J. Egypt. Soc. Toxicol.
(Vol. 36: 53-60 Jan. 2007)
WWW.estoxicology.org

HARMFUL EFFECT OF SOME INSECTICIDES ON VITAL PARAMETERS OF ALBINO RATS

El-Deeb, A.E.A.*; Abd El-Aleem, I.M.* and Sherin, S.Ghaleb **

** Dept. of Agric.Chem., Fac. of Agric. Moshtohor, Benha Univ., Egypt*
*** Forensic Meicine. & Toxicology Dept. Fac. of Med., Cairo Univ. (ElKaser Aleini)*

ABSTRACT

The present study aims at comparing the *in vivo* effect among *B. thuringiensis* (bio-insecticide), chlorpyrifos (organophosphorus insecticide) and flufenoxuron (insect growth regulator) on the biochemical parameters, toxicity some reproductive parameters and histopathological changes in tissue specimens of different organs of albino rats.

In flufenoxuron and chlorpyrifos administrated rats body weight and kidney weight significantly decreased as compared with the corresponding weights of the control groups. Also, significant reduction occurred in total protein and serum cholinesterase activity after oral administration of chlorpyrifos and flufenoxuron. Values of total lipids, triglycerides and cholesterol significantly increased throughout the experiment and hyperlipidemia, hypercholesolemia and hyperuremia were noticed in chlorpyrifos and flufenoxuron administrated rats. Also, the mean values of serum transaminases (ALT and AST) and alkaline phosphate (ALP) activities were increased.

Prolonged administration of chlorpyrifos caused no effect on hemoglobin concentration, however, it significantly decreased leukocyte count, erythrocyte count, hematocrite values, platelet count and blood indices. On the other hand, flufenoxuron exerted significant decreases in all hematological parameters as compared with the control group. Likewise, chlorpyrifos and flufenoxuron administration significantly decreased testis weight, concentration of sperm cells, percentage of live sperms but on the other hand, caused increase in percentage of abnormal sperms. The orally administration of flufenoxuron and chlorpyrifos led to histopathological changes in liver, kidneys and testis of the treated rats. On the other hand, bio-insecticides (*Bacillus thuringiensis*) did not show such hazardous effects on the orally administrated rats and consequently it would be safe to people and can be used on all food crops.

Key words: Insecticides – Liver – Kideny – testis – Albino rats.

INTRODUCTION

Pesticides are toxic chemical compounds designed to control pests, causal organisms of plant disease, weeds and other living organisms that reduce the quantity and quality of crop yields.

Zhao *et al.* (1995) studied administration of water containing 100 mg/L and 20 mg/L flufenoxuron to Wister male rats. Rats were killed at the second and sixth weeks after experiment initiation, respectively. They found that serum testosterone, testis cholesterol, and hepatic tissue cholesterol levels decreased significantly. Marty *et al.* (2004) found that the administration of flufenoxuron caused relative increase in the abnormal sperm, but on the other hand, caused relative decrease in body weight, kidney weight, reproduction and fertility.

El-Hamaky *et al.* (1990) mentioned that organo-phosphate pesticides such as chlorpyrifos work by interfering with the activity of the cholinesterase enzyme, which is necessary for proper nerve function. Without this enzyme, impulses continue to pass down the nerve fiber disrupting the nervous system and ultimately resulting in death by respiratory failure but do not accumulate in the tissues of humans or animals. Administration of sublethal doses of chlorpyrifos resulted in altered enzyme activities of liver, renal damage and reproductive disorders to experimental animals (Lemus and Abd El-Ghany, 2000).

Firdaus *et al.* (2003) and Mohammed and Siddiqui (2003) found that chlorpyrifos decreased red blood cells (RBCs) white blood cells counts (WBCs) and, packed cell volume (Hct) and serum protein level. On the other hand, the mean corpuscular volume (MCV), mean corpusclar hemoglobin (MCH), mean corpuscular hemoglobin concentrations (MCHC), the activities of alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and blood cholesterol level

increased. Also, Armando *et al.* (2004) reported that chlorpyrifos increased the activities of ALT, AST and ALP in blood.

Johnson (2005) and USEPA (2005) reported that administration of chlorpyrfos caused a significant increase in liver weight, blood creatinine and urea levels, but decreased body weights, kidney and testis weights. They also found that cholesterol levels and ALP activities were increased. Hepatocytic hypertrophy, mineralization of renal pelvic epithelium, epididymal aspermia, atrophy of seminiferous tubules and hyperplasia of renal pelvic epithelium were observed. Microscopic examination revealed hepatocellular hypertrophy (centrilobular) in males, increase in mean relative liver weight and hepatocellular hypertrophy.

Cranshaw (2006) and PIP (2006) reported that *B. thuringiensis* is considered safe to people and non target species, such as wildlife. Some formulations can be used on essentially all food crops. In addition, *B. thuringientsis* is an insecticide with unusual properties that make it useful for pest control in certain situations. *B. thuringiensis* is a naturally occurring bacterium common in soils throughout the world. Several strains can infect and kill insects, because of this property, *B. thuringiensis* has been developed for insect control.

Therefore, a comparative study was conducted among *B. thuringiensis* (bio-insecticide), cholorpyrifos (organo-phosphorus insecticide) and flufenoxuron (insect growth regulator) with the object of following up the change that might tuke place in biochemical parameters, toxicity and histopathological changes in tissue specimens of different organs of albino rats.

MATERIALS AND METHODS

The used insecticides were obtained from Plant Protection Research Institute, Agriculture Resarch Center, Ministry of Agriculture, Dokki, Giza Governorate, Egypt.

Forty male albino rats "Swiss strain" weighting 120-140 g each were used in this study. Rats were provided by the Rats Farm at Nuclear Research Center, Atomic Energy Authority and fed on standard synthetic normal diet for 14 days in the animals house under normal conditions (Table, 1).

Table (1): Composition of the standard synthetic normal diet calculated as g/100 g diet.

Ingredient	g/100 g diet
Carbohydrates (sucrose and starch)	66.00
Total protein	20.00
Fats	4.50
Cellulose	9.00
Vitamins mixture	0.35
Salts mixture	0.15

The forty rats under study were divided into four groups, 10 per each. All the rats were fed on the normal standard diet for 12 weeks. The first group of rats was used as a control group (-ve), the second one received *Bacillus thuringiensis* var. kurstaki orally at a dose of 1000 mg/100 g body weight (b.w.). The third group received flulenoxuron orally at a dose of 10.5 mg/100 g b.w. which is equivalent to 0.1 of LD_{50}. The fourth received chlorpyrifos orally at a dose of 0.955 mg/100 g b.w. which is equivalent to 0.1 of LD_{50} every other day for 3 months.

Blood samples were collected after 4, 8 and 12 weeks from the retro-orbital plexus of overnight fasted rats. Each blood sample was divided into two parts, the first one was used for serum preparation and assay of the biochemical parameters including liver functions, kidney functions and lipid profile whereas the second one was used for assay of the complete blood picture according to Dacie and Lewis (1986).

Total lipids were determined according to Schmit (1964). Cholesterol was determined according to Kaplan and Pesce (1996). Triglycerides were determined according to Fossati *et al.* (1982). Protein was determined according to Henery (1964).

Urea was determined according to Patton and Crouh (1977). Uric acid was determined according Harris (1995). Alanine transaminase (ALT) and aspartate transaminase (AST) were determined according to Reitman and Frankel (1957). Alkaline phosphatase activity (ALP) was determined according to Bessey *et al.* (1964). Creatinine was determined according to the method of Henery *et al.* (1974). Serum cholinesterase activity (CHE) was determined according to Ellman *et al.* (1961). The reproductive parameters of sperms were recorded according to Bearden and Fuguay (1980).

Tissue specimens were collected from rats livers, kidneys and testis and rabidly fixed in 10% neutral buffered formalin. After proper fixation, thin paraffin sections were routinely prepared and stained with H & E stain for microscopical examination according to Drury and Wallington (1986). The histopathological examination was conducted in Faculty of Vet. Med., Cairo University.

The ANOVA model was used for statistical analysis of the obtained data according to Snedecor and Cochran (1983). Treatments means were compared by Duncan test at 5 and 1% levels of significance (Duncan, 1955).

RESULTS AND DISCUSSION

Table (2) illustrates that body weight (b.w.), liver, kidney and testies weights of rats recived *B. thuringiensis* orally decreased slightly as compared with the control group. On the other hand, both flufenoxuron and chlorpyrifos resulted in significant decrease in body weight, kidney and testis weights but at the same time caused increase in liver weight as compared with corresponding weight values of the control group. These results are in agreement with those reported by Blumbach *et al.* (2000), Marty *et al.* (2004) and Johnson (2005).

Table (2): Effect of the used insecticides on body weight and weight of some organs (g) of rats after 12 weeks.

Parameters	Control	*Bacillus thuringiensis* (1000 mg/100 g b.w.)	Flufenoxuron (10.5 mg/100 g b.w.)	Chlorpyrifos (0.955 mg/100 g b.w.)	L.S.D.	
					0.05	0.01
Body weight	260.25±10.86	251.18±11.20	230.77±4.61	201.41±3.83	9.75	14.78
Liver weight	10.14±0.41	10.11±0.39	10.98±0.43	11.15±0.52	0.31	0.34
Kidney weight	2.98±0.11	2.74±0.09	2.18±0.08	2.25±0.08	0.03	0.04
Testis weight	2.69±0.02	2.61±0.04	2.02±0.03	2.20±0.06	0.06	0.07

Table (3): Effect of the used insecticides on serum enzymes.

Parameters	4 weeks				8 weeks				12 weeks				L.S.D.	
	Con.	*B. thur.*	Fluf.	Chlor.	Con.	*B. thur.*	Fluf.	Chlor.	Con.	*B. thur.*	Fluf.	Chlor.	0.05	0.01
ALT (U/L)	238.6 ±23.2	235.5 ±21.1	338.3 ±31.2	371.2 ±23.2	240.6 ±21.5	236.2 ±7.2	317.3 ±22.2	327.1 ±31.2	239.2 ±19.3	235.2 ±19.2	518.3 ±35.1	545.2 ±41.5	40.8	55.3
AST (U/L	218.3 ±17.3	224.2 ±19.9	250.4 ±21.1	258.6 ±25.1	220.1 ±18.5	222.2 ±17.3	326.1 ±29.2	345.1 ±28.2	221.1 ±17.3	217.2 ±18.3	349.1 ±31.8	456.1 ±36.1	45.2	61.2
ALP (U/L)	75.8 ±8.2	76.2 ±11.3	74.2 ±6.0	85.6 ±10.5	76.5 ±7.8	75.8 ±9.3	90.2 ±11.4	85.2 ±9.5	74.2 ±6.8	79.8 ±7.3	110.1 ±8.2	140.2 ±14.3	15.2	22.9
Cholinesterase (U/L)	590.8 ±30.4	580.4 ±28.4	563.4 ±39.4	270.6 ±30.9	588.1 ±31.4	580.4 ±28.4	540.2 ±29.1	270.1 ±29.1	588.1 ±30.9	571.0 ±28.2	490.2 ±29.2	221.6 ±21.7	41.8	57.1

Table (4): Effect of the used insecticides on serum total proteins, creatinine, urea and uric acid of albino rats.

Parameters	4 weeks				8 weeks				12 weeks				L.S.D.	
	Con.	*B. thur.*	Fluf.	Chlor.	Con.	*B. thur.*	Fluf.	Chlor.	Con.	*B. thur.*	Fluf.	Chlor.	0.05	0.01
Total proteins (g/dl)	6.18 ±0.18	6.45 ±0.11	6.39 ±0.13	6.28 ±0.09	6.35 ±0.13	6.34 ±0.11	5.58 ±0.12	5.20 ±0.11	6.22 ±0.11	6.41 ±0.17	4.74 ±0.12	4.49 ±0.08	0.20	0.27
Creatinine (mg/dl)	0.88 ±0.11	0.74 ±0.09	1.56 ±0.06	1.68 ±0.04	0.84 ±0.04	0.91 ±0.02	2.11 ±0.06	2.91 ±0.05	0.87 ±0.07	1.13 ±0.08	2.75 ±0.07	3.91 ±0.09	0.12	0.16
Urea (mg/dl)	34.15 ±2.55	30.17 ±3.18	42.50 ±2.95	50.71 ±3.99	35.12 ±2.17	33.26 ±4.13	65.13 ±5.17	91.13 ±6.21	33.17 ±2.50	32.17 ±2.11	89.51 ±3.29	99.12 ±5.12	5.89	7.98
Uric acid (mg/dl)	3.81 ±0.11	3.95 ±0.14	3.18 ±0.07	3.27 ±0.08	3.28 ±0.11	4.18 ±0.11	4.52 ±0.12	4.64 ±0.08	3.66 ±0.13	3.68 ±0.07	4.66 ±0.08	5.57 ±0.11	0.18	0.24

Con.: Control *B. thur.: Bacillus thuringiensis* Fluf.: Flufenoxuron Chlor.: Chlorpyrifos

Table (3) reveals that serum transaminase activities (ALT and AST) of the rats received flufenoxuron and chlorpyrifos orally increased significantly after 4 and 8 weeks and the increase became more pronounced after 12 weeks from the beginning of the experiment. Also, a significant increase occurred in alkaline phosphatase (ALP) after 8 and 12 weeks from beginning of the experiment. Such an effect may be attributed to the extended toxic effect of the flufenoxuron and chlorpyrifos related insecticides beyond the nervous system to include cell signaling cascades that are vital to hepatic homeostasis (Armando *et al.*, 2004).

Serum cholinesterase enzyme is composed of two distint cholinesterases (acetyl cholinesterase and butryl cholinesterase). Acetyl cholinesterase is the true cholinesterase while the butryl cholinesterase is pseudo-cholinesterase and present in serum. Both acetyl cholinesterase and butryl cholinesterase have similar inhibitors and activators. Therefore, inhibition of butryl cholinesterase reflects inhibition of acetyl cholinesterase. The major substrate is acetylcholine, the neurotransmitter found at the myoneural junction. Data presented in Table (3) indicate that flufenoxuron and administrated caused slight decrease in cholinesterase activity within all time of experiment, however, the decrease in this enzyme activity was significant due to chlorpyrifos in the 4th week and the decrease became more pronounced by plonging period of the experiment byeond this period. These findings are in agreement with those of Vodela and Dalvi (1995), Ashry *et al.* (2002) and Verma *et al.* (2002).

Table (4) shows reduction in total proteins after oral administration of flufenoxuron and chloropyrifos. The reduction in total proteins was slight after 4 weeks and became more obvious after 8 weeks and achieved the maximum by the 12th week as compared with the control group. Unlike the impact of using these pesticides on total proteins, usage of both the two pesticides could not exert any pronounced change in values of the aforementioned parameters (Firdous *et al.*, 2003).

Serum creatinine and urea were determined as indicators of kidney functions, since the increase in these components above standard levels means that the kidney is less active or in abnormal case. Values of serum creatinine, urea and uric acid were elevated throughout the experiment. The hyperuremia was noticed during the 8th and 12th week of treatment as compared with the normal level of control group. The elevation of blood creatinine, urea and uric acid in treated rats may be attributed to the toxic effect of chlorpyrifos and flufenoxuron which led to disorders in the kidney causing reduction in the glomerular filtration rate and consequently retention of urea in the blood. These findings are closely resembled to those obtained by El-Kashory (1999) and Johnson (2005). Also, USEPA (2005) indicated that the elevated blood urea level may reflect an accelerated rate of protein catabolism rather than decreased urinary excretion of urea, while severe hepatic insufficiency causes decreased blood urea level apparently because of impaired urea synthesis. Since creatinine production is endogenous, being dependent on muscle mass its level in the blood is usually independent of diet unlike urea.

Values of total lipids, triglycerides and total cholesterol (Table 5) significantly increased through the experimental period. Hyperlipidemia and hypercholesterolemia were noticed due to oral administration of chlorpyrifos and flufenoxuron as there were sharp increase in values of total lipids, triglycerides, cholesterol after the 8th and 12th weeks of treatment as compared with the control levels. These results are in agreement with the results of El-Kashory (1999) who suggested that hyperlipidemia and hypercholesterolemia are expected to occur due to liver impairment of organophosphorus treated animals.

Data presented in Table (6) indicate that administration of chlorpyrifos caused significant decrease in leukocytic count, erthrocytic count, hemoglobin concentration, hematocrite value, platelet count and blood indices (MCV, MCH) in the treated rats as compared with the control group. These results are in agreement with those of Firdaus *et al.* (2003) and Mohammed and Siddiqui (2003).

Data presented in Table (7) indicate that the concentration of sperm cells in flufenoxuron and chlorpyrifos administrated rats significantly decreased in the 12th week of the experiment, as compared with the control group. Likewise, the living sperms and sperm mortality in the flufenoxuron and chlorpyrifos administrated rats significantly decreased in the 12th week of the experiment, as compared with the control group. On the other hand, the percentage of abnormal sperms in flufenoxuron and chlorpyrifos administrated rats significantly increased in 12th week of the experiment as compared with the control group. These results are in agreement with those of Marty *et al.* (2004).

The liver of the control rats showed normal structure of hepatic lobules and hepatocytes, hepatocytes form columns of cells adherent to each other by one or more surfaces. Bile canaculi were present in between two columns of hepatocytes. At least, one surface of any hepatocyte was on contact with liver sinusoids. The cytoplasm often appeared coarsely granular with empty vacuolated areas where lipid droplets have been dissolved during preparation of the section. The nuclei were spherical, centrally located and variable in size and with one nucleolus. Hepatocytes may be binucleated, the sinusoids were variable in diameter and lined by discontinuous sheet of endothelial cells with flat nuclei, Kupffer's cells also, located in the sinusoidal walls (Fig., 1). This picture is the same as described in Ross and Pawlina (2005).

In liver of flufenoxuron orally administrated rats the hepatocytes showed cytomegalic changes in size and the cytoplasm was granular and vacuolar (Fig., 2). Hepatic cell nuclei appeared fragmented chromation along the hepatic vacuolation of different sizes and widening blood sinusoids denoting degenerating hepatic cells.

Table (5): Effect of the used insecticides on serum total lipids, triglycerides and cholesterol in albino rats.

Parameters	4 weeks				8 weeks				12 weeks				L.S.D.	
	Con.	*B. thur.*	Fluf.	Chlor.	Con.	*B. thur.*	Fluf.	Chlor.	Con.	*B. thur.*	Fluf.	Chlor.	0.05	0.01
Total lipids (mg/dl)	550.8 ±30.3	730.4 ±39.2	840.8 ±41.4	880.9 ±42.1	552.6 ±33.2	690.8 ±39.7	965.4 ±39.3	980.3 ±41.4	551.3 ±31.2	781.8 ±31.7	1362.8 ±41.1	1455.6 ±49.5	70.9	96.1
Triglycerides (mg/dl)	258.4 ±20.9	450.3 ±31.4	531.6 ±38.2	565.8 ±37.3	260.9 ±19.5	470.9 ±21.4	615.8 ±39.5	640.2 ±40.6	259.4 ±18.5	450.3 ±26.4	758.6 ±39.5	889.8 ±43.2	54.9	74.5
Cholesterol (mg/dl)	141.9 ±18.1	140.6 ±17.2	190.2 ±16.8	220.6 ±19.5	140.3 ±12.6	150.1 ±16.3	200.4 ±19.2	260.7 ±19.9	142.8 ±13.9	130.5 ±15.1	290.3 ±17.9	431.6 ±21.6	38.8	52.6

Table (6): Effect of the used insecticides on hematological parameters of albino rats.

Parameters	4 weeks				8 weeks				12 weeks				L.S.D.	
	Con.	*B. thur.*	Fluf.	Chlor.	Con.	*B. thur.*	Fluf.	Chlor.	Con.	*B. thur.*	Fluf.	Chlor.	0.05	0.01
RBCs (10^6/mm)	5.93 ±0.32	5.34 ±0.44	5.18 ±0.51	5.86 ±0.22	5.88 ±0.34	5.94 ±0.36	4.57 ±0.29	4.61 ±0.23	5.89 ±0.48	5.26 ±0.41	2.81 ±0.18	3.41 ±0.22	0.55	0.75
WBCs (10^3/mm)	5.86 ±0.32	6.94 ±0.36	6.52 ±0.25	7.18 ±0.44	5.84 ±0.33	5.81 ±0.26	5.80 ±0.36	4.66 ±0.24	5.79 ±0.22	7.48 ±0.31	7.41 ±0.41	6.18 ±0.18	0.55	0.75
Hb (mg/dl)	16.32 ±0.98	15.66 ±0.88	14.33 ±0.71	15.69 ±0.83	16.43 ±0.57	15.77 ±0.82	11.13 ±1.11	14.12 ±1.23	16.29 ±1.46	15.32 ±1.32	7.88 ±0.44	13.92 ±0.91	1.57	2.13
Hct %	49.13 ±2.14	47.12 ±2.27	43.19 ±1.99	41.12 ±1.35	48.99 ±2.12	47.15 ±2.17	31.16 ±2.13	27.14 ±0.99	49.32 ±1.98	49.15 ±1.99	22.17 ±0.97	20.13 ±0.88	3.06	4.15
MCV fl	88.17 ±4.33	86.13 ±4.51	86.12 ±5.23	82.14 ±6.44	87.99 ±3.25	89.13 ±4.18	78.71 ±5.13	78.12 ±6.17	88.66 ±4.51	90.15 ±6.13	77.22 ±5.14	77.08 ±5.09	8.66	11.74
MCH Pg	28.27 ±1.58	28.05 ±1.74	27.89 ±1.33	22.55 ±1.11	28.99 ±1.97	27.17 ±1.98	23.99 ±1.33	29.12 ±1.48	27.98 ±2.11	29.87 ±2.08	26.55 ±1.94	33.12 ±1.86	2.88	3.91
Platelets (10^3/min)	460.18 ±44.50	452.18 ±39.18	435.14 ±34.17	419.20 ±29.14	458.66 ±31.47	456.12 ±33.29	344.15 ±34.48	319.12 ±26.15	456.34 ±29.88	450.88 ±31.98	281.33 ±23.88	260.29 ±21.77	54.57	73.95

Table (7): Effect of the used insecticides on reproductive parameters of albino rats.

Parameters	Control	*Bacillus thuringiensis* (1000 mg/100 g b.w.)	Flufenoxuron (10.5 mg/100 g b.w.)	Chlorpyrifos (0.955 mg/100 g b.w.)	L.S.D.	
					0.05	0.01
Conc. of sperm cells in ($x10^6$ sperm/epididymis)	66.18±3.98	63.19±3.12	45.16±2.99	34.98±2.15	1.48	1.64
Sperm motility %	63.12±2.15	67.18±2.77	45.20±2.55	26.17±2.81	0.44	0.49
Live sperm %	87.15±3.28	89.13±3.99	60.69±3.12	50.98±2.88	0.93	1.03
Sperm abnormality %	12.98±1.18	13.44±1.25	16.11±1.91	18.84±1.98	3.01	3.33

Con.: Control *B. thur.: Bacillus thuringiensis* Fluf.: Flufenoxuron Chlor.: Chlorpyrifos

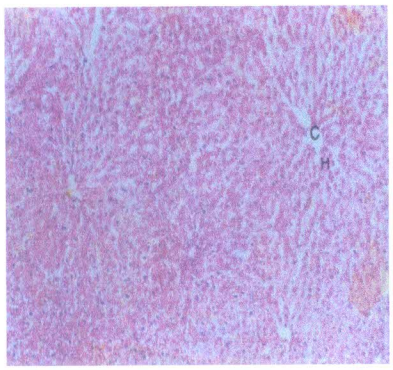

Fig. (1): Section of normal liver of adult albino rat of the control group.

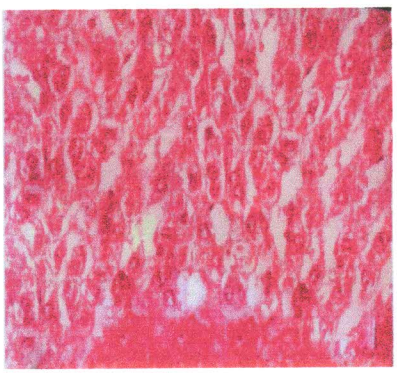

Fig. (2): Section of liver of adult albino rat received 1/10 of LD_{50} of IGR (flufenoxuron).

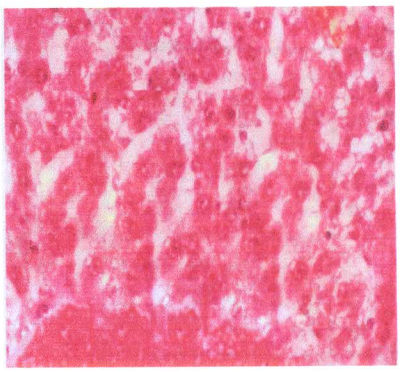

Fig. (3): Section of liver of adult albino rat received 1/10 of LD_{50} of organo-phosphorus (chloropyrifos).

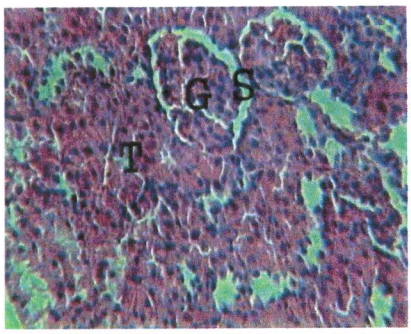

Fig. (4): Section of normal kidney of adult albino rat of the control group.

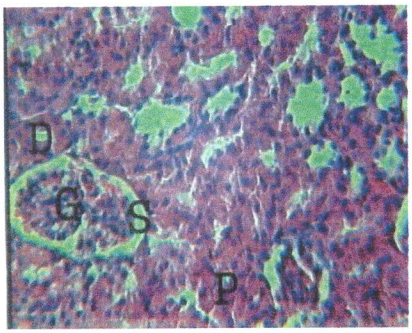

Fig. (5): Section of kidney of adult albino rat received 1/10 of LD_{50} of IGR (flufenoxuron).

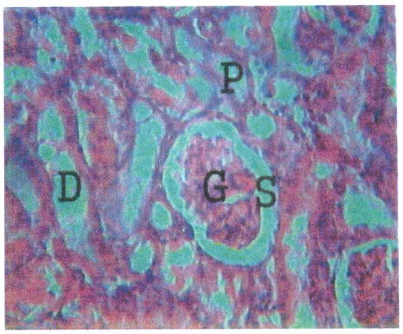

Fig. (6): Section of kidney of adult albino rat received 1/10 of LD_{50} of organo-phosphorus (chloropyrifos).

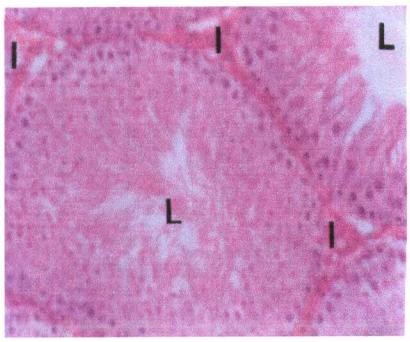

Fig. (7): Section of normal testis of adult albino rat of the control group.

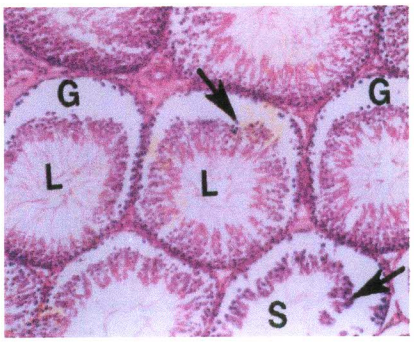

Fig. (8): Section of testis of adult albino rat received 1/10 of LD_{50} of IGR (flufenoxuron).

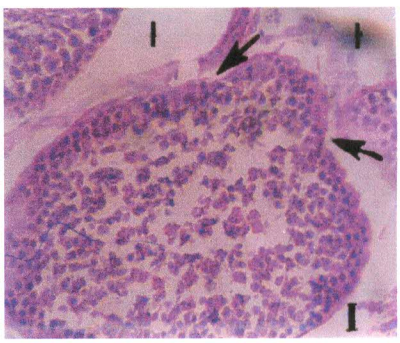

Fig. (9): Section of testis of adult albino rat received 1/10 of LD_{50} of organo-phosphorus (chloropyrifos).

In liver of chlorpyrifos administrated rats, there was loss of cell architecture and increased degeneration of hepatic cells. Most of hepatic cells were necrotic and enlarged and cytoplasm was granular and vacular. Widening blood sinusoids denoting degenerating hepatic cells (has no nuclei) as shown in Fig. (3). These results are in agreement with the results of Gomes *et al.* (1999) and Revathi and Kumar (2000).

The histological structure of the renal cortex of the control group showed normal structure of both renal corpuscles and tubules. The renal corpuscles appeared as dense rounded structures known as glomeruli, surrounded by narrow spaces called Bowman. Bowman's capsule consisted of an inner or visceral layer covering the glomerulus and an outer layer or parietal layer become continuous with the wall of the proximal convoluted tubule (Fig., 4). This picture is the same as described in Gartner and Hiatt (2001).

Fig. (5) shows that the capillary tuft of the flufenoxuron orally administrated rats appeared smaller with partial endothelial vacuolation. The Bowman's space was increased. The convoluted tubules were widely separated, narrowing of tubules due to cloudy swelling of their cells. Oral administration of chlorpyrifos caused marked degeneration in some of renal corpuscles, proximal distal convoluted tubules, decrease in size of glomeruli and marked increase in size of Bowmans spaces (Fig., 6). This picture agrees with those described by Oncu *et al.* (2002), Johnson (2005) and USEPA (2005).

The testis of the control rats showed normal histological pattern which is built up of seminiferous tubules and the interstitial cells were found in between the tubules. These tubules are rounded or oval in cross sections and contained different stages of spermatogenic cycle. The lumina of seminiferous tubules are filled with spermatozoa. The interstitial cells were irregular polyhedral cells with large spherical nuclei (Fig., 7). This picture coincides with that described by Russell *et al.* (1996). Flufenoxuron administration led to mild to moderate degree of degenerative changes in germinal layers of seminiferous tubules in the form of appearance of vacuolations, moderate separation of basement membrane and occlusion of seminiferous tubules (Fig., 8). The picture of the testis of the chlorpyifos treated rats shows severe degree of degenerative changes in germinal layers of seminiferous tubules with enlargement of blood vessels (Fig., 9). This picture agrees with those described by Thomas (2001) and Johnson (2005). This might be attributed to a direct cytotoxic effect on seminiferous tubules, an indirect effect of organophosphorus on the blood vessels of testis, which causes vascular stasis, inhibition of overall hormonal control mechanism at either the gonadal or the hypothalamic pituitary levels.

The results obtained herein confirmed that both the organophosphorus and insect growth regulator (IGR) insecticides might be harmful for people and nontarget species such as wildlife. Hence, *Bacillus thuringiensis* (bio-insecticides) would be a suitable substitute for such two insecticides, where it assured its safety to the orally administrated rats and consequently it would be safe to people and can be used on all food crops.

REFERENCES

Armando M., Frederic J.S., and Theodore, A.S. (2004): Developmental effects of chlorpyrifos extend beyond neurotoxicity: critical periods for immediate and delayed-onset effects on cardiac and hepatic cell signaling. Environ Health Perspect. 112(2): 170–178.

Ashry, K.M.; Abu-Qare, A.W.; Saleem, F.R.; Hussein, Y.A.; Hamza, S.M.; Kishk, A.M. and Abou-Donia, M.B. (2002): Inhibition and recovery of maternal and fetal cholinesterase enzymes following a single oral dose of chlorpyrifos in rats, Archives of Toxicol. 76(1): 30-39.

Bearden, J.H. and Fuguay, J.W. (1980): "Applied Animal Reproduction" Reston Publishing Co., Inc. Reston, Virginia, p. 158-165.

Bessey, O.A.; Lowry, O.H. and Brock, M.J. (1964): A method for rapid determination of alkaline phosphatase with five cubic millimeters of serum. J. Biol. Chem., 164: 321-329.

Blumbach, K.A.; Deger, H.M. and Dekant, W. (2000): Biotransformation and male rat-specific renal toxicity of diethyl ethyl and dimethyl methylphosphonate. Toxicol Sci., 53(1):24-32.

Cranshaw' W.S. (2006): Bacillus thuringiensis. Colorado State University Cooperative Extension Entomologist and Professor, Bioagric. sciences and pest. manag. 11/99.

Dacie, S.J. and Lewis, S.M. (1986): "Basic Hematological techniques" In Practical Hematology. International Student 6th ed. Churchill Livingstone. Edinburgh, London, Melbourne, and New York.

Drury, R. and Wallington, E. (1986): Carlton's histological technique 4th Ed., Oxford University. Press, N.Y., Toronto.

Duncan, D.B. (1955) : Multiple range test and multiple F. test Biometrics, 11.

El-Hamaky, M.A; Refaei A.F., Hegazy M.A. and Hussein N.M. (1990): Knock-down and residual activity of certain insecticides Mededelingen Van De Faculteit Land bouwwetenschappen Rijksuniversiteit Gent, 55 (2b): 601 – 607.

El-Kashory, A.A. (1999): Subchronic toxicity studies of Imimacloprid, Profenofos and Carbosulfan and their mixtures on albino rats Ph.D. Thesis, Fac. of Science, Cairo Univ., Egypt.

Ellman, G.L.; Courtney, K.D. and Andres, V.Jr. (1961): A new and rapid colorimetric determination of acetyl cholinesterase activity. Biochem. Pharmacol. 7: 88-95.

Firdous, K.; Shakoori, A.R.; Hafeez, M.A. and Ali, S.S. (2003): Short term effects of chlorpyrifos on hematology and biochemical components of blood of the Sprague-Dawley rat. Pakistan-Journal-of-Zoology., 35(3): 237-243.

Fossati, P. (1982): Quantitative determination of Triglycerides in serum or plasma.Clin. Chem. 28(2078).

Gartner, L.P. and Hiatt, J.L. (2001): Color Textbook of Histology. 2nd ed. WB Saunders Co. Philadelphia, New York, London. Gilbert, L.I.; W. Goodman.

Gomes, J.; Dawodu, A.H.; Lloyd, O. and Anilal, S.V. (1999): Hepatic injury and disturbed amino acid metabolism in mice following prolonged exposure to organophosphorus pesticides, Human and Experimental Toxicology; 18(1): 33.

Harris, J.M. (1995): Clinical Chemistry Interpretation and techniques. 4th ed. Williams and Wilkins. Baltimore, Philadelphia, Hong Kong, London.

Henery, R.J. (1964): Colorimetric determination of total protein. Clinical Chemistry, Harper & Row Publishers, New York. p. 181.

Henery, R.J.; Cannon, D.C. and Winkelman, J.W. (1974): Clinical industry: Principles and techniques, 2ed., New York, Harper and Row; pp. 4, 22-24.

Johnson, K.A. (2005): Toxicology & Environmental Research and Consulting, Midland, MI; Laboratory Project Study 1-35.

Kaplan, L.A.; and Pesce, A.J. (1996): Kit for measurement of cholesterol in serum or plasma.Clinical Chemistr, Mosby Ed.

Lemus, R. and Abd El-Ghany, A. (2000): Chlorpyrifos: An unwelcome pesticide in our homes. Rev. Environ. Health. 15(4): 421-33.

Marty, M.S.; Zablotny, C.L.; Liberacki, A.B. and Yano, B.L. (2004): Toxicology & Environmental Research and Consulting. The Dow Chemical Company, Midland, MI; Laboratory Project Study p. 221;

Mohammed, F.R. and Siddiqui, M.K. (2003): Biochemical Enzyme Activity in Different Tissues of Rats Exposed to a Novel Phosphorothionate Journal of Environmental Science and Health, Part B: Pesticides, Food Contaminants, and Agricultural Wastes Vol. 38, No. 1: 59 - 71.

Oncu M., Gultekin F.; Karaoz, E.; Altuntas, I. and Delibas, N. (2002): Nephrotoxicity in rats induced by chlorpyrifos-ethyl and ameliorating effects of antioxidants. Human and Experim. Toxicol. 21(4): 223-230.

Patton, C.J. and Crouh (1977): Colorimetric determination of urea. S.R. Anal. Chem., 49.464-469.

PIP (Pesticide Information Project) (2006): Bacillus thuringiensis. Report: Cornell Univ., USDA/Extension Service/National Agric. Pesticide Impact Assessment Program. 1- 37.

Reitman, S. and Frankel, S. (1957): A colorimetric for the determination of serum glutamic oxaloacetic and glutamic pyruvic transaminases. Am. J. Clin Path.; 28:56.

Revathi, K. and Kumar, S. (2000): Histopathological alterations induced by sub acute dosage of chlorpyrifos 40% E.C. in Swiss albino mice J. Exper. Zool. India., 3(1): 45-47

Ross, M.H. and Pawlina, W. (2005): Histology. A text and atlas. 5th ed. Lippincott Willims and Wilkins. New York, London, Tokyo.

Russell, L.D.; Ettlin, R.; Sinha; H. and Clegg, E.D. (1996): Histological and Histopathological evaluation of the testis. Cache Riv. Pr. Florida. Cited In "Casarett and Doull's toxicology. The Basic science of Poisons". 6th ed. Mc Graw-Hill. Medical Publishing Division. N.Y., Chicago, London.

Schmit, J.M. (1964): Colorimetric determination of total lipid. Thesis, Lyon, 1964.

Snedecor, C.W. and Cochran, W.C. (1983): Statistical methods. Iowa State Press, Ames, Iowa, USA.

Thomas, J.A. (2001): Toxic response of the reproductive system. In "Casarett and Doull's toxicology. The Basic science of Poisons". 6th ed. Mc Graw-Hill. Medical Pub. Division. N.Y., Chicago, London.

USEPA USEnvironmental Protection Agency. (2005): Health Effects Division Chapter of the Tolerance Reassessment Eligibility Decision Document.

Verma, R.S.; Jatav, P.C. and Nalini, S. (2002): Chlorpyrifos induced inhibition and reactivation of serum cholinesterase activity in rats. Indian J. Toxicol., 9(1): 29-33:

Vodela, J.K. and Dalvi, R.R. (1995): Comparative toxicological studies of chlorpyrifos in rats and chickens. Veterinary and Human Toxicol. 37(1): 1-3.

Zhao, Z.L.; Wu, N.P. and Gao, W.H. (1995): The influence of fluoride on the content of testosterone and cholesterol in rat, China Fluoride; 28(3): 128- 130

التأثير الضار لبعض المبيدات الحشرية على بعض المؤشرات الحيوية فى الفئران البيضاء

عبدالنبى السيد الديب* – إبراهيم محمد عبدالعليم* – شيرين صلاح الدين غالب**

** قسم الكيمياء الزراعية – كلية الزراعة بمشتهر – جامعة بنها – مصر.*
*** قسم الطب الشرعى والسموم – كلية طب قصر العينى – جامعة القاهرة – مصر.*

يهدف هذا البحث إلى دراسة تأثير المبيدات الحشرية مثل المبيدات الحيوية ومنظمات النمو الحشرية والمبيدات الفوسفورية على الفئران البيضاء. وقد أجرى هذا البحث على أربعين فأر تم تغذيتها على عليقة متوازنة لمدة أسبوعين ثم قسمت إلى ٤ مجموعات: المجموعة الأولى ضابطة (كنترول) والثانية تم إعطاؤها مبيد حيوى وهو البيسلس ثيرنجنسس كروستاكى (١٠٠٠ ملليجرام/١٠٠ جم) والثالثة تم إعطاؤها ١٠/١ من الجرعة النصف مميتة من أحد منظمات النمو الحشرية (الفلوفينوكسيورون) بجرعة (١٠,٥ ملليجرام/١٠٠ جرام) والرابعة تم إعطاؤها ١٠/١ من الجرعة النصف مميتة من المبيدات الفوسفورية (الكلوروبيروفوس) بجرعة (٠,٩٥٥ ملليجرام/١٠٠ جرام وزن حى) يوم بعد يوم لمدة أثنى عشر أسبوعاً. وقد أخذت عينات الدم بعد ٤، ٨، ١٢ أسبوع من بداية التجربة. وقد أوضحت النتائج ما يلى:

- عدم وجود تأثيرات معنوية ضارة على الفئران المعاملة بالمبيد الحيوى (البسيلس ثيرنجنسس كروستاكى) طول فترة التجربة.
- هناك انخفاض معنوى فى الوزن الحى ووزن الكلى والخصية وعلى العكس هناك ارتفاع معنوى فى وزن الكبد فى الفئران المعاملة بالمبيد الفوسفورى أو منظم النمو الحشرى بالمقارنة بالكنترول.
- هناك ارتفاع معنوى فى مستوى الأنزيمات الناقلة لمجموعة الأمين وكذلك أنزيم الفوسفاتيز القلوى وعلى العكس هناك انخفاض معنوى فى نشاط أنزيم الكولين استريز طوال مدة التجربة فى الفئران المعاملة بالمبيد الفوسفورى أو منظم النمو الحشرى بالمقارنة بالكنترول.
- هناك ارتفاع معنوى فى مستوى الدهون الكلية والجليسريدات الثلاثية والكوليستيرول فى الدم فى الفئران المعاملة بالمبيد الفوسفورى أو منظم النمو الحشرى بالمقارنة بالكنترول.
- هناك انخفاض معنوى فى مستوى البروتين الكلى بينما هناك ارتفاع معنوى فى مستويات الكرياتنين واليوريا وحمض اليوريك بالدم فى الفئران المعاملة بالمبيد الفوسفورى أو منظم النمو الحشرى بالمقارنة بالكنترول.
- كما أوضحت الدراسة وجود إنخفاض كبير فى عدد كرات الدم الحمراء والبيضاء وتركيز الهيموجلوبين والصفائح الدموية فى الفئران المعاملة بالمبيد الفوسفورى أو منظم النمو الحشرى بالمقارنة بالكنترول.
- هناك انخفاض معنوى فى عدد ونشاط الحيوانات المنوية وعلى العكس من ذلك هناك ارتفاع معنوى فى نسب الحيوانات المنوية الميتة والمشوهة فى الفئران المعاملة بالمبيد الفوسفورى أو منظم النمو الحشرى بالمقارنة بالكنترول.
- حدوث تغيرات هستوباثولوجية فى عدد من الأعضاء تحت الدراسة من أهمها استمالة بخلايا الكبد والكلى والخصية بالإضافة إلى وجود بؤر نيكروزية فى الكبد فى الفئران المعاملة بالمبيد الفوسفورى أو منظم النمو الحشرى بالمقارنة بالكنترول.
- لذلك يجب الاتجاه إلى استعمال المبيدات الحيوية لما لها من تأثير آمن على البيئة والصحة والحد من الإسراف فى استخدام المبيدات الفوسفورية أو منظمات النمو الحشرية لما لها من تأثير ضار على الإنسان والحيوان والبيئة.