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MONITORING OF SOME PESTICIDES IN NILE RIVER – DAMIETTA

Khaled H. El-Ezaby*, Mahmoud S. Ibrahem and Amany F. Abdo

Environmental Sciences Department, Faculty of Science at Damietta, Mansoura University, New Damietta City, Egypt

ABSTRACT

The present study was carried out to assess the organochlorine pesticide residues in water, sediment and fish samples from Damietta branch of the River Nile at Damietta governorate. Four sites were selected, these sites are Bossat Karim El-Din, Farskour, Al-Kaheel, and Al-Adliah through the period of spring 2006 to winter 2007. In water samples, 17 organochlorine pesticide residues were determined. The results indicated that only 9 residues were detected. Bossat Karim El-Din water analysis showed that α-BHC was 28.45 µg/l, in average of the four seasons, while the other residues were found in varied levels: 16 µg/l (4,4`-DDE), 44.78 µg/l (Endosulfan II) and 50.72 µg/l (4,4`-DDD). Sediment samples contained high levels of organochlorine pesticide residues. In Bossat site, the sediment contained β- BHC (0.274 µg/g), υ-BHC (0.6 µg/g) and Endosulfan I (0.72 µg/g). Moreover, the results confirmed the detection of different amounts of pesticides residues in gills, viscera and gonads of *Tilapia sp.* fish. It was found that, the majority of pesticide residues were detected in the visceral tissues compared with gonads and muscles. Heptachlor pesticide (1.86 µg/g fresh weigh) was the only residue detected in fish gonads at Farskour site. It is fortunate that no organochlorine pesticide residues were detected in fish muscles. However, it is worth mentioning, that the mean concentrations of liver function enzymes in all fish samples is much correlated with organochlorine pesticides residues in liver.

Key words: Pesticides residues, Damietta branch, Fish, Water, Sediment.

INTRODUCTION:

The quality of water in rivers, lakes, ponds and streams greatly influence the water use. The introduction of pollutants from human activity in many parts of the world has seriously degraded water quality. Sources of water pollution are domestic, agricultural or industrial. In Egypt, wastewater and agriculture drains, containing pesticide residues, are discharged into the Nile river directly. Several hundred pesticides of different chemical nature are currently used for agricultural purposes all over the world. Because of their widespread use, they are detected in various environmental matrices, such as soil, water and air [**Chhatwal (1996)**].

Trace organic compounds, such as pesticides, herbicides, and other agricultural chemicals, are toxic to most life forms and therefore can be significant contaminants of surface waters. These chemicals are not common constituents of domestic waste water but result primarily from surface runoff from agricultural, and park land. These chemicals are classified as priority pollutants [**Tchobanoglous & Burton (1991)**]. Waters contaminated with these pollutants endanger public health through the direct use as well as through feeding with fish that live in the polluted streams.

Uptake and accumulation of pesticide residues by microorganisms and fish led to build up in the food chain [**Ongley (1996) and Jensen *et al.*, (1997)**]. Fishes are excellent organisms for monitoring chlorinated hydrocarbons. They reflect long term exposure since they lose chlorinated hydrocarbons slowly, if at all [**lieb *et al.*, (1974)**].

MATERIAL AND METHOD

1. Study Area and Samples Collection:

The sampling locations were chosen to represent the probably dangered areas of the Nile River – Damietta Branch within Damietta Governorate and those that may be affected by dispersing of pesticides from agriculture run-off and industrial wastes, on different aquatic pathways around and neighboring to this area. In addition, they were chosen to cover all of the varieties of water quality found at this habitat. Accordingly, four sampling sites have been selected representing the aquatic environment at the study area as shown in figure (1). These sites extend from Bossat Karim El-Din, the southern border of Damietta Governorate to Al-Adliah at the north of the Governorate.

Grab samples of water and sediment were collected seasonally for one year from Bossat Karim El-Din, Farskour, Al-Kaheel and Al-Adliah, during the period from spring 2006 to winter 2007. At the same times, fish samples were also caught from the segment under investigation

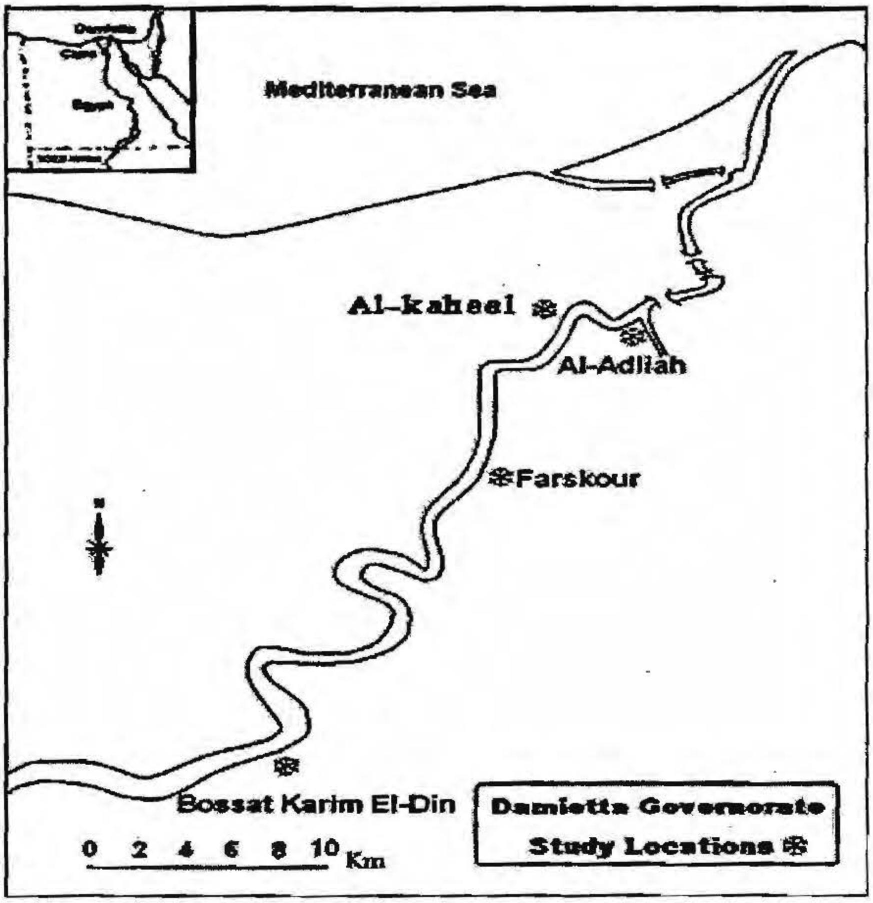

Fig. (1): Map showing sampling locations

2. ORGANOCHLORINE PESTICIDE RESIDUES ANALYSIS:

2.1. Extraction and Clean-up of water samples:

Organochlorine pesticides were extracted from the water by the liquid-liquid extraction. Known volume of water samples (1 liter) were extracted three times with 50 ml portions of a mixture of 15% methylene chloride and 85% *n*- Hexane. The combined extracts were dehydrated by anhydrous sodium sulfate and concentrated to about 2 ml by evaporation under vacuum. The previously obtained extract was passed through the column at a flow rate of 5 ml/min. The column was eluted at the same rate with 200 ml eluting solvent (6% diethyl ether in petroleum ether). The elute was concentrated to suitable volume in a rotary evaporator, after which it was dried in a test tube at 50°C. Then they are determined by gas chromatography (AOAC, 1990a).

2.2. Extraction and Clean-up of sediment and fish samples:

Extraction of pesticides residues was carried out using acetonitrile-petroleum ether partitioning. Clean up was done on florisil column with one mixture (6% diethyl ether in petroleum ether) as described by the official methods of analysis (AOAC, 1990b).

2.3. Separation and identification of the studied organochlorine pesticide residues by GC:

Before injection into gas liquid chromatography apparatus, the dried extract was dissolved in 1 ml n- hexane of chromatographic grade. The conditions for GC analysis of Organochlorine pesticides were as shown in Table (1).

Table (1): The conditions for GC analysis of Organochlorine pesticides

Instrument:	HP 5890 Series plus (EPC) Gas chromatograph
Detector:	^{63}Ni electron captur
Column:	Glass column
Chart speed:	2.5m.m/min
Column packing material:	Silicon GE-30
Injection temperature:	250°C
Detector temperature:	300°C
Column temperature:	205°C
Carrier gas:	N_2 (1kg/cm^2)
Rate of pressure:	Air (0.2 kg/ cm^2)
Injection volume:	2µL
Retention time/min:	

α- BHC (7.842); β- BHC (8.277); υ- BHC (9.578); σ-BHC (10.565); Aldrin (11.573); Heptachlor epoxide (12.376); Heptachlor (10.149) min; Endosulfan I (13.332); 4, 4-DDE (14.285); Dieldrin (14.849); Endrin (15.029); 4, 4-DDD (15.727); Endosulfan II (16.054);

RESULTS AND DISCUSSION

In this study, seventeen organochlorine pesticide residues were investigated in the collected water, sediment and fishes samples varied along the locations and seasons

1. Pesticide residues in water samples:

Results in Table (2) revealed that the detected compounds were BHC (α-, β- ,σ-BHC), Aldrin, 4,4`-DDE, 4,4`-DDD, Endosulfan II, 4,4`-DDT and Endosulfan sulfate. Organochlorine pesticide residues were not detected in water samples during summer 2006 that may be attributed to high temperature (30°C) of water during Summer season, in which pesticides are unstable in water, and the rate at which they are hydrolyzed increases with temperature increasing [**Howard (1991)**]. Moreover, the volatility properties of organochlorine pesticides may cause losing of them to the atmosphere and transported of it far from their source [**Haque & Freed (1975) and Ritter *et al.*, (1996)**].

In spring 2006, β-, υ- and σ-BHC, Heptachlor, Heptachlor epoxide, Endosulfan I, Dieldrin, Endrin, Endrin aldehyde and Methoxychlor, were not detected in all of the study locations, while α- BHC concentration was 66.87, 18.52, 25.28 and 53 µg/l at Bossat Karim El-Din, Farskour, Al-Kaheel and Al-Adliah, respectively. Aldrin concentration was 10.84, 16.65 and 14.74 µg/l at Farskour, Al-Kaheel and Al-Adliah, respectively. 4,4`- DDE, 4,4`-DDD and Endosulfan II were only detected at Bossat Karim El-Din with a values of 16, 50.72 and 44.78 µg/l, respectively. At the same time, 4,4`-DDT and Endosulfan sulfate were only detected at Al-Kaheel water samples with a concentration of 41.83 and 36.35 µg/l, respectively. In autumn 2006, only β-BHC and Aldrin were detected. The concentration of β-BHC was 10.15 µg/l at Al-Kaheel, while Aldrin concentration was 6.49 µg/l at Al-Adliah location. In winter 2007, α-BHC was detected at Al-Kaheel and Al-Adliah, with a value of 15.34 and 16.25 µg/l, respectively. σ-BHC and Aldrin were detected only at Al-Adliah site with a value 1.16 and 7.06 µg/l, respectively. The high concentrations of organochlorine pesticide residues in water could be attributed to the agricultural run off resulting from the extensive agricultural activity in the bank of these locations. These banned organochlorine pesticides can leach through the soil, run-off [**Guenzi & Beard (1967)**] water erosion [**Swoboda &Thomas(1968)**] wind erosion [**Aly & Badawy(1984)**] turbidity and primary productivity [**Simpson *et al.*,(1996) and Hong *et al.*, (1999)**]. Those proportions of the leachate may reach irrigation and drainage water and then transferred to the Nile water [**Hassan *et al.*,(1996)**]. However, there was indication of recent use of pesticides during spring, autumn and winter seasons. The use of pesticides in agriculture and public health in Damietta Governorate has generally been increasing due to rising population and demand for agro-chemicals [**Mwevura *et al.*, (2002)**].

The concentrations of organochlorine pesticides in water samples in the present study were much greater than the data reported by[**Abou-Arab *et al.*, (1995); Hassan *et al.*, (1996); Metwally (2000); Abbassy *et al.*, (1999) Sarkar *et al.*, (2003)**] at snowfed and rainfed rivers/ streams.

Table (2): Residue levels of organochlorine pesticide residues in water samples (µg/l) collected from different sites of Damietta Governorate during period from Spring (2006) to Winter (2007).

Site	Season	α- BHC	β-BHC	υ-BHC	σ-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan I
Bossat Karim El-Din	Spring	66.87	ND	ND	ND	ND	ND	ND	ND
	Summer	ND	ND	ND	ND	ND	ND	ND	ND
	Autumn	ND	ND	ND	ND	ND	ND	ND	ND
	winter	ND	ND	ND	ND	ND	ND	ND	ND
Farskour	Spring	18. 52	ND	ND	ND	ND	10.84	ND	ND
	Summer	ND	ND	ND	ND	ND	ND	ND	ND
	Autumn	ND	ND	ND	ND	ND	ND	ND	ND
	winter	ND	ND	ND	ND	ND	ND	ND	ND
Al-Kaheel	Spring	25. 28	ND	ND	ND	ND	16.65	ND	ND
	Summer	ND	ND	ND	ND	ND	ND	ND	ND
	Autumn	ND	10.15	ND	ND	ND	ND	ND	ND
	winter	15. 34	ND	ND	ND	ND	ND	ND	ND
Al-Adliah	Spring	53	ND	ND	ND	ND	14.74	ND	ND
	Summer	ND	ND	ND	ND	ND	ND	ND	ND
	Autumn	ND	ND	ND	ND	ND	6.49	ND	ND
	winter	16. 25	ND	ND	1.16	ND	7.06	ND	ND

Table (2 continued): Residue levels of organochlorine pesticide residues in water samples (µg/l) collected from different sites of Damietta Governorate during period from Spring (2006) to Winter (2007).

Site	*Season*	*Endrin*	*4,4'-DDD*	*Endosulfan II*	*4,4' DDT*	*4,4'-DDE*	*Endosulfan Sulfate*	*Dieldrin*
Bossat Karim El-Din	*Spring*	*ND*	*50.72*	*44.78*	*ND*	*16*	*ND*	*ND*
	Summer	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Autumn	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	winter	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Farskour	*Spring*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Summer	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Autumn	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	winter	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Al-Kaheel	*Spring*	*ND*	*ND*	*ND*	*41.83*	*ND*	*36.35*	*ND*
	Summer	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Autumn	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	winter	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Al-Adliah	*Spring*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Summer	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Autumn	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	winter	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*

2. Pesticide residues in sediment samples:

As shown in Table (3), Endosulfan I, Dieldrin and Endosulfan sulfate were the only pesticide residues detected in spring 2006. The concentration of Endosulfan I was 0.72 µg/g dry weight sediment at Bossat Karim El-Din. Dieldrin concentration was 0.23 µg /g dry weight sediment at Al-Kaheel location that might be attributed to the past use of Aldrin and/or Dieldrin itself as dieldrin is formed from aldrin by chemical oxidationin soil [**Ritter *et al.*, (1996)**].

Endosulfan sulfate was only detected at Farskour and Al-Kaheel with concentration of 0.62 and 1.69 µg/g dry weight sediment, respectively. Al-Adliah site regarded disappearing of pesticide residues. In summer 2006, it was noted that, among the previously mentioned detected pesticide residues in sediment during this study, β-BHC, σ-BHC, Endosulfan I and Endosulfan sulfate were the only pesticide residues detected at Farskour site with concentration of 0.59, 0.34, 1.12 and 1.02 µg/g dry weight sediment, respectively, during this season, while other sites regarded disappearing of organochlorine pesticide residues. In autumn 2006, it is obvious that, α-, β-and σ-BHC and Aldrin were the only organochlorine pesticide residues detected at autumn season. β-BHC was detected only at Bossat Karim El-Din with a value of 0.27 µg/g dry weight sediment, while σ-BHC was detected only at Farskour with a value of 0.05 µg/g dry weight sediment. α-BHC and Aldrin were the only pesticide residues detected at Al-Adliah site with a value of 0.46 and 0.02 µg/g dry weight sediment, respectively. In winter 2007, α-BHC was detected only at Al-Adliah with a value of 0.90 µg/g dry weight sediment. υ-BHC was detected only at Bossat Karim El-Din site with concentration of 0.6 µg/g dry weight sediment. While β- BHC, σ-BHC and 4,4`-DDE were detected at Farskour site with concentrations of 0.70, 0.20 and 0.05 µg/g dry weight sediment, respectively. At the same time, σ-BHC was detected at Al-Kaheel sediment samples with concentration of 0.47 µg/g dry weight sediment. Presence of Endosulfan sulfate and Endosulfan I in sediment samples was agree with (**Nowell *et al.*, 1999**), which explained that Endosulfan is moderately hydrophobic and persistent could be bioconcentrated by aquatic organisms and can be found at higher concentration in sediment in areas where they are being heavily used. Endosulfan can be mobilized from contaminated soils into water bodies. There, it could be adsorbed to particulate matter, ending up in the sediment (**Leonard *et al.*, 2001**) and that reflects the great capacity of soil to adsorb and accumulate such pollutants (**Kalmaz and Kalmaz, 1979**). Also detection of 4,4`-DDE in Farskour sediment might be derived from the aged and weathered agricultural soils and transported by surface runoff to the river sediment [**Mwevura *et al.*, (2002)**].

Table (3): Pesticide residue levels of organochlorine pesticide residues in Sediment samples (µg/g dry weight) collected from different sites of Damietta Governorate during period from Spring (2006) to Winter (2007).

Site	Season	α-BHC	β-BHC	υ-BHC	σ-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan I
Bossat Karim El-Din	Spring	ND	ND	ND	ND	ND	ND	ND	0.72
	Summer	ND	ND	ND	ND	ND	ND	ND	ND
	Autumn	ND	0.274	ND	ND	ND	ND	ND	ND
	winter	ND	ND	0.6	ND	ND	ND	ND	ND
Farskour	Spring	ND	ND	ND	ND	ND	ND	ND	ND
	Summer	ND	0.59	ND	0.34	ND	ND	ND	1.12
	Autumn	ND	ND	ND	0.048	ND	ND	ND	ND
	winter	ND	0.70	ND	0.20	ND	ND	ND	ND
Al-Kaheel	Spring	ND	ND	ND	ND	ND	ND	ND	ND
	Summer	ND	ND	ND	ND	ND	ND	ND	ND
	Autumn	ND	ND	ND	ND	ND	ND	ND	ND
	winter	ND	ND	ND	0.47	ND	ND	ND	ND
Al-Adliah	Spring	ND	ND	ND	ND	ND	ND	ND	ND
	Summer	ND	ND	ND	ND	ND	ND	ND	ND
	Autumn	0.456	ND	ND	ND	ND	0.022	ND	ND
	winter	0.90	ND	ND	ND	ND	ND	ND	ND

Table (3 continued): Pesticide residue levels of organochlorine pesticide residues in Sediment samples (µg/g dry weight) collected from different sites of Damietta Governorate during period from Spring (2006) to Winter (2007).

Site	*Season*	*Endrin*	*4,4'-DDD*	*Endosulfan II*	*4,4'-DDT*	*4,4'-DDE*	*Endosulfan Sulfate*	*Dieldrin*
Bossat Karim El-Din	*Spring*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Summer	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Autumn	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	winter	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Farskour	*Spring*	*ND*	*ND*	*ND*	*ND*	*ND*	*0.62*	*ND*
	Summer	*ND*	*ND*	*ND*	*ND*	*ND*	*1.02*	*ND*
	Autumn	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	winter	*ND*	*ND*	*ND*	*ND*	*0.05*	*ND*	*ND*
Al-Kaheel	*Spring*	*ND*	*ND*	*ND*	*ND*	*ND*	*1.69*	*0.23*
	Summer	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Autumn	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	winter	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Al-Adliah	*Spring*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Summer	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	Autumn	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
	winter	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*

3. Pesticide residues in fish gills and viscera:

The obtained results in Table(4) revealed that the detection of BHC (the isomers α-, β-, υ- and σ-BHC), Heptachlor, Aldrin, Endosulfan I, 4,4`-DDE, Dieldrin, Endrin, 4, 4`-DDD and Endosulfan sulfate were detected in gills and visceral samples of *(Tilapia sp.)*. During spring 2006, α- BHC, β- BHC and Dieldrin were the only pesticide residues detected at that season. The concentration of α- BHC was 0.84 µg/g fresh weight at Bossat Karim El-Din site, where β- BHC concentration was 0.41 µg/g fresh weight at Al-Kaheel. At the same time, Dieldrin was detected at Farskour, Al-Kaheel and Al-Adliah with concentration of 0.46, 0.42 and 0.26 µg/g fresh weight, respectively. In summer 2006, α- BHC concentrations were 0.66, 1.02 and 1.12 µg/g fresh weight at Bossat Karim El-Din, Farskour and Al-Adliah, respectively. β- BHC was not detected at all sites, while υ- BHC was detected at Al-Kaheel with a value of 0.75 µg/g fresh weight. σ- BHC was detected at Farskour and Al-Adliah, with concentrations of 0.11 and 0.98 µg/g fresh weight, respectively. Heptachlor was detected at Bossat Karim El-Din site with a concentration value of 0.30 µg/g fresh weight. Aldrin was not detected in Al-Adliah site however its concentrations were 0.82, 1.01 and 0.91 µg/g fresh weight at Bossat Karim El-Din, Farskour and Al-Kaheel, respectively. Endosulfan 1 was detected only at Al-Kaheel and Al-Adliah with concentrations values of 0.46 and 0.50 µg/g fresh weight, respectively. 4,4`-DDE concentrations were 0.82, 1.10, 1.46 and 1.01 µg/g fresh weight at Bossat Karim El-Din, Farskour, Al-Kaheel and Al-Adliah, respectively, where Dieldrin was not appeared during this season except at Al-Adliah site with concentration of 1.03 µg/g fresh weight. Endosulfan sulfate detected at Al-Kaheel with concentration of 0.51 µg/g fresh weight but was not detected at other sites. In autumn 2006, Bossat Karim El-Din fish samples contained α- BHC, υ- BHC, σ-BHC, Aldrin, Endosulfan I, 4,4`-DDE, Endrin and 4,4-DDD with concentrations of 0.04, 0.08, 0.11, 0.05, 0.01, 0.17, 0.08 and 0.06 µg/g fresh weight, respectively. Farskour fish samples contained high concentration of α- BHC, υ- BHC and σ-BHC 0.41, 0.07 and 0.13 µg/g fresh weight, respectively. BHC (the isomers α-, β-, υ- and σ-BHC) and 4,4`-DDE were detected at Al-Kaheel with concentrations of 0.12, 0.01,0.04, 0.07 and 0.14 µg/g fresh weight, respectively. It was observed that, organochlorine pesticides were not detected at Al-Adliah site during autumn. In winter 2007, α -BHC was detected only at Farskour site with a value of 1.02 µg/g fresh weigh, while υ- BHC was detected only at Farskour and Al-Adliah with values of 0.058 and 0.06 µg/g fresh weigh, respectively. σ-BHC concentrations were 0.06 and 0.08 µg/g fresh weigh at Farskour and Al-Adliah, where Aldrin concentration was 0.02 µg/g fresh weigh at Farskour site. 4,4`-DDE was detected at all study sites, Bossat Karim El-Din, Farskour, Al-Kaheel and Al-Adliah with concentrations of 0.20, 0.13, 0.16 and 0.26 µg/g fresh weigh, respectively. 4,4`-DDD was detected only at Al-Adliah with a value of 0.09 µg/g fresh weigh. The increasing of organochlorine pesticide residues concentrations in fish gills and viscera might be due to the accumulation of such compounds by direct absorption through the gills, and by exposure to contaminated sediments, consumption of insects and smaller fish **[Bush & Kadlec (1995)]**.

Table (4): Residue levels of organochlorine pesticides in fish gills and viscera of *Tilapia Sp.* (Bolti fish) samples (µg/g) for the period from Spring (2006) to Winter (2007)

Site	Season	α-BHC	β-BHC	υ-BHC	σ-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan I
Bossat Karim El-Din	Spring	0.84	ND	ND	ND	ND	ND	ND	ND
	Summer	0.66	ND	ND	ND	0.30	0.82	ND	ND
	Autumn	0.043	ND	0.077	0.106	ND	0.052	ND	0.01
	winter	ND	ND	ND	ND	ND	ND	ND	ND
Farskour	Spring	ND	ND	ND	ND	ND	ND	ND	ND
	Summer	1.02	ND	ND	0.11	ND	1.01	ND	ND
	Autumn	0.409	ND	0.068	0.125	ND	ND	ND	ND
	winter	1.02	ND	0.058	0.055	ND	0.02	ND	ND
Al-Kaheel	Spring	ND	0.41	ND	ND	ND	ND	ND	ND
	Summer	ND	ND	0.75	ND	ND	0.91	ND	0.46
	Autumn	0.123	0.01	0.041	0.072	ND	ND	ND	ND
	winter	ND	ND	ND	ND	ND	ND	ND	ND
Al-Adliah	Spring	ND	ND	ND	ND	ND	ND	ND	ND
	Summer	1.12	ND	ND	0.98	ND	ND	ND	0.50
	Autumn	ND	ND	ND	ND	ND	ND	ND	ND
	winter	ND	ND	0.06	0.08	ND	ND	ND	ND

Table (4 Continued): Residue levels of organochlorine pesticides in fish gills and viscera of *Tilapia Sp.* (Bolti fish) samples (µg/g) for the period from Spring (2006) to Winter (2007)

Site	Season	Endrin	4,4'-DDE	Endosulfan II	4,4'-DDT	4,4'-DDD	Endosulfan sulfate	Dieldrin
Bossat Karim El-Din	Spring	ND	ND	ND	ND	ND	ND	ND
	Summer	ND	0.82	ND	ND	ND	ND	ND
	Autumn	0.081	0.081	ND		0.061	ND	ND
	winter	ND	0.20	ND	ND	ND	ND	ND
Farskour	Spring	ND	ND	ND	ND	ND	ND	0.46
	Summer	ND	1.1	ND	ND	ND	ND	ND
	Autumn	ND	ND	ND	ND	ND	ND	ND
	winter	ND	0.13	ND	ND	ND	ND	ND
Al-Kaheel	Spring	ND	ND	ND	ND	ND	ND	0.42
	Summer	ND	1.46	ND	ND	ND	0.51	ND
	Autumn	ND	0.138	ND	ND	ND	ND	ND
	winter	ND	0.16	ND	ND	ND	ND	ND
Al-Adliah	Spring	ND	ND	ND	ND	ND	ND	0.26
	Summer	ND	1.01	ND	ND	ND	ND	1.03
	Autumn	ND	ND	ND	ND	ND	ND	ND
	winter	ND	0.26	ND	ND	0.09	ND	ND

4. Pesticide residues in fish muscles

In the present study, organochlorine pesticide residues were not detected in fish's muscles, that may be attributed to the low level of fat in muscles, so the pesticide residues may be accumulated in other organs more than muscles.

5. Pesticide residues in fish gonads:

The results showed the absence of organochlorine pesticides from fish gonads, except Heptachlor pesticide that was the only organochlorine pesticides detected at Farskour site with a concentration of 1.86 µg/g fresh weigh. The detection of heptachlor might be attributed to the extensive using of this pesticide in agriculture.

6. Effect of pesticide residues on fish liver functions:

6.1. Determination of Glutamic Pyruvic Transaminase (GPT), Glutamic Oxaloacetic Transaminase (GOT) and Alkaline phosphatase (ALP) in liver :

GPT, GOT and ALP were measured in fish liver samples caught from the study sites. The results are showed in Tables (5,6 and 7).

The results showed that higher levels of GPT, GOT and ALP found in the samples with higher accumulation of pesticide residues. This is evidence, which deduce the high concentrations of GOT, GPT and ALP enzymes in liver of fish samples, which had taken from Al-Kaheel and Bossat Karim El-Din sites.

Table (5): Variations in Glutamic Pyruvic Transaminase (GPT) enzyme activity in liver of *T. nilotica* (u/ml).

Site / Series	Bossat Karim El-Din	Farskour	Al-Kaheel	Al-Adliah
1	108.0	104.6	106.0	109.3
2	110.6	87.3	134.47	119.3
3	105.3	96.0	133.3	87.3
4	116.0	90.0	132.6	77.3
5	116.0	102.6	136.0	82.0
Mean ± SD	118.2 ± 4.8	96.1 ± 7.6	133.9 ± 1.4	95.04 ± 18.3

Table (6): Variations in Glutamic Oxaloacetic Transaminase (GOT) enzyme activity in liver of *T. nilotica* (u/ml).

Site Series	Bossat Karim El-Din	Farskour	Al-Kaheel	Al-Adliah
1	131.5	114.6	129.2	92.25
2	140.0	112.3	149.7	89.2
3	136.9	115.3	170.3	75.3
4	153.8	117.6	179.2	95.3
5	145.3	116.1	161.5	82.6
Mean ± SD	141.5 ± 8.5	115.2 ± 2.0	158.0 ± 19.5	86.9 ± 8.03

Table (7): Variations in Alkaline Phosphatase (ALP) enzyme activity in liver of *T. nilotica* (u/L).

Site Series	Al-Adliah	Bossat Karim El-Din	Farskour	Al-Kaheel
1	59.9	63.63	60.94	112.45
2	58.6	49.43	74.07	107.7
3	57.2	48.67	39.84	110.09
4	57.9	35.24	67.5	91.41
5	62.7	47.92	53.67	103.92
6	67	45.23	60.58	97.7
Mean ± SD	60.55 ± 3.71	48.35 ± 9.13	59.43 ± 11.83	103.88 ± 8.00

CONCLUSION

In conclusion, the concentration of the examined organochlorine pesticide residues in water were significantly exceeding the standards of organochlorine pesticides in water according to (WHO, 1984b) and the British Environmental Quality Standards (Gray, 1999). Sediment samples were found containing high levels of organochlorine pesticide residues. In addition, the concentrations of these examined organochlorine pesticide residues in fish samples (gills, viscera and gonads) were slightly exceeding the standards of organochlorine pesticides in fish according to Environmental Protection Agency. The majority of pesticide residues were detected in the visceral tissues compared with gonads and muscles. It is fortunate that no organochlorine pesticide residues were detected in fish muscles. However, it is worth mentioning, that the mean concentrations of liver function enzymes in all fish samples is much correlated with organochlorine pesticides residues in liver.

Therefore, and based on the obtained results the authors are strongly recommend periodic monitoring for micropollutants in Damietta branch, with special emphasis to pesticide residues in water and fish to assure safety and quality of these vital resources.

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الملخص العربى

رصد لبعض المبيدات فى نهر النيل – دمياط.

د/ خالد حسن العزبى*، أ.د/ محمود سالم إبراهيم، أمانى فريد عبده
قسم علوم البيئة – كلية العلوم بدمياط – جامعة المنصورة
مدينة دمياط الجديدة – مصر.

تهدف هذه الدراسة إلى تقدير وتقييم بعض متبقيات المبيدات العضوية المكلورة فى المياه والرسوبيات والأسماك بنهر النيل بمحافظة دمياط. ولقد تم اختيار الأربعة مواقع التالية للدراسة: بساط كريم الدين وفارسكور والكحيل والعدلية وذلك خلال الفترة من ربيع ٢٠٠٦ إلى شتاء ٢٠٠٧. وتم تقدير ١٧ مبيد من متبقيات المبيدات العضوية المكلورة بالمياه وتبين وجود ٩ متبقيات فقط. وقد تبين أن متوسط تركيز مبيد α- BHC حوالي 28,45ميكروجرام/لتر ببساط كريم الدين، كما وجدت تركيزات مبيدات 4,4`-DDE و Endosulfan II و 4,4`-DDD ١٦,٠ ميكروجرام/لتر و ٤٤,٧٨ميكروجرام/لتر و ٥٠,٧٢ ميكروجرام/لتر على التوالي.

ومن ناحية أخرى فقد وجدت تركيزات عالية من متبقيات المبيدات العضوية المكلورة فى عينات الرسوبيات. ففى منطقة بساط كريم الدين كان تركيز متبقيات المبيدات كالتالي: ٠,٢٧٤ ميكروجرام/جم بالنسبة لمبيد β-BHC و ٠,٦ ميكروجرام/جم لمبيد γ- BHC و ٠,٧٢ ميكروجرام/جم لمبيد Endosulfan I. وعلاوة على ذلك فقد أكدت النتائج وجود العديد من متبقيات المبيدات فى أحشاء وخياشيم ومناسل أسماك البلطي. وقد لوحظ ارتفاع تركيز متبقيات المبيدات فى الأحشاء والخياشيم مقارنة بالمناسل والعضلات حيث شهدت الاخيرة خلوها من اى متبقيات. من الجدير بالذكر ان متوسط تركيز إنزيمات وظائف الكبد فى جميع عينات الأسماك كانت مرتبطة بتركيز متبقيات المبيدات العضوية المكلوره فى أكبادها.