CONTAMINATION OF RIVER NZOIA BY ALACHLOR METOLACHLOR AND THEIR DEGRADATION PRODUCTS

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ABSTRACT

Pollution of River Nzoia by pesticide has been suspected for sometime because the river drains one of Kenya's largest and richest agricultural basins. Improper agronomic practices have rendered the River Nzoia basin prone to massive soil erosion and pollution of the River Nzoia by agrochemical run-offs. Although 2-chloro-2',6'-diethyl-N-methoxymethyl)acetaniline(alachlor) and 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl)acetamide(metolachlor) are widely used herbicides in the river catchment basin, there has not been any monitoring effort to determine the levels of their residues and their metabolites in the river to date. This study was therefore conducted in order to give an insight of the status of pollution by these herbicides and their stable degradation products along the river.

Water, sediments and fish sample were collected at bi-monthly intervals from August, 1998 to February, 1999 from nine sampling sites along river Nzoia. Water samples were extracted using acetone and hexane solvent. Sediments were extracted with dichloromethane and n-hexane by centrifuging techniques while fish samples were subjected to soxhlet extraction (Mann, 1995; UNEP, 1988). The extracts were cleaned and dried by passing through florisil and sodium sulphate respectively, and analysed by chromatographic methods using external standards to determine the quantities of these herbicides and their metabolites in the samples.

2-chloro-2',6'-diethyl-N-(methoxymethyl)acetaniline(alachlor), 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl)acetamide(metolachlor) and the metabolites; 2, 6 – diethylaniline and 2-ethyl-6-methylaniline (DEMA) were detected in 51.58, 37.03 and 81.48% respectively of all the water samples analysed. In sediments, 2-chloro-2',6'-diethyl-N-(methoxymethyl)acetaniline (alachlor) was detected in 51.58%, while 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl)acetamide(metolachlor) and DEMA were both detected in 70.37%. In fish, 2-chloro-2',6'-diethyl-N-(methoxymethyl)acetaniline (alachlor),

2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl) acetamide (metolachlor) and DEMA were detected in 18.75, 25.00 and 56.25% of the samples respectively. The mean concentration of 2-chloro-2',6'-diethyl-N-(methoxymethyl)acetaniline (alachlor) in water, sediments and fish are 0.81, 26.4 and 7.44 ppb respectively, while for 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl)acetamide(metolachlor), the mean concentration levels are 1.07, 576.2 and 190.0 ppb, respectively. The mean concentrations of 2-chloro-2',6'-diethyl-N-(methoxymethyl)acetaniline(alachlor) in sediments and fish were about 32 times and 9 times higher than in water respectively. On the other hand, the mean concentrations of 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl)acetamide(metolachlor) in sediments and fish were about 500 and 190 times higher than in water respectively. The total aniline metabolites (DEMA) were about 22 times higher in both sediments and fish than in water. The results generally indicates that the mean concentrations of 2-chloro-2',6'-diethyl-N-(methoxymethyl)acetaniline(alachlor), 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl)acetamide(metolachlor) and DEMA were higher in sediments and fish than in water. On the average the concentration of the total metabolites in water, sediments and fish were higher than the parent compound. All residues indicated a general decrease in levels from Mumias to the Nzoia river delta at Lake Victoria, indicating the self cleansing capacity of the river. 2-chloro-2',6'-diethyl-N-(methoxymethyl)acetaniline(alachlor) which is more toxic than 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl)acetamide (metolachlor) had higher overall concentrations in all media than 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl)acetamide (metolachlor). The agricultural use of 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-ethyethyl)acetamide(metolachlor) as a herbicide is therefore recommended in preference to 2-chloro-2',6'-diethyl-N-(methoxymethyl)acetaniline(alachlor). The significance of including the stable metabolites in the monitoring programmes is clearly exhibited and recommended.

ASSESSMENT OF *CHIRONOMUS* (DIPTERA: CHIRONOMIDAE) LARVAL HEAD DEFORMITIES AS POSSIBLE BIOINDICATORS FOR POLLUTANTS IN SEDIMENTS OF RIVER NZOIA, KENYA.

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ABSTRACT

The study examined the morphological changes in benthic populations of midges resulting from pollution stresses along River Nzoia. 10,116 headparts of chironomids from 8 sites along River Nzoia were investigated for deformities. The fleshy part of the head was removed by Potassium Hydroxide (KOH) and fixed on slides with Euparal® for examination under a microscope at 400X magnification.

Results showed that there were more deformities in Webuye, with 69.81% of the examined menta deformed, followesd by Shibale 29.54%, Mumias 26.28%, Delta 24.79%, Moisbridge 2 & 1 with 28.31% and 22.38% respectively. The control site on Mt. Elgon had the least menta deformities of 8.82%. Webuye also had the highest mandible deformities, with 36.75% deformed followed by Mumias (12.92%) while there were no mandible deformities at the Mt. Elgon control site. The antennae showed greatest deformities at Moisbridge 2 (13.43%) and the lowest at the control site on Mt. Elgon, where 2.86% of the antennae examined were deformed.

There was a high prevalence of deformities in the tripartite teeth at all sites. For example, in Kitale, outer median (OM) and central median (CM) had 3.26% and 3.94% deformities, followed by the fourth outer lateral tooth (OL_4) 4.69% for heads with at least one deformity. Absence, bluntness, asymmetry and shortness in menta teeth as bioindicators were more common in all sampled sites than other parameters monitored, with the highest frequency occurring for bluntness (13.84%) followed by asymmetry (6.42%), and shortness (4.53%) for Webuye site. The least bioindicator in frequency at this site was extra teeth

(0.75%). Overlapping teeth were observed only in Moisbridge 1 samples, representing 0.05% of the total teeth examined for this site.

The data show that chironomid head deformities in River Nzoia can be used as bioindicators of pollution as more deformities were found in more polluted areas than slightly polluted or unpolluted sites. The results further indicate that the best mentum parameter for pollution monitoring is the median tripartite teeth, with asymmetry and bluntness as possible bioindicators.