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Assessment of some Pesticides in Water, Sediment, *Clarias gariepinus* and *Procambarus clarkii* from two localities at Muweis canal, Zagazig, Egypt

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ABSTRACT

The distribution of pesticides in water, sediments, *Clarias gariepinus*, and *Procambarus clarkii* from Muweis canal at two localities was investigated to evaluate the pollution status and potential hazard in the river system. A total of 28 pesticides were analyzed using gas chromatography (GC) with electron capture detector. The concentration of pesticide residues ranged from ND (not detected) to 0.560mg/l for water samples, ND to 0.73 µg/g dw for sediment, ND to 9.653 µg/g ww for *C. gariepinus*, and ND to 6.875 µg/g ww for *P. clarkii*. High concentrations of organochlorine pesticides, specifically fenpropathrin, endosulfan ii, delta-BHC and dieldrin observed in all environmental media, are an indication of the current illegal use of banned pesticides for agricultural activities in the region. Tal-Haween water samples revealed the highest content of pesticides followed by El-Shabakat water, while the sediment of Tal-Haween observed more contaminated than that of El-Shabakat. Also, *C. gariepinus* exhibited more polluted than *P. clarkii*. Analysis of data showed significant differences between gills of *C. gariepinus*, water and sediment samples of Tal-Haween site in fenpropathrin and endosulfan ii respectively, while exhibited a highly significant difference between water and sediment samples of El-Shabakat site in aldrin. Moreover, there was a highly significant difference in correlation coefficient between water and sediment samples of El-Shabakat site in endosulfan ii and endrin. Concerning the mean concentrations of some pesticides in water and fish, the levels were higher than that recommended by the international permissible limits. It is an indication of a potential cancer hazard for the local inhabitants with lifetime consumption of pesticide-polluted fish.

INTRODUCTION

Aquatic resources (ponds, streams, rivers, oceans and seas) and fisheries are providing peoples with long-term benefits. Those benefits can be the direct financial ones that provide profit, employment and save money. For instance, the seafood industry gives hobs to business fisheries, retailers and wholesalers. More indirect, but equally valuable, benefits of aquatic ecosystems and fish include sports fishing, recreational boating, relaxation, natural beauty and swimming (Sciencedaily, 2008). There are occupational risks and safety concerns in the aquaculture industry. A few practices have caused ecological degradation (David *et al*., 2009).

Pesticides are compounds used to control pests, including aquatic weeds, insects, plant diseases and aquatic snails which carry the cause of schistosomiasis.

Pesticides have been observed to be very harmful to fish and the other organisms, which constitute the food chain. Pesticides are used widely in forestry, agriculture, public health and in veterinary practices, and are categorized according to their target use. The three major pesticides are insecticides (insect control), fungicides (Mycotic control) and herbicides (weed control) but the highly toxic is the insecticides. Since fishes are essential sources of lipids and proteins for domestic animals and humans, so fish health is very important for human beings. Insecticides are the chemical compounds which used to control insects by killing or preventing them from participating in undesirable behaviours or damaging. The pollution of surface water by insecticides is known to have ill impacts on the survival, growth, and reproduction of aquatic organisms. Various insecticides concentrations are found in many types of wastewater and various investigations have observed them be poisonous to aquatic organisms, especially fish species. Although chemistry has advantages, it creates great disadvantages as insecticides are threatening the long-term survival of major ecosystems by disturbance of environmental relationships between organisms and loss of biodiversity. The insecticidal residues which pollute the water are fundamentally due to the intensive agriculture combined with surface drainage and surface runoff, usually within a few weeks after application. Insecticides lead to reproductive disorders, decrease the rate of growth, and cause spinal deformities and histopathological changes in liver, gills, hematopoietic tissue such as the spleen, renal tubules, kidney and endocrine tissues as well as the brain, neurological disorder and genetic defect are other biological indicators of exposure to insecticides. Fishes are especially sensitive to the environmental water pollution. Thus, these contaminants such as insecticides may essentially harm certain biochemical and physiological processes that various types of insecticides can cause harmful effects to physiological and health status of fishes. Potentially, toxic substances are often released into the aquatic ecosystem. When is the dispatch of large quantities of toxins there might be an immediate effect as estimated by the sudden large-scale aquaculture mortality, for instance, fish kills caused by contamination of waterways with agricultural pesticides. Lower limits of discharge may result in accumulation of toxins in aquatic creatures. The final results, which may happen after a long period has passed toxins through the environment, and include low metabolism, immune suppression, and harm to the epithelia and gills (Sabra and Mehana, 2015).

Pollution of water systems and Paranoá Lake with organochlorine insecticides has been reported (Gold-Bouchot *et al.*, 1995), and is mostly due to the runoff of the chemicals applied in agriculture. The illegal utilization of organochlorine insecticides in agriculture proceeded for many years after. The chemical stability of these substances, their high lipid solubility and poisonous quality to animals and human (Bouwman *et al.*, 1990), have led researchers to be worried about their presence in the nature (Caldas *et al.*, 1999).

The aims of this work are to evaluate the level of Muweis canal contamination by pesticides and to assess the potential health risk posed to the consumers from the exposure to pesticides through the ingestion of fish grown in the Lake.

MATERIALS AND METHODS

Description of study areas:

Fish samples were collected from two localities at Sharkia Province that considered as natural sources for the fishery (Fig. 1). These localities lie east to Domietta Branch (Nile water). The two localities are from Muweis canal at El-Shabakat village (I) and Tal-Haween village (II). El-Shabakat village lies at the north of Zagazig city and was selected as a polluted area; where it receives agricultural wastes. Tal-Haween village lies at the south of Zagazig city and was selected as a polluted area (agricultural drainage area).

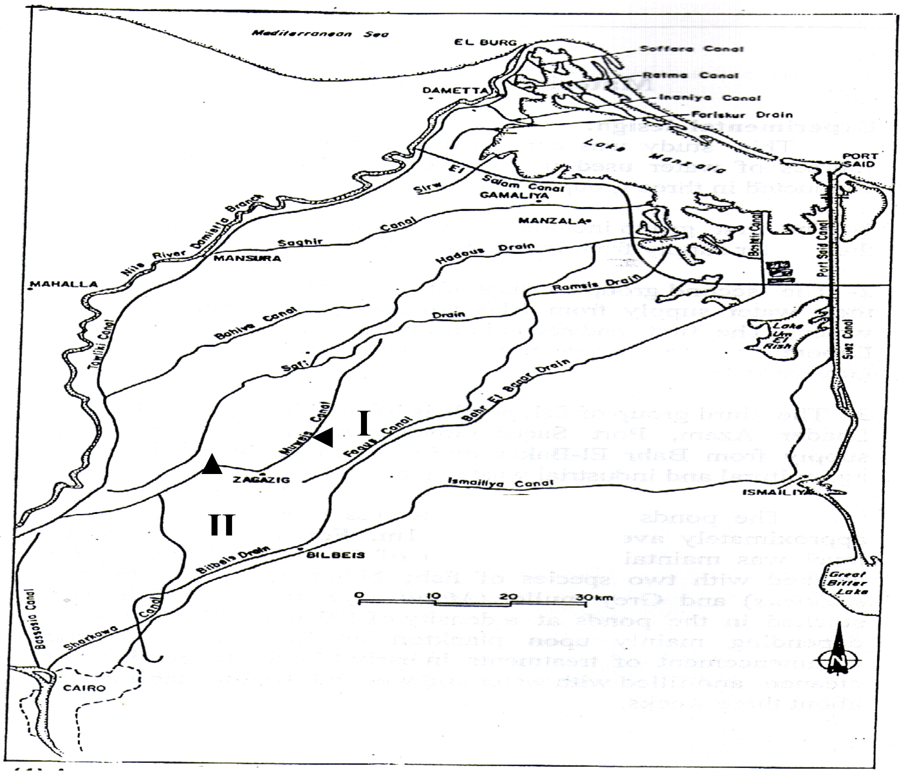

Fig. 1: A map showing the study sites.

Sampling sites:

Samples were collected bimonthly during the period from September 2017 to August 2018 from Muweis canal at El-Shabakat village (Fig. 2) and Tal-Haween village (Fig. 3). A large number of peoples are visiting the sites for heavy fishing, so these areas suffering severe disturbance from human activity (agricultural or fishing).

Fig. 2: Location of Muweis canal at El-Shabakat village.

Fig. 3: Location of Muweis canal at Tal-Haween village.

The studied species:

C. gariepinus (Fig. 4) is one of the most important freshwater fishes in Egypt. Total production of it in 1996 from the River Nile only about 11.310 tons; i.e. it contributes about 17.5% of the total Nile catch in Egypt. It is greyish olive to olive brown to blackish above, white or greyish beneath (Ibraheim and Khater, 2013).

Fig. 4: *Clarias gariepinus* (Burchell, 1822).

P. clarkii (Fig. 5) was introduced in the early 1980′s into Egypt after a trial for its aquaculture that eventually failed and some of them were thrown into the Nile. *P.*

clarkii was greatly spread all over the River Nile, its branches and ditches through the Delta, Cairo and Giza (Ibrahim *et al*., 1995).

Fig. 5: *Procambarus clarkii* (Girard, 1852).

They were left without control and caused a lot of damage to the fisheries of the Nile possibly by eating the eggs and young fish beside damaging the nets of fishermen as well as causing serious damages to irrigation systems as a result of their burrowing activities (Soliman *et al*., 1998b). Considerable effort has been paid to control its dispersal with pesticides (Hobbs *et al*., 1989& Khalil *et al*., 2015).

Analytical procedures:

One litre water samples were collected at the surface of the canal (6 samples/month) and kept refrigerated until analysis. Approximately 2 kg of sediment samples (6 samples/month) were dried at room temperature, ground, homogenized and kept at room temperature until analysis. Fish samples were captured (15 samples for each species/month),fish gills wrapped in aluminium foil and kept at -20°C until analysis. Size of individuals within the same species did not vary significantly. Two species were selected for this study: crayfish (*P. clarkii*) and catfish (*C. garpienus*). Water, sediment and fish samples were taken bimonthly from each site and analyzed for pesticide residues (organophosphorus and organochlorine) according to Azab *et al*., 2013; using gas chromatography (GC) with electron capture detector at the Central laboratory of pesticides, Ministry of Agriculture, Cairo, Egypt.

RESULTS AND DISCUSSION

A-Water analysis:

Pesticides in water:

Comparing the average concentrations of pesticides in the study sites, the data recorded in Table (1) and Fig. 6 showed the seasonal and annual variations in pesticides concentration in water samples. The concentrations had the order: Esfenvelarate > fenpropathrin > endosulfan ii > delta-BHC > dieldrin > other pesticides in water samples of El-Shabakat village, while it had the order: fenpropathrin > pṕ-DDT > aldrin> other pesticides in water samples of Tal-Haween village.

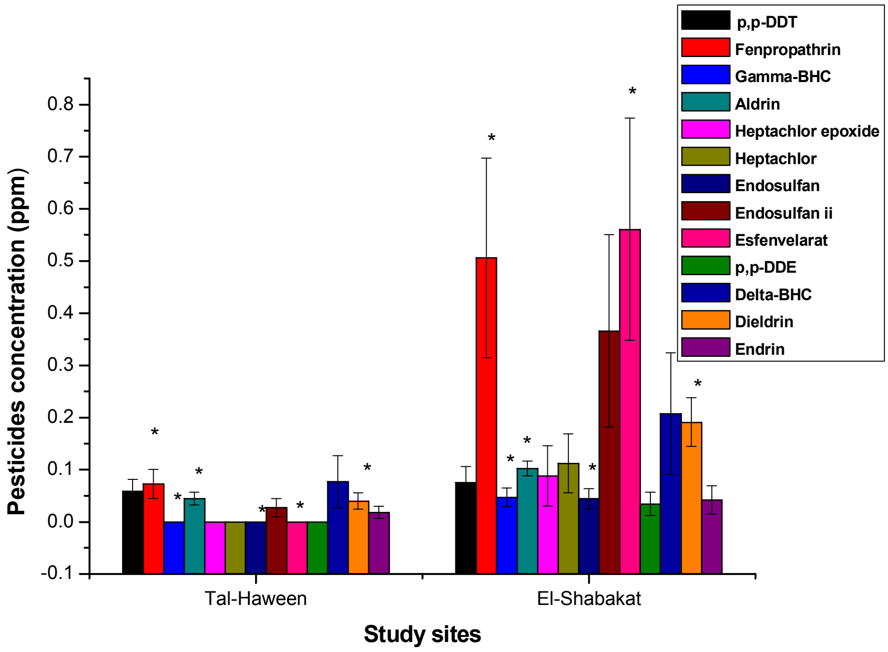

Fig. 6: Pesticide concentrations (annual mean ± SE) in water samples collected from the investigated sites at Muweis canal during autumn 2017- summer 2018.

Table 1: Average seasonal variations of some pesticides concentration (ppm) in water samples collected from Muweis canal at Tal-Haween (T) and El-Shabakat (E) villages from autumn 2017 to summer 2018.

Pesticides / Seasons / Sites		Autumn 2017	Winter 2018	Spring 2018	Summer 2018
PP-DDT	**T**	**0.136 ± 5E-4***	**ND**	**0.099 ± 1E-3***	**ND**
	E	**0.104 ± 5E-4***	**ND**	**0.196 ± 3E-4***	**ND**
Fenpropathrin	**T**	**0.131 ± 1E-3***	**ND**	**ND**	**0.158 ± 0.002***
	E	**1.030 ± 0.030***	**ND**	**ND**	**0.994 ± 0.007***
Gamma-BHC	**T**	**ND***	**ND**	**ND**	**ND***
	E	**0.095 ±1E-3***	**ND**	**ND**	**0.092 ± 4E-4***
Aldrin	**T**	**ND***	**0.036 ±4E-4***	**0.055 ±1E-3***	**0.087 ± 0.001***
	E	**0.066 ±0.002***	**0.070 ±0.003***	**0.115 ± 0.005***	**0.158 ± 0.003***
Heptachlor epoxide	**T**	**ND***	**ND**	**ND**	**ND**
	E	**0.352 ± 5E-4***	**ND**	**ND**	**ND**
Heptachlor	**T**	**ND***	**ND**	**ND**	**ND***
	E	**0.083 ±7.5E-4***	**ND**	**ND**	**0.365 ± 0.012***
Endosulfan	**T**	**ND***	**ND**	**ND**	**ND***
	E	**0.052 ± 3E-4***	**ND**	**ND**	**0.125 ± 5E-4***
Endosulfan ii	**T**	**ND***	**0.107 ± 0.005**	**ND**	**ND***
	E	**1.191 ± 0.061***	**0.188 ± 0.156**	**ND**	**0.084 ± 4E-4***
Esfenvelarat	**T**	**ND***	**ND**	**ND**	**ND***
	E	**1.181± 0.071***	**ND**	**ND**	**1.062 ± 0.007***
PP-DDE	**T**	**ND***	**ND**	**ND**	**ND**
	E	**0.136 ± 0.004***	**ND**	**ND**	**ND**
Delta-BHC	**T**	**ND**	**0.306 ± 0.002***	**ND***	**ND**
	E	**ND**	**0.737 ± 0.015***	**0.091 ± 1E-3***	**ND**
Dieldrin	**T**	**ND**	**ND***	**0.058 ± 0.002***	**0.100 ± 5E-4***
	E	**ND**	**0.167 ± 0.002***	**0.282 ± 0.006***	**0.315 ± 0.005***
Endrin	**T**	**ND**	**0.072 ± 5E-4***	**ND**	**ND**
	E	**ND**	**0.167 ±1E-3***	**ND**	**ND**

-ND means not detected.
-Data are represented as mean ± SE, (n=48).
* Means in the same column are significantly different ($p < 0.05$), using independent t-test.

Moreover, the water samples of El-Shabakat village is more polluted with pesticides than that of Tal-Haween village, and the pesticides concentration was restricted in winter and spring seasons other than summer and autumn seasons. Concerning the mean concentrations of pesticides; aldrin (1×10^{-5} mg/l), esfenvelarat (0.005 mg/l), Gamma-BHCand Delta-BHC (2×10^{-5} mg/l), pṕ-DDT (2×10^{-6} mg/l), dieldrin (5×10^{-6} mg/l), endrin (2×10^{-6} mg/l), heptachlor and heptachlor epoxide (1×10^{-5} mg/l), methoxychlor (5×10^{-6} mg/l), endosulfan (0.1µg/l), endosulfan ii (0.1µg/l), fenpropathrin (0.009 mg/l), and p,ṕ -DDE (10×10^{-6} mg/l) the levels were higher than the permissible levels recommended by Nowell and. Resek (1994), Dalvie *et al.* (2003) and WHO (2004).

B- Sediment analysis:

Pesticides in sediment:

Comparing the average concentrations of pesticides in the study sites, the data recorded in Table (2) and Fig. 7 showed the seasonal and annual variations in pesticide concentrations in sediment samples. The concentrations had the order: methoxychlor > endosulfan sulfate > other pesticides in sediment samples of El-Shabakat village, but it had the order: methoxychlor > dieldrin > other pesticides in sediment samples of Tal-Haween village. It seems that the concentration of the insecticides was not obviously higher in sediments than in bodies of water (Abdel Baky *et al*., 1998). Concerning the mean Concerning the mean concentrations of pesticides dieldrin (0.0050mg/kg), pṕ -DDE (0.828 mg/kg), endrin aldehyde (0.76mg/kg), heptachlor epoxide (0.014mg/kg), aldrin (0.0050 mg/kg), ethion (0.025 mg/kg), endosulfan, endosulfan ii and (0.0512 mg/kg), the levels were lower than the permissible levels recommended by Nowell and. Resek (1994) and Sonoma County Water Agency (2009), while endosulfan sulfate (0.0512 mg/kg), methoxychlor (0.0050 mg/kg) and dieldrin in water samples of Tal-Haween village were higher than that of the permissible limits.

Table 2: Average seasonal variations of some pesticides concentration (µg/g) in sediment samples collected from Muweis canal at Tal-Haween (T) and El-Shabakat (E) villages from autumn 2017 to summer 2018.

Pesticides	Seasons / Sites	Autumn 2017	Winter 2018	Spring 2018	Summer 2018
Aldrin	T	0.005 ± 5E-5*	ND	ND	0.009 ± 5E-4*
	E	ND*	ND	ND	0.005 ± 5E-4*
Heptachlor epoxide	T	ND	ND*	ND	ND
	E	ND	0.004 ± 4E-4*	ND	ND
Endosulfan	T	0.004 ± 3.5E-4*	ND	0.012 ± 5E-4	0.013 ± 2.5E-4
	E	ND*	ND	0.008 ±2.5E-4	0.012 ± 3.5E-4
Endosulfan ii	T	ND	0.006 ± 3E-4*	ND	ND
	E	ND	0.008 ± 2E-4*	ND	ND
Endosulfan sulfate	T	ND*	ND	ND	ND*
	E	0.092 ± 0*	ND	ND	0.094 ± 0*
PP-DDE	T	ND	ND*	ND	ND
	E	ND	0.014 ± 3.5E-4*	ND	ND
Dieldrin	T	ND	0.141 ± 1E-3*	ND	ND
	E	ND	0.009 ± 1.5E-4*	ND	ND
Endrin aldehyde	T	ND	ND	0.002 ± 4E-5*	ND
	E	ND	ND	ND*	ND
Methoxychlor	T	ND	2.920 ± 0.020*	ND	ND
	E	ND	2.188 ± 0.058*	ND	ND
Eithion	T	0.017 ± 3E-4*	ND	ND	ND
	E	ND*	ND	ND	ND

- ND means not detected. Data are represented as mean ± SE, (n=48).

* Means in the same column are significantly different ($p < 0.05$), using independent t-test.

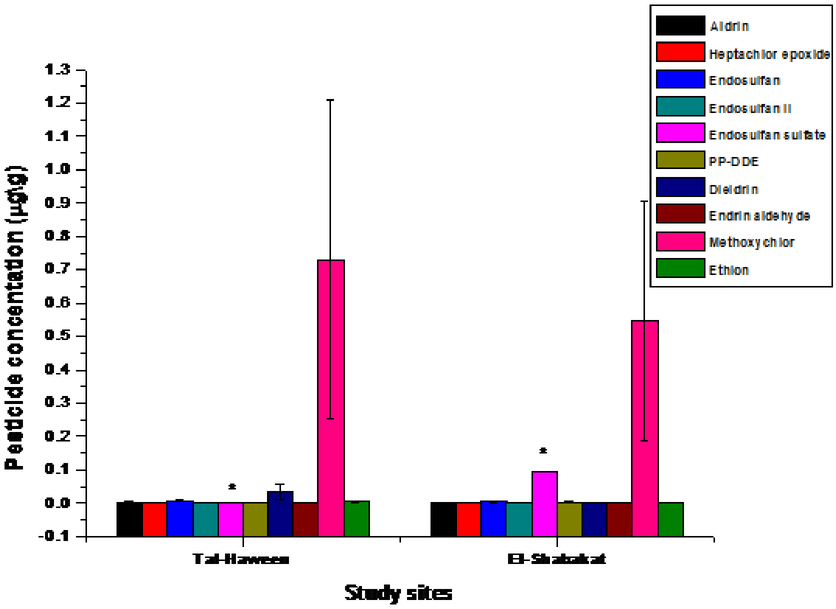

Fig. 7: Pesticides concentration (annual mean ± SE) in sediment samples collected from the investigated sites at Muweis canal during autumn 2017 - summer 2018.

C- Fish analysis:

Pesticides in fish gills:

Comparing the average concentrations of pesticides and the correlation coeffecient (r) in the investigated sites, Tables (3 & 4 & 5a, b & 6a, b) and Fig. 8 showed variations between pesticide concentrations in fish gills. The concentrations had the order: methoxychlor > other pesticides in both fish species. Moreover, the fish *C. gariepinus* is more polluted with pesticides than *P. clarkii*. The present study revealed that p,ṕ-DDT (1 mg/kg), fenpropathrin (< 0.1 mg/kg), aldrin (0.1 mg/kg), heptachlor (0.1 mg/kg), endrin (0.1 mg/kg) and concentrations were lower than the permissible levels recommended by Nowell and. Resek (1994), while methoxychlor (< 0.1 mg/kg) concentration was higher than the permissible limit in *c. gariepinus* of both study sites.

Table 3: Average seasonal variations of some Pesticides concentration (µg/g) in gills of *Clarias gariepinus* collected from Muweis canal at Tal-Haween (T) and El-Shabakat (E) villages from autumn 2017 to summer 2018.

Pesticides \ Seasons	Sites	Autumn 2017	Winter 2018	Spring 2018	Summer 2018
PP-DDT	**T**	0.278 ± 1E-3*	ND	ND	0.278 ± 1E-3*
	E	ND*	ND	ND	ND*
Fenpropathrin	**T**	0.057 ± 0.003*	ND	ND	0.066 ± 3.5E-4*
	E	ND*	ND	ND	ND*
Aldrin	**T**	0.008 ± 3.5E-4*	0.021± 5E-4*	ND	0.009 ± 3.5E-4*
	E	ND*	0.012 ± 5E-4*	ND	ND*
Heptachlor	**T**	ND	0.023 ± 5E-4*	0.031± 5E-4*	ND
	E	ND	ND*	0.023 ± 5E-4*	ND
Endrin	**T**	ND	ND	ND	ND
	E	ND	ND	ND	ND
Methoxychlor	**T**	10.418 ± 0.018*	17.577 ± 0.027*	ND	10.618 ± 0.004*
	E	6.659 ± 0.004*	ND*	ND	7.121 ± 5E-4*

- ND means not detected. Data are represented as mean ± SE, (n=120).

* Means in the same column are significantly different ($p < 0.05$), using independent t-test.

Table 4: Average seasonal variations of some Pesticides concentration (µg/g) in gills of *P. clarkii* collected from Muweis canal at Tal-Haween (T) and El-Shabakat (E) villages from autumn 2017 to summer 2018.

Pesticides \ Seasons	Sites	Autumn 2017	Winter 2018	Spring 2018	Summer 2018
PP-DDT	**T**	ND	ND	ND	ND
	E	ND	ND	ND	ND
Fenpropathrin	**T**	ND	ND	ND	ND
	E	ND	ND	ND	ND*
Aldrin	**T**	0.011 ± 5E-4*	0.014 ± 4E-4*	ND	0.020 ± 1E-4*
	E	ND*	0.011 ± 5E-4*	ND	ND
Heptachlor	**T**	ND	ND	0.022 ± 5E-4*	ND
	E	ND	ND	0.025 ± 3.5E-4*	ND
Endrin	**T**	ND	0.015 ± 2.5E-4*	ND	ND
	E	ND	ND*	ND	ND
Methoxychlor	**T**	ND*	ND*	ND	ND*
	E	10.095 ± 0.0015*	7.110 ± 0.010*	ND	10.208 ± 0.003*

- ND means not detected.
- Data are represented as mean ± SE, (n=120).

* Means in the same column are significantly different ($p < 0.05$), using independent t-test.

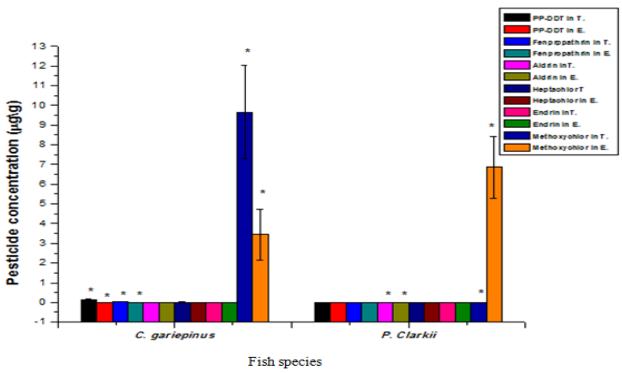

Fig. 8: Pesticides concentration (annual mean ± SE) in gills of *C. gariepinus* and *P. clarkii* collected from Muweis canal at Tal-Haween (T) and El-Shabakat (E) villages during autumn 2017-summer 2018.

Table 5a: Correlation coefficient between pesticide contents (µg/g or ppm) for *Clarias gariepinus* from Muweis canal at Tal-Haween village (E) during autumn 2017 - summer 2018.

Pesticides	Tissues	gills	sediment	water
P,ṕ-DDT	Gills	1	ND	0.133
	Sediment	ND	ND	ND
	Water	0.133	ND	1
Fenpropathrin	Gills	1	ND	0.999**
	Sediment	ND	ND	ND
	Water	0.999**	ND	1
Aldrin	Gills	1	-0.177	- 0.163
	Sediment	- 0.177	1	0.292
	Water	- 0.163	0.292	1
Endosulfan ii	Gills	ND	ND	ND
	Sediment	ND	1	1.000**
	Water	ND	1.000**	1
Dieldrin	Gills	ND	ND	ND
	Sediment	ND	1	-0.541
	Water	ND	-0.541	1
Methoxychlor	Gills	1	0.729*	ND
	Sediment	0.729*	1	ND
	Water	ND	ND	ND

- ND means not detected.

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 5b: Correlation coefficient between pesticide contents (µg/g or ppm) for *C. gariepinus* from Muweis canal at El-Shabakat village (T) during autumn 2017 - summer 2018.

Pesticides	Tissues	gills	sediment	water
Aldrin	Gills	1	-0.330	-0.497
	Sediment	-0.330	1	0.850**
	Water	-0.497	0.850**	1
Heptachlor epoxide	Gills	ND	ND	ND
	Sediment	ND	1	-0.332
	Water	ND	-0.332	1
Endosulfan	Gills	ND	ND	ND
	Sediment	ND	1	0.578
	Water	ND	0.578	1
Endosulfan ii	Gills	ND	ND	ND
	Sediment	ND	1	- 0.205
	Water	ND	- 0.205	1
Dieldrin	Gills	ND	ND	ND
	Sediment	ND	1	- 0.114
	Water	ND	- 0.114	1
Methoxychlor	Gills	1	- 0.576	ND
	Sediment	- 0.576	1	ND
	Water	ND	ND	ND

- ND means not detected.

** Correlation is significant at the 0.01 level (2-tailed).

Table 6a: Correlation coefficient between pesticide contents (µg/g or ppm) for *P. clarkii* from Muweis canal at Tal-Haween village (T) during autumn 2017 - summer 2018.

Pesticides	**Tissues**	**gills**	**sediment**	**water**
Aldrin	Gills	1	0.701	0.287
	Sediment	0.701	1	0.483
	Water	0.287	0.483	1
Endosulfan ii	Gills	ND	ND	ND
	Sediment	ND	1	1.000**
	Water	ND	1.000**	1
Dieldrin	Gills	ND	ND	ND
	Sediment	ND	1	-0.541
	Water	ND	-0.541	1
Endrin	Gills	1	ND	1.000**
	Sediment	ND	ND	ND
	Water	1.000**	ND	1

- ND means not detected.

** Correlation is significant at the 0.01 level (2-tailed).

Table 6b: Correlation coefficient between pesticide contents (µg/g or ppm) for *P. clarkii* from Muweis canal at El-Shabakat village (E) during autumn 2017 - summer 2018.

Pesticides	**Tissues**	**gills**	**sediment**	**water**
Aldrin	Gills	1	-0.330	-0.497
	Sediment	-0.330	1	0.850**
	Water	-0.497	0.850**	1
Heptachlor epoxide	Gills	ND	ND	ND
	Sediment	ND	1	-0.332
	Water	ND	-0.332	1
Endosulfan	Gills	ND	ND	ND
	Sediment	ND	1	0.578
	Water	ND	0.578	1
Endosulfan ii	Gills	ND	ND	ND
	Sediment	ND	1	- 0.205
	Water	ND	- 0.205	1
Dieldrin	Gills	ND	ND	ND
	Sediment	ND	1	- 0.114
	Water	ND	- 0.114	1
Methoxychlor	Gills	1	0.045	ND
	Sediment	0.045	1	ND
	Water	ND	ND	ND

- ND means not detected.

** Correlation is significant at the 0.01 level (2-tailed).

Pesticides concentration showed seasonal variations, being greater in autumn and summer and lowest in winter and spring. These results comply with those recorded by Yamashita *et al*. (2000), Barakat *et al*. (2002), Abbassy *et al*. (2003), Kelderman *et al*. (2005), El-Kady *et al*. (2007), Westbom *et al*. (2008), Qiu *et al*. (2009), Malhat (2010), Barakat *et al*. (2012), and Azab *et al*. (2013). This may be attributed to the cultivation and irrigation seasons which was higher in summer and autumn seasons. These variations may be attributed to the differences between the localities, and the amount and source of pollution from an area to another. The high pesticide content in gills of fish collected from the two sources of water can be related to an accumulation of such toxins from the water primarily through fish gill where metallothionine enhances that bioaccumulation in gills and its uptake could be controlled by the amount of water passing through the gills (Saeed, 2000).

Moreover, it is obvious that the average pesticide concentrations in *C. gariepinus* were higher than those of *P. clarkii*. This may be due to the difference of feeding habits of the two species, where the former fish is mainly omnivorous feeding on fish, insect larvae, molluscs, planktonic organisms and water weeds (Bishai and Khalil, 1997) which accumulate large amounts of toxins (Rizkalla and Abou-Donia, 1996a,b). Also, *P. clarkii* feeds mainly on the eggs and young fish (Soliman *et al*., 1998b) which accumulate fewer amounts of toxins. Moreover, *C.gariepinus* lives mainly in the muddy or semi-muddy bottom (Bishai and Khalil, 1997) other than *P. clarkii* which wanders in water from the surface to bottom, being frequently in contact with soil particles (Ibrahim *et al*., 1995).

CONCLUSION

The results of this study concluded that the long-term exposure of fish to pesticides means continuous health hazards for the residents. So, the human population is at high risk by consuming these contaminated fishes**.** The data given in this investigation facilitates the assessment of potential toxic danger resulting from exposure to various levels of these compounds. The information could be obtained useful in the environmental hazard evaluation of freshwater and marine organisms. Finally, Protection of water quality and wildlife is possible when defending the use of pesticides. Also, when Pesticides must choosing judiciously and are utilized in combination with other pest management tools and applied securely, the surface water contamination and pollution and of our aquatic life could be avoided. Besides enemy safe utilization of this pesticides, more trial work should be performed to decide the time of exposure and concentration that don't cause significant sublethal impacts on fish.

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REFERENCES

Abbassy, M. S.; Ibrahim, H. Z., and Abdel-Kader, H. M. (2003). Persistent organochlorine pollutants in the aquatic ecosystem of Lake Manzala, Egypt. Bulletin of Environmental Contamination and Toxicology, 70(6), 1158–1164.

Azab, M. M.; Darwish, A. A.; Mahmoud, H. A. and Sdeek, F. A. (2013). Residue levels of organochlorine pesticides in some ecosystem components of Manzala Lake. Environ Monit Assess, 185:10257–10268.

Barakat, A. O.; Kim, M.; Qian, Y., and Wade, T. L. (2002). Organochlorine pesticides and PCB residues in sediments of Alexandria Harbour, Egypt. Baseline/Marine Pollution Bulletin, 44: 1421–1434.

Barakat, A. O.; Mostafa, A.; Wade, T. L.; Sweet, S. T.and El Sayed, N. B. (2012). Assessment of persistent organochlorine pollutants in sediments from Lake Manzala, Egypt. Mar Pollut Bull, 64(8): 1713–1720.

Bishai, H. M. and Khalil, M. T. (1997): Freshwater fishes of Egypt. Publication of National Biodiversity Unit, 9: 1-229.

Bouwman H.; Coetzee A. and Schutte, C. H. J. (1990). Environmental and healthimplications of DDT-contaminated fish from the Pongolo Flood Plain. J. Afr. Zool., 104:275-286.

Caldas, E. D.; Coelho, R.; Souza, L. C. K. R. and Siba, S. C. (1999). Organochlorine Pesticides in Water, Sediment, and Fish of Paranoá Lake of Brasilia, Brazil. Bull. Environ. Contam. Toxicol., 62:199-206.

Dalvie, M. A.; Cairncross, E.; Solomon, A. andLondon, L. (2003). Contamination of rural surface and ground water by endosulfan in farming areas of the Western Cape, South Africa. Environmental Health: A Global Access Science Source. pp. 1-15.

David, W. C.; Richard, C.; Steven, J.; Gaydos, J. G. and William, W.C. (2009). Aquaculture Environmental Toxicological, and Health tissues. Int. J. Hyg. Environ Health, 212: 369-377.

El-Kady, A. A.; Abdel-Wahhab, M. A.; Henkelmann, B.; Belal, M. H.; Morsi, M. K. S.; Galal, S. M., and Schramm, K. W. (2007). Polychlorinated biphenyl, polychlorinated dibenzop- dioxin and polychlorinated dibenzofuran residues in sediments and fish of the River Nile in the Cairo region. Chemosphere, 68, 1660–1668.

Girard, C. (1852). A revision of the North American astaci, with observations on their habits and geographic distribution. Proceedings of the Academy of Natural Sciences of Philadelphia, 6: 87-91.

Gold-Bouchot, G.; Silva-Herrera, T. and Zapata-Peréz, O. (1995). Organochlorine pesticide residue concentrations in biota and sediments from Rio Palizada, Mexico. Bull Environ Contam Toxicol 54: 554-561.

Hobbs, H. H.; Jass, J. P. and Huner, J. V. (1989). A review of global crayfish introductions with particular emphasis on two North American species (Decapoda, Cambaridae). Crustaceana, 56: 299-316.

Ibrahim, A.M.; Khalil, M. T. and Mubarak, M.F. (1995). On the feeding behavior of the Exotic crayfish, *P. clarkii* in Egypt and its prospects in the bicontrol of local vector snails. J. Union. Arab. Biol., Cairo, 4:321-340.

Ibraheim, M.H. and Khater, Z. Z. K. (2013). The Effect of electromagnetic field on water and fish *Clarias garpienus*, Zagazig, Egypt. Life Science Journal, 10(4): 3310-3324.

Kelderman, P.; Xuedong, Y. and Drossaert, W. M. E. (2005). Sediment pollution with respect to heavy metals and organic micropollutants in the city canals of Delft (The Netherlands)—assessment of a data base of 188 sediment stations. Hennef: European Water Association (EWA).

Khalil, A.; Salama, M.; Khater, Z. and Saeed, R. (2015). Effect of Chlorpyrifos and Neem seed extract (Azadirechtein) on hepatopancreatic cellular structures of the freshwater crayfish *Procambarus clarkii*. Egypt. J. Aquat. Biol. & fish., 19 (2): 125 - 136.

Malhat, F. M. M. (2010). Organochlorines and organophosphorus pesticides, petroleum hydrocarbons, polychlorinated biphenyls and trace metal monitoring of Nile river in Egypt. Ph. D. Thesis, Chemistry Department, Faculty of Science, Menofiya University.

Nowell, L. H. and Resek, B. A. (1994). National Standards and Guidelines for Pesticides in Water, Sediment, and Aquatic Organisms: Application to Water-Quality Assessment. Reviews j Environmental Contamination and Toxicology, 140: 1-154.

Qiu, Y. W.; Zhang, G.; Guo, L. L.; Cheng, H. R.; Wang, W. X.; Li, X. D., and Wai, O. W. H. (2009). Current status and historical trends of organochlorine pesticides in the ecosystem of Deep Bay, South China. Estuarine, Coastal and Shelf Science, 85: 265–272.

Rizkalla, E. and Abo-Donia, M. A. (1996a): Some industrial heavy metal pollutants in River Nile and their effect on biological and non-biological inhabitants. 1. Essential heavy metals. Egypt, J. Agric. Res., 74 (1): 225-237.

Rizkalla, E. and Abo-Donia, M. A. (1996b): Monitoring of some heavy metals in River Nile water in relation to their levels in tilapia in upper Egypt. Egypt, J. Agric. Res., 74 (1): 239-251.

Sabra, F. S. and Mehana, E. E. (2015). Pesticides Toxicity in Fish with Particular Reference to Insecticides. Asian Journal of Agriculture and Food Sciences, 03 (01): 40-60.

Sciencedaily Cornelia Dick-Pfaff (2008) .Wohlriechender Muckentod 19.07.2004.

Saeed, S. M. (2000): A study on factors affecting fish production from certain fish farms in the Delta. M.Sc. Thesis. Faculty of Science, Ain Shams University, Egypt.

Soliman, G.N.; El-Assal, F.; El-Deen, M.S. and Hamdi, S.A.H (1998b). The reproductive biology of the red swamp crayfish *P. clarkii* (Girard, 1852) (Decapoda: Cambridae) in the River Nile, Egypt. Egypt. J. Zool, 30: 311-325.

Sonoma County Water Agency (2009). Appendix B. Sediment samples guidelines. Stream Maintenance Program Manual. Project No. 08.002, pp. 1-18.

Westbom, R.; Hussen, A.; Megersa, N.; Retta, N.; Mathiasson, L.and Bjrklund, E. (2008). Assessment of organochlorine pesticide pollution in Upper Awash Ethiopian state farm soils using selective pressurised liquid extraction. Chemosphere, 72:1181–1187.

World Health Organization (WHO) (2004). WHO Guidelines for Drinking Water Quality. WHO, Geneva, Switzerland.

Yamashita, N.; Urushigawaa, Y.; Masunaga, S.; Walash, M. I. and Miyazaki, A. (2000). Organochlorine pesticides in water, sediment and fish from the Nile River and Manzala Lake in Egypt. International Journal of Environmental Analytical Chemistry, 77(4): 289–303.

ARABIC SUMMARY

تقييم بعض المبيدات في المياه والتربه و سمك *Clarias gariepinus* و *Procambarus clarkii* من منطقتين بقناة مويس بالزقازيق - مصر.

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تم دراسة توزيع مبيدات الآفات في المياه ، والرواسب ، و *Clarias gariepinus* و *Procambarus clarkii* بقناة مويس من موقعين لتقييم حالة التلوث والمخاطر المحتملة في النظام النهري. تم تحليل ٢٨ مبيد حشري بإستخدام جهازالغاز الكروماتوجرافي (GC) مع كاشف التقاط الإلكترون. تراوح تركيز متبقيات المبيدات من لا يوجد إلى ٠.٥٦٠ ميلي جرام / لتر لعينات المياه ، لا يوجد إلى ٠.٧٣ ميكروجرام/ جرام وزن جاف للرواسب ، لا يوجد إلى ٩.٦٥٣ ميكروجرام/ جرام وزن رطب لـ *C. gariepinus* و لا يوجد إلى ٦.٨٧٥ ميكروجرام/ جرام وزن رطب ل *P. clarkii*. التركيزات العالية من مبيدات الآفات الكلورية العضوية ، وخاصة فنبروباثلين ، و اندوسالفان أثنين، و دلتا بنزين سداسي الكلور و ثنائي الإندرين التي لوحظت في جميع الوسائط البيئية ، هي مؤشر على الاستخدام غير القانوني الحالي لمبيدات الآفات المحظورة للأنشطة الزراعية في المنطقة. وكشفت عينات مياه منطقة تل- حوين عن أعلى محتوى لمبيدات الآفات تليها مياه منطقة الشبكات ، في حين أن رواسب منطقة تل حوين لوحظت ملوثة أكثر من تلك الموجودة بمنطقة الشباكات. أيضا ، أظهرت النتائج أن *C. gariepinus* أكثر تلوثا من *P. clarkii*. وأظهر تحليل البيانات وجود فروق ذات دلالة إحصائية بين الخياشيم في *C. gariepinus* و المياه ، وعينات المياه والرواسب في منطقة تل حوين في فنبروباثلين و أندوسلفان أثنين على التوالي ، في حين أظهرت اختلاف كبير بين عينات المياه والرواسب في منطقة الشبكات في الإندرين. علاوة على ذلك ، كان هناك فرق كبير للغاية في معامل الترابط بين عينات المياه والرواسب في منطقة الشبكات في الإندوسلفان أثنين والإندرين. فيما يتعلق بمتوسط تركيزات بعض مبيدات الآفات في المياه والأسماك ، كانت المستويات أعلى من تلك الموصى بها من الحدود المسموح بها دوليًا. وهو مؤشر على وجود خطر محتمل للسرطان بالنسبة لسكان مناطق الدراسه مع استهلاكهم طويل المدى لهذه الأسماك الملوثة بالمبيدات.