pure) Butachlor, obtained from Fungicides India Limited, Jammu, was used for the experiments. The test solutions were prepared by dissolving the required quantity of the weedicide in acetone. Two control groups were maintained. The negative control group received acetone at the maximum acetone volume used in the dilution of the dosing concentrations.

Tomlin (1994) has reported LC_{50} (96-h) values for butachlor in case of rainbow trout as 0.52 mg/l, in blue gill sunfish as 0.44 mg/l and channel catfish as 0.14 mg/l, while Farah *et al* (2003) reported LC_{50} as 2.34 ppm for *Heteropneustes fossilis*, 3.25 ppm for *Clarias batrachus* and 2.82 ppm for *Channa punctatus*. During the present study *C. c. communis* showed almost normal behavior up to a concentration of 0.32ppm of butachlor. Above this concentration its behaviour started changing, with the number of opercular beats increasing with increase in the concentration of the weedicide. The LC_{50} (48h) value of the weedicide in the fish was found to be 1.28 ppm.

Behavioural changes as a result of environmental stress are an indication of potential toxic effects. For example the sublethal concentrations of carbaryl accelerated the swimming activity and the frequency of opercular beats in catfish, *Mystus vittatus* (Arunachalam *et al*, 1980). The behavioral changes observed in the carp during the present study included restlessness, hyperactivity, gulping of air and increased frequency of opercular beats. More or less similar changes have been reported by Sarikaya and Yilmaz (2003) in common carp (*C. carpio*) and by *Polat et al* (2002) and Baser et al. (2003) in guppies (*Peocilia reticulata*) using other chemicals. The increased frequency of opercular beats and gulping of air may be due to increased demand for oxygen as a consequence of the added cost of detoxification of butachlor (Scott *et al*. 2004). It is widely accepted that the stress response is characterized by physiological changes. Hyperactivity of the fish in the form of accelerated and erratic swimming due to butachlor toxicity has been linked to neurotoxic effect through inhibition of cholinesterase (Rajyalakshmi *et al*. 1996; Farah et al, 2004).

The present study is a part of research work being conducted in the Centre of research for Development with the aim of establishing pattern of toxicity of butachlor on aquatic organisms. The help extended by the FIL Industries, Jammu is gratefully acknowledged. It is hoped that the investigation will help in understanding the behaviour of the weedicide in the aquatic habitats of the valley as well as its impact on the fish and other aquatic species encountered in these habitats.

REFERENCES

Arunachalam, S., Jeyalakshmi Aboobucker, S., 1980. Toxic and sublethal effect of carbaryl on a freshwater catfish, *Mystus vittatus* (Bloch). Arch. Environ. *Contam.Toxicol.* **9**: 307–316.

Baser, S., Erkoe, F., Selvi, M., Kocak, O. 2003. Investigation of acute toxicity of permethrin on guppies *Poecilia reticulata.Chemosphere* **51**: 469–474.

Beestman, G. B. & Deming, J. M. 1974. Dissipation of acetanilide herbicides from soil. *Agro. J.* **66** : 308È11.

Chiang, H. C., Wang, Y. S. & Chen, Y. L. 1987. Residues and dissipation of three major herbicides, butachlor, chlomethoxynil and benthiocarb in paddy fields in Taiwan. *Proc. 11th Asian-PaciDc W eed Sci. Soc. Conf.*, 163È71.

Clesceri, L.S., Greenberg, A.E., Eaton, A.D., (ed.) 1998. *Standard methods for the examination of water and wastewater*, 20th Edition.American Public Health Association (APHA), Washington, DC.

Lin, K. H., Yen, J. H., Wang, Y. S. (1997). Accumulation and elimination Kinetics of Herbicide Butachlor, Thiobencarb and Chlomethoxyfen by *Aristichthys nobilis*. *PestiSci*. **49**:178-184.

Pal, O. R. and Vanjara, A. K., 2001. Removal of malathion and butachlor from aqueous solution by clays and organoclays. *Separation and Purification Technology* **24**: 1-2.

Polat, H., Erkoe, F. U., Viran, R., Kocak, O., 2002. Investigation of acute toxicity of beta-cypermethrinon guppies *Poecilia reticulata*. *Chemosphere* **49**: 39–44.

Rajyalakshmi, T., Srinivas, T., Swamy, K. V., Prasad, N. S., Mohan, P. M., 1996. Action of the herbicide Butachlor on cholinesterases in the freshwater snail *Pila globosa* (Swainson). *Drug Chem. Toxicol.* **19** (4): 325–331.

Sarikaya, R., Yilmaz, M., 2003. Investigation of acute toxicity and the effect of 2,4-D (2,4-dichlorophenoxyacetic acid)herbicide on the behavior of the common carp (*Cyprinus carpio L.*, 1758; Pisces, Cyprinidae). *Chemosphere* **52**: 195–201.

Scott, G. R., Sloman, K. A. 2004. The effects of environmental pollutants on complex fish behaviour: integrating behavioural and physiological indicators of toxicity. *Aquatic Toxicology* **68**: 369–392

Soengas, J. L., Agra-Lago, M. J., Carballo, B., Andrés, M. D., Veira, J. A. R., 1996. Effect of an acute exposure to sublethal concentrations of cadmium on liver carbohydrate metabolism of Atlantic salmon (*Salmo salar*). *Bull. Environ. Contam. Toxicol.* **57**: 625–631.

Tomlin, C., 1994. The *Pesticide Manual, 10th ed.*. Crop Protection Publications, British Crop Protection Council, Farnham, Surrey, UK., K.

Yousuf A. R. 1996. Fishery resources of Kashmir. In: *Ecology, Environment and Energy* (A. H. Khan and A. K. Pandit, eds.) pp. 75 -120. Kashmir University.