ENVIRONMENTAL POLLUTION IN SOME LOCALITIES IN KALUOBIA. 4TH SCIENTIFIC VET. MED. CONFERENCE

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ENVIRONMENTAL POLLUTION IN Some LOCALITIES IN KALUOBIA

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ABSTRACT

Environmental pollution in industrial localities is a real problem threats all forms of life in these areas. The present study was done to focus a clue of light about the magnitude of this problem in some industrial localities in Egypt. Samples of soil, vegetation, surface water and tissues of wild rats cached near two main factories in Abou Zabal (A.Z) locality (Superphosphate fac.) and in Kaha near factory of batteries and chemical industries. In addition, we collected the same respective samples from a rural area (Meet Radey Village). The levels of some heavy metals (lead, cadmium, mercury, iron, and manganese) were monitored in soil, vegetation and surface water at different distances from the local point source of pollution. Also the hematological picture and residues of these metals were detected in livers and kidneys of wild rats cached from these localities . Histopathological investigations were also carried on different internal organs of wild rats to explore the effect of the examined pollutant on these animals . The results indicated a pronounced high levels of the examined metals in soil, vegetation, water and tissues collected from the industrial localities together with different hematological and histopathological alteration in liver, kidney ,spleen, lung, testis , heart and brain which appeared more pronounced in animals collected near the sources of pollution in Kaha and Abou Zabal.

INTRODUCTION

More than one-and-a-half billion people live in urban areas with dangerous levels of air pollution and the situation is getting worse as cities grow and more and more vehicles, industries, homes and power stations contribute to the polluting load. Some of the highest air pollution levels are in the developing countries. Urban air pollution brings with it acute and chronic lung diseases, heart disease, lung cancers and lead-induced neurological damage in children. The effects are even more severe in tropical climates and where sufferers are also exposed to other infectious agents ***WHO , 1997.***

Kelowska,1993 recorded significant higher values of lead , cadmium , copper and ferrous in samples of 11 vegetables purchased in Krakow, the center of an industrial region of southern Poland. Samples obtained from an agricultural region far from industrial establishment didn't exceeded the permitted values of the examined metals.

Dobrazanski et al., 1994 found that green forage and bovine blood serum from 80 farms within the copper mining area of legnica Glogow had twice the content of cu , pb and cd of samples from another area which was 80 km distant, but zn content was the same.

Hylander et al., 1994 stated that mercury content in bird feathers indicated biomagnification and that mercury originating from the amalgamation process has a higher bioavailability than mercury naturally present in soil minerals.

Koponen and Niemela, 1995 in their study concerned with arthropods and pollution found that significant fewer beetles (Cleoptera) were trapped near (0.5 Km) from a smelter and fertilizer factory than at sites further away (3.5 and 9 Km). They also added that there was difference in ground-living fauna due to changes in ground vegetation due to pollution.

Dogra et al., 1996 attributed cattle high mortality in area near a metal recovery factory to toxic levels of lead , cadmium and chromium. These metals were recovered from environmental samples (soils, water, leaves, grass and sediment) , human blood and hair and animal samples (blood, urine, liver, kidney, bones). Based on environmental, clinical, analytical and histopathological observations the mortality has been attributed to toxic levels of metals in the body and the malnourished status of the animals.***WHO ,1997*** reported that lead annual mean concentration is below 0.1 °g/m3 in most cities of Western Europe and between 0.2 and 0.6 °g/ m3 in Eastern European cities. In North American cities annual mean lead concentration is below 0.05 °g/m3. Countries still using leaded petrol or slowly switching to unleaded petrol report increasing concentrations of the airborne lead. Thus, in Cairo, high lead levels were recorded in districts with heavy congested traffic. In March 1994, in the course of several days, rush hour lead values peaked at 12 µg/m3. Epidemiological studies indicate that all children in Cairo are susceptible to lead pollution. Lead is absorbed from the air and by ingestion. The central nervous system is the primary target organ for lead toxicity in children. Exposure of children to even low concentrations may produce neurophysiological damage, including impairment of learning abilities, behaviour, intelligence and motor coordination. Prenatal exposure to lead produces toxic effects on the human fetus including reductions in gestational age, birthweight, and mental development.

Concerning to histopathological changes associated with heavy metal intoxication, ***Watanabe et al., 1986*** recorded bronchopneumonia and alveolitis in the lung with fatty change and lymphocytic cellular infiltration in the liver of mice fed cadmium-polluted rice. In addition, ***Park et al., 1987 and Stirling et al., 1988*** observed necrosis in liver of rats with iron overload.Also ***Jubb et al., 1993*** mentioned that, cadmium and mercury intoxication was accompanied with renal tubular necrosis and testicular degeneration.

Moreover, ***Carlton and McGavin 1995*** reported that , cadmium , mercury and lead were nephrotoxic and their intoxictions were characterized by tubular nephrosis and necrosis with presence of hyaline casts in lumen of tubules. Also they added that, iron intoxication was associated with massive hepatic necrosis and biliary hyperplasia in piglets and foals. Also, ***Farina et al., 1996*** stated that pulmonary lesions of cadmium intoxication in rats was characterized by atalectasis and emphysema.

In Egypt, superphosphate industry is growing to fulfill the requirement of different plants for fertilizer improving crop production; however, this industry usually resulted in arising of many pollutants in the surrounding environment. On the other hand chemical industries like the production of batteries and different military stuffs like pullets of gun shoot, has a dangerous role in pollution of the surrounding environment. The present work is a trial for monitoring the levels of some heavy metals (manganese, iron, cadmium, mercury and lead) in vegetation, soil and surface water. Hematological tissue residue and histopathological investigations were carried on wild rats cached from the environment surrounding two main factories at two different industrial localities in Kaluobia Governorate.These factories were superphosphat factory at Abou Zabal and the military factory of batteries manufacture and chemical industries belonging to armed force in Kaha .

MATERIAL AND METHODS

Area of study: The study was conducted on two localities (Abou Zabal and Kaha) in Kaluobia Governorate, Egypt. In the first locallity the source of pollution was arised from superphosphate manufacturing plant and in the other locality (Kaha) the source of pollution was established from the factory of batteries and chemical industries.

Collection of Samples: Soil, wild vegetation and surface water samples were collected at different distances from the point source of pollution (100,300 & 500 meter). Also some wild rats inhibiting these areas were caught. The blood samples were collected for some hematological examination according to Kelly, 1984. The obtained tissues were used for estimation of some heavy metals residues and also for histopathological investigations. Similar samples were collected from a rural area (Meet Radey) where there is no industrial source of pollution.

Preparation of samples: Samples collected from soil and wild vegetation were digested before analysis according to the method of ***Walsh, 1971***. Samples of water were filtered through 0.45 U Millipore diameter filter paper and preserved with nitric acid till analysis. Liver and kidneys samples of wild rats caughted in the areas were obtained after scarifying of animals and kept frozen at -20°C until analysis .

Analysis of samples: prepared samples were analyzed for determination of some heavy metals (manganese, iron,cadmium,mercury and lead) using atomic absorption spectrophotometer (Perkin Elmer, Model 3110) with alteration of burner head, hollow cathode lamp, wave length and slit in relation to the examined metal.

Histopathological investigations: Specimens from different organs of wild rats were taken and fixed in 10% buffered neutral formalin . Paraffin sections of five micron in thickness were prepared, stained with hematoxylene and eosin after ***Drury et al., 1984*** and examined microscopically.

The data obtained in this study were statistically analyzed according to ***Snedcor, 1971.***

RESULTS

The results concerned with the concentrations of some heavy metals in wild vegetation, soil, surface water and the residues of the examined heavy metals in liver and kidneys of wild rats caught from the examined industrial areas Kaha and Abou Zabal and the control area (Meet Radey)were tabulated in tables 1,2,3 & 4 respectively . Hematological investigations were done for wild rats from each locality and the results tabulated in table (5).

Hispopathological examination of the liver revealed congestion of portal vessels and sinusoids with mononuclear cellular infiltration of the portal area particularly lymphocytes. Diffuse hydropic degeneration of hepatic cells and congestion of central veins were observed in livers of rats from Abou Zabal. In animals cached from Kaha, vacuolation of some hepatic cells and proliferation of the lining epithelium of the bile ducts with formation of many newly ductules were also noticed. Focal hepatic necrosis evidenced by pyknosis of nuclei and deeply eosinophilic cytoplasm was found. Moreover, focal area of fibrosis replaced hepatic parenchyma and surrounded with regenerated hepatic cells and lymphocytic cellular reaction was recorded (Fig. 1 & 2).

Severe congestion of the splenic sinuses with excessive deposition of brown granules of hemosiderin pigments were the main microscopic changes observed in the examined spleen of rats from both localities . In one case, distortion of the normal histological splenic structure with excessive proliferation of the lymphoid cells and accumulation of numerous multinucleated giant cells megakaryocytes were recorded (Fig. 3 & 4).Cellular and nuclear pleomorphism of lymphoid cells with aggregation of many debris- laden macrophages in the germinal center of splenic follicle were also noticed (Fig. 5) . Microscopically, the examined kidneys of rats obtained from Abou Zabal showed congestion of the renal blood vessels and intertubular capillaries with presence of erythrocytic and hyaline casts within the lumen of dilated renal tubules. Focal areas of cloudy swelling and necrosis of some convoluted tubule with mononuclear cellular infiltration were detected .

Moreover in one case, focal accumulation of pleaomorphic lymphocytic cells in interstitial tissue was also noticed (Fig. 6) .The histopathological examination of lungs in rats of A.Z. revealed catarrhal bronchopneumonia evidenced by hyperplasia of bronchial goblet cells with accumulation of mucous mixed with cellular debris in the bronchial lumen (Fig. 7). Congestion of the pulmonary vessels and interalveolar capillaries with perivascular lymphocytic cellular aggregation were detected (Fig. 8). The examined lung of rats from Kaha showed thrombosis of some pulmonary vessels with extravasation of erythrocytes and presence of pale eosinophilic fluid within some alveoli . In addition the septa of some alveoli were packed with dark brown granules of haemosiderin pigment. Thickening of interstitial tissue due to fibrous C.T proliferation and mononuclear inflammatory cellular infiltration was observed. Multiple areas of pulmonary inflammatory edema and compensatory alveolar emphysema were also detected (Fig. 9). Animals of both localities showed massive destruction of the lining germinal epithelium of many semineferous tubules with presence of cellular debris mixed with inflammatory cells mainly lymphocytes and macrophages within the lumen of these tubules were microscopically seen. Moreover , congestion of intertubular blood vessels and perivascular edema were also found.The intermuscular blood vessels and capillaries were dilated and engorged with erythrocytes. Multiple areas of mononuclear cellular infiltration of the myocardium mainly lymphocytes and macrophages were recorded (Fig. 10) . Focal hyalinization of some cardiac muscles with presence of intermuscular hemorrhages were also detected particularly in hearts of rats from Kaha . Congestion of cerebral blood vessels and capillaries with focal areas of gliosis were noticed. In Kaha some rats showed necrosis of some pyramidal neurons evidenced by loss of cellular details and highly eosinophilic cytoplasm (Fig.11). Focal areas of hemorrhage replaced the cerebral parenchyma particularly around congested blood capillaries were also seen in some cases.

Table (1): Statistical analysis for the concentrations of some heavy metals in wild vegetation obtained near some sources of pollution veres that obtained from a rural area (Mean ± S. E.) PPM.

Metal Locality and distance	Lead	Mercury	Cadmium	Iron	Manganese
*Meat Rady (Control)	0.208 ± 0.12	0.022±0.002	0.012±0.001	1.240±0.025	0.202±0.16
*Kaha (Fac. of batteries & chemical industies					
-100 meter	1.26 ± 0.28	0.725±0.03	0.075±0.003	8.980±0.85	0.673±0.65
-300 meter	1.182± 0.22	0.665±0.03	0.056±0.002	5.005±0.52	0.51±0.46
-500 meter	1.028±0.19	0.544±0.02	0.031±0.002	4.017±0.50	0.362±0.34
Abou Zabal (Superphosphate fac.)					
-100 meter	1.162±0.22	0.085±0.009	0.055±0.002	3.430±0.53	0.465±0.44
-300 meter	1.020±0.18	0.055±0.006	0.025±0.002	2.30±0.32	0.212±0.21
-500 meter	0.512±0.15	0.050±0.006	0.011±0.001	1.00±0.21	0.120±0.18

Table (2): Statistical analysis for the concentrations of some heavy metals in soil obtained near some sources of pllution versus that obtained from a rural area (Mean ± S. E.) PPM.

Metal Locality and distance	Lead	Mercury	Cadmium	Iron	Manganese
*Meat Rady (Control)	0.6 ± 0.02	0.73±0.002	0.012±0.001	1.240±0.025	0.202±0.16
*Kaha (Fac. of batteries & chemical industies					
-100 meter	18.21 ± 3.12	8.9±0.21	1.02±0.002	1810±16.22	29.42±4.41
-300 meter	12.52± 2.92	8.1±0.30	1.03±0.002	1730±16.12	22.16±3.22
-500 meter	9.63±2.75	7.8±0.33	0.90±0.001	1695±15.91	16.12±2.71
Abou Zabal (Superphosphate fac.)					
-100 meter	7.52±1.82	7.52±0.18	0.42±0.001	950±15.20	28.44±4.23
-300 meter	5.12±1.86	5.9±0.22	0.38±0.002	820±14.92	26.34±3.62
-500 meter	3.41±1.20	5.6±0.21	0.22±0.001	670±14.12	20.22±2.92

Table (3): Statistical analysis for the concentrations of some heavy metals in urface water obtained at different ditance from the outlet of some industrial plants in Kaha and Abou Zabal versus that obtained from a rural area (Mean ± S. E.) PPM.

Metal Locality and distance	Lead	Mercury	Cadmium	Iron	Manganese
*Meat Rady (Control)	0.060 ± 0.012	....	0.010±0.003	0.52±0.12	0.97±0.007
*Kaha (Fac. of batteries & chemical industies					
-100 meter	0.332 ± 0.071	0.15±0.031	0.035±0.013	1.99±0.159	3.92±0.036
-300 meter	0.280± 0.062	0.12±0.026	0.030±0.012	1.26±0.150	3.50±0.035
-500 meter	0.225±0.060	0.09±0.022	0.024±0.011	0.85±0.131	2.20±0.029
Abou Zabal (Superphosphate fac.)					
-100 meter	0.164±0.044	0.12±0.030	0.022±0.010	1.67±0.152	2.20±0.028
-300 meter	0.142±0.042	0.08±0.024	0.018±0.009	1.20±0.141	2.12±0.024
-500 meter	0.166±0.042	0.04±0.014	0.012±0.008	0.79±0.133	2.09±0.021

Table (4): Heavy metals residues in liver and kidney of wild ratsfrom industrial versus rural areas in kalnobia governorate.

Metal Tissue and Locality	Lead	Mercury	Cadmium	Iron	Manganese
Meet Radey					
Liver	[illegible]	[illegible]	0.01±0.009	8.71±2.11	6.75±2.12
Kidney	[illegible]	[illegible]	0.009±0.004	3.70±1.32	4.20±1.42
Kaha					
Liver	24.25±2.21	28.32±2.9	0.31±0.05	20.12±3.10	25.22±3.30
Kidney	20.14±2.14	28.22±3.1	0.28±0.05	18.22±2.61	20.12±3.11
A.Z					
Liver	14.2±2.131	21.22±2.2	0.20±0.04	12.14±2.91	10.16±2.20
Kidney	10.25±1.40	20.15±2.1	0.18±0.04	15.31±2.51	11.12±2.81

Table (5): Table (4): Hematological picture of wild ratsfrom industrial versus rural areas in kalnobia governorate.

Locality / Parameters	Kaha	Abou-Zabal	Meet Radey
RBCs X10 6	4.92±0.34	5.51±0.32	7.1±0.25
H.b	9.23±0.33	9.50±0.30	11.21±0.23
P.C.V	37.18±0.32	38.20±0.32	44.31±0.30
WBCs X10 3	21.62±1.23	14.92±0.65	10.08±0.33
Lymphocytes	58.25±0.45	56.45±0.55	55.25±0.52
Neutrophils	38.12±0.43	37.22±0.44	36.21±0.42
Monocytes	1.53±0.33	1.43±0.31	1.63±0.32
Basophils	1.32±0.19	1.32±0.22	2.10±0.23
Eosinophils	2.92±0.34	3.52±0.40	4.25±0.28

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Fig. 1: Liver of rat showing focal area of fibrosis surrounded with lymphocytic cellular reaction. H & E stain X 100

Fig. 2: High power of pervious Fig. showing area fibrous tissue proliferation surrounded with regenerated hepatic cells. H & E. stain X 400.

Fig. 3: Spleen of rat showing distortion of the normal histological splenic structure with excessive proliferation of the lymphoid cells and accumulation of numerous multinucleated giant cells. H & E stain X 100.

Fig. 4 : High power of pervious Fig. showing presence of multinucleated giant cell ...megakaryocytes .... H & E stain X 400.

Fig. 5 : Spleen of rat showing cellular and nuclear pleomorphism of lymphoid cells with aggregation of many debris-laden macrophages in the germinal center of splenic follicle. H & E stain X 400.

Fig. 6: Kidney of rat showing focal accumulation of pleaomorphic lymphocytic cells in interstitial tissue.

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Fig. 8: Lung of rat showing congested blood vessel with perivascular lymphocytic cellular aggregation , H & E stain X 400.

Fig. 9: Lung of rat showing inflammatory edema and compensatory alveolar emphysema. H & E stain X 100.

Fig. 10: Heart of rat showing mononuclear cellular infiltration of the myocardium mainly lymphocytes and macrophages . H & E stain X 400.

Fig. 11: Brain of rat showing necrosis of some pyramidal neurons evidenced by loss of cellular details and highly eosinophilic cytoplasm. H & E stain X 400.

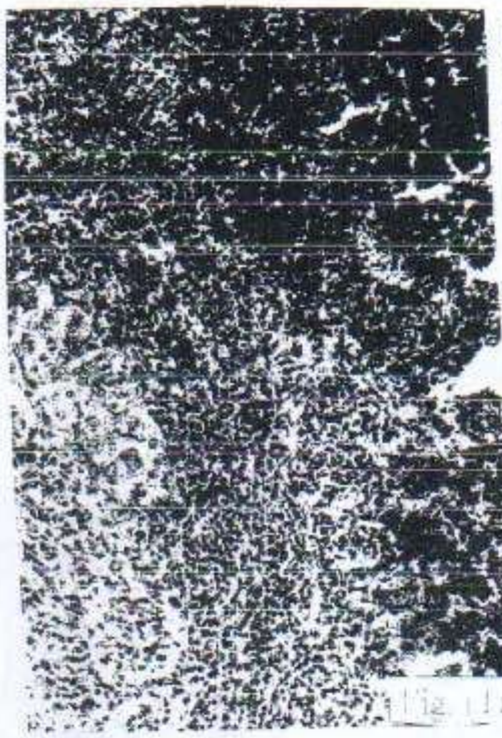
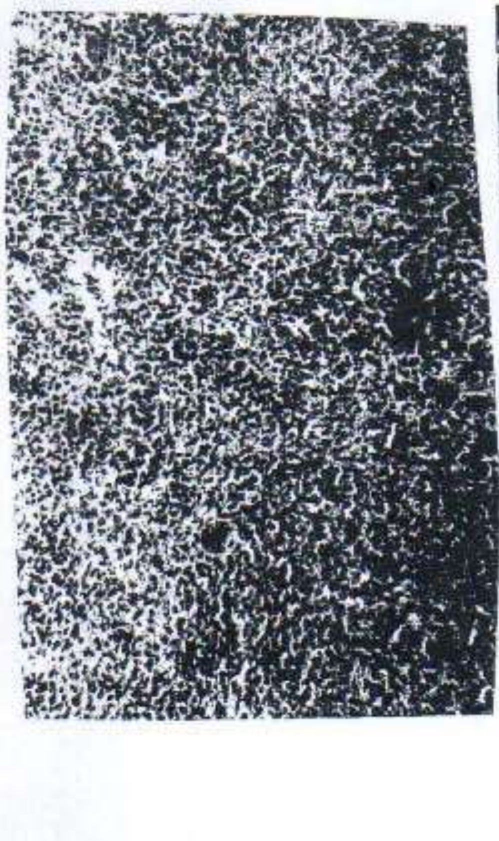
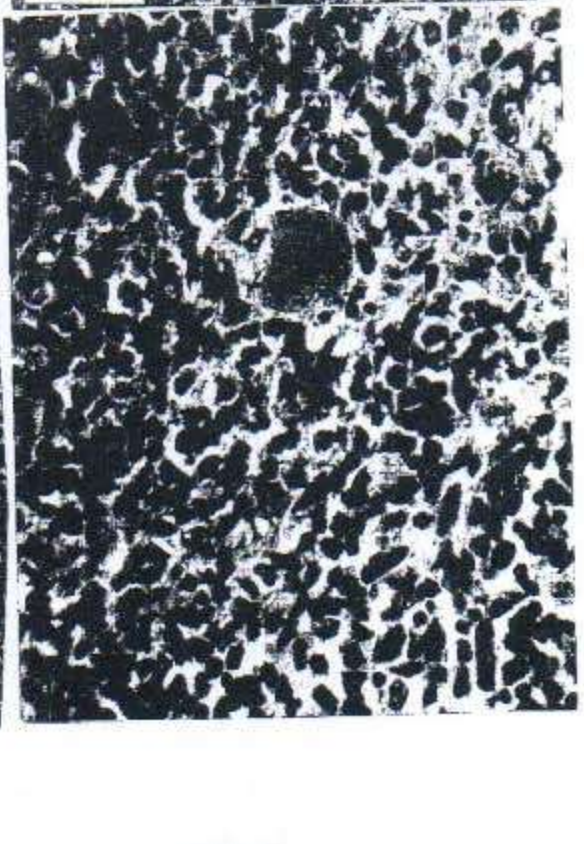


Fig. (1)

Fig. (2)





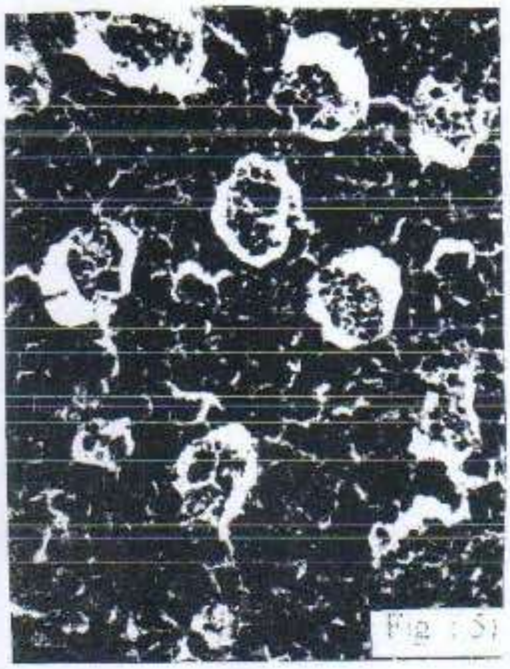


Fig. (5)

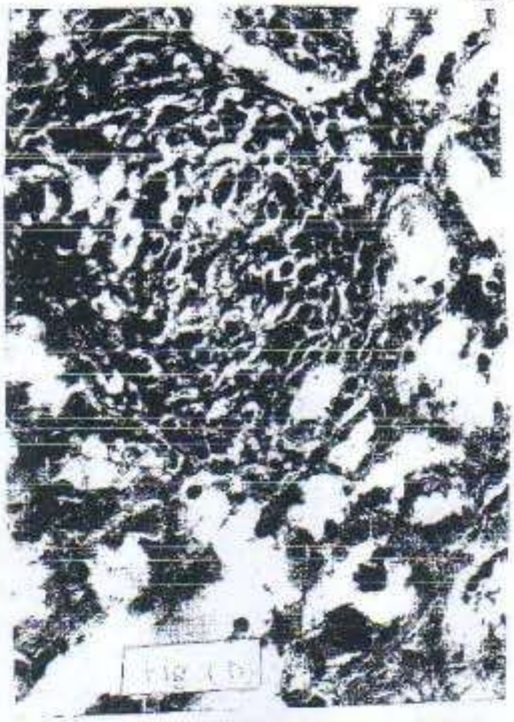


Fig. (6)

Fig. (7)

Fig. (10)

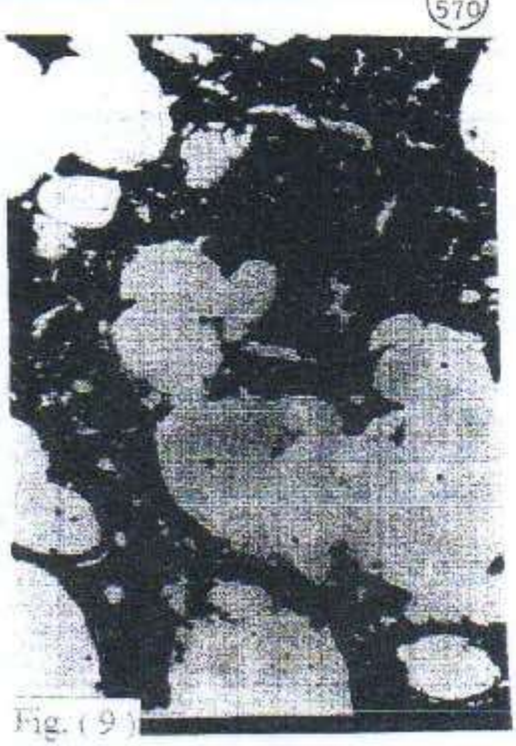


Fig. (9)

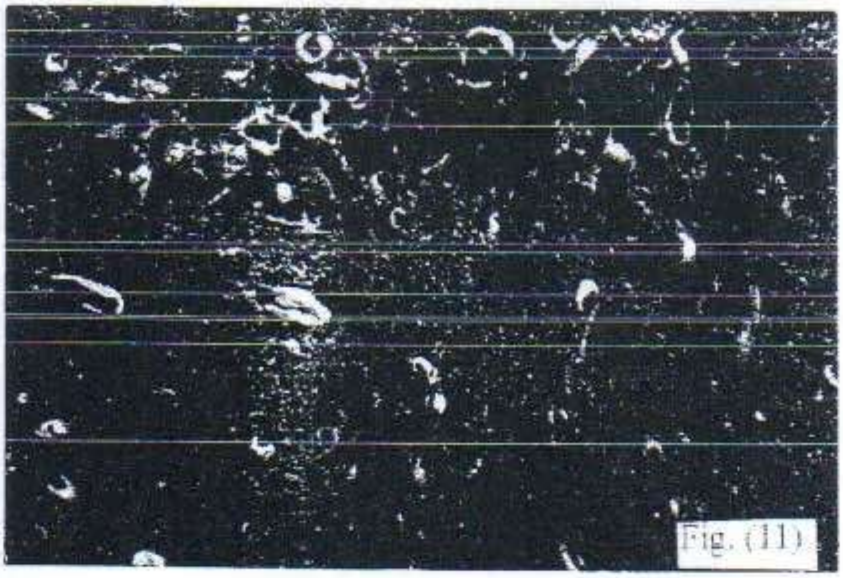


Fig. (11)

DISCUSSION

Environmental pollution in industrial localities has a major contribution in the occurrence or the aggravation of diseases either to workers or to peoples inhabiting the surrounding localities . The picture of pollution would vary to a great extent and it depends on the different industrial activities . Effect of environmental pollutants in industrial localities is not confined to exposed workers or people in close localities. Industrial pollutants will find its way to disturb all the surroundings like soil, vegetation and drinking water. Also, we should expect the animals of the polluted localities would have a higher tissue burden of the arised pollutants.

Table (1) shows that the concentrations of lead was highest 1.260 ± 0.28 in wild vegetation obtained from Kaha at 100 meter distance from the military factory and then the levels of lead declined at (200 & 300)to 1.182 ± 0.22 and 1.028 ± 0.19 respectively. In Abou Zabal the levels of lead recorded in wild vegetation collected near superphosphate factory were 1.62 ± 0.22, 1.020 ± 0.18 and 0.512 ± 0.15 at 100, 300, and 500 meter respectively. In similar to the first locality, the levels of lead in wild vegetation decreased by the increase in distance of collection from the source of pollution. This indicate that both factory (Military fac. at Kaha and superphosphate fac. at Abou Zabal) are a source of lead pollution at different degree and the first Fac. at Kaha seems to have a higher contribution for lead output to the surrounding environment.

The picture of lead concentration in wild vegetation has a good similarity with its levels in soil as indicated in table (2). The levels of soil lead in Kaha were higher than the respective samples of soil collected at similar distance from the examined source of pollution at Abou Zabal. In both localities the discharge of the factory find its way to a local surface water passage where it increases the level of lead in water body of such passage. Table (3) shows that lead content in water samples obtained from Rashah El-Kaluobia where the military factory discharge was higher than lead concentration in Ismailia canal (where the superphosphate fac. discharge) at similar distances from the local point source of pollution. All samples obtained from the control area (Meet Radey) recorded lower limit. We believe that both factories (Military and superphosphate fac.) are a considerable source of lead pollution and this is reflected on the surrounding environment.

Regarding to mercury, table (1) indicates higher levels of mercury in wild vegetation collected near the military fac. of Kaha (100,300 & 500) meters than its level in vegetation collected at similar distances from superphosphate fac. at A.Z. However the values of mercury in samples collected either from Kaha or from A.Z. were higher than mercury levels in wild vegetation obtained from Meet Radey (control area). Mercury concentrations were (0.725 ± 0.03; 0.665 ± 0.03 and 0.544 ± 0.02) and (0.085 ± 0.009; 0.055 ± 0.006 and 0.050 ± 0.006) in wild vegetations obtained from Kaha and A.Z. after 100,300 and 500 meters from the examined local source of pollution respectively while mercury levels in Meet Radey (rural control area) was (0.022 ± 0.002).

In similarity to mercury levels in wild vegetation table (2) shows soil mercury was higher in the area surrounding to military Fac.at Kaha. Soil mercury levels were 8.9 ± 0.21 ; 8.1 ± 0.30 and 7.8 ± 0.33 after 100, 300 and 500 meters respectively from the military fac. at Kaha while it was 7.2 ± 0.18;5.9 ± 0.22 and 5.6 ± 0.21 at 100,300 and 500 meters distance from superphosphate fac. at A.Z respectively. Soil mercury level at Meet Radey was much lower (0.73±0.02) PPM. This indicates that both factories pollute the surrounding environment with mercury and it was higher in the area surrounding the military fac. at Kaha. ***Mankovska, 1996*** recorded concentrations of mercury in the foliage of forest tree in Slovakia from sites in highly polluted areas. Mercury concentrations ranged from 1.249±4.402 in Rudnany iron ore mine, and ranged from (0.013-0.749) in 9 other industrial regions; (0.021±0.737) in 4 mountain forests; and 0.053± 0.538 in a military area. The mercury content in the soil (0-5) cm from a mercury smelting plants ranged from 9.9 to 130 mg/kg.

Mercury concentrations resulted from the discharge of both factories as indicated in table (3) resulted in contamination of surface water near-by each Fac. we should pay attention for this problem as this surface water either in Kaha(Rashah El-Kaluobia) or in A.Z (Ismailia canal) used for drinking of animals and irregation of lands. ***Dellinger et al., 1995*** recorded that mercury contaminated fish that the people of Ojibwa of the upper Great lakes in the USA used to put it in a major parts of their diets resulted in a dose related slowing of brain visual processing activity when given to female Long Evans rats for 90 days.

Cadmium seems to be a significant contaminants for the surrounding environment as a result from Kaha military fac.or Abou Zabal superphosphate fac. Table (1) shows higher concentrations of cadmium in wild vegetation obtained from Kaha followed by Abou Zabal at all the examined localities (100, 200 & 300 meters) from the local source of pollution.Also , soil cadmium (table 2) and surface water cadmium (table 3) being elevated due to the output of both factories. Cadmium levels were in a decrease order with higher distance from the source of pollution and this is a good indication for the contribution of both factories in pollution of the surrounding environment.

Iron and manganese like the previous heavy metals (lead, mercury and cadmium) arised from both factories and contaminate the surrounding environment like vegetation (table 1) ; soil (table 2) ;and surface water (table 3). Both metals produced at higher extent from Kaha military fac. with concomitant higher levels of Iron and manganese in samples obtained from Kaha at the various distance (100, 200 & 300) meters. Their levels also declined at higher distance either in Kaha or A.Z. and this give a good idea about the role of these factories in contamination of the surrounding environment with these metals.

In the previous part of this study, we used vegetation, soil , and surface water for monitoring of heavy metals resulted from two main factories in Kaha & A.Z. at Kaluobia Governorate. In a similar study, ***Djingova et al., 1996*** used the leaves of Populus nigra Italica as a standard biomonitor for heavy metal (Pb , Ni ,Cd , Fe & Cu) pollution from weak indirect to strong iron industrial pollution . They found that in areas with low indirect anthropogenic influence , no significance changes were established, while in heavily polluted areas, the heavy metal concentrations in the leaves reflected the activities of the emitting sources.

For further biomonitoring the heavy metals arising from the studied point sources of pollution we used wild rats from both industrial localities under investigation together with others from the rural control area and used for determination of the same heavy metals (lead, mercury, cadmium, iron and manganese) in their livers and kidneys. Also wild rats were subjected for hematological and pathological investigations.

Table (4) give an idea about the metals in livers and kidneys of wild rats from industrial and non-industrial localities. It is well recognized that livers and kidneys of wild rats cached from the industrial localities have a higher tissue burden of the examined heavy metals. This reflects the bioavilability of these metals from the surrounding environment to the tissues of existing animals. Our results coincided with ***Schoof et al., 1995*** who recorded that soil lead when given at dose levels of 0.11 -3.43 mg lead/Kg b.wt. resulted in bone lead concentration ranged from 0.64 13.1 ug lead /gm. They also found that the bioavilability of soil lead was 41% as compared with lead acetate. Also, several records investigated the cumulative effect of the investigated metals in different tissues of which ***Seth et al., 1976 ; Kundomal et al., 1982 and Kundomal et al., 1986 for cadmium and Nezel and Vogt ,1976; Holm,1978 and Hamir et al., 1983 for lead and Loosmore et al., 1971; Reinders 1971 and Timbrell, 1982*** for mercury.

Tissue residues of heavy metals under investigation were higher in wild rats obtained from Kaha than that obtained from A.Z and the lowest tissue residues were recorded in livers and kidneys of wild rats cached from Meet Radey.This part of the study means that wild rats can be used as a mirror for biomonitoring heavy metal pollution in industrial areas. Our study was similar to that of Mouw et al.,1975 who used wild rat as an indicator for environmental pollution with lead in urban area versus a rural one. Urban rats had much higher tissue lead value than rural rats. They assumed that the elevation in first locality caused by difference in factors affecting absorption of ingested lead or increased respiratory exposure to airborne lead or both, and lead in precipitated dust. This study is also confirmed by ***Zipser and Kraczkowski, 1993*** who recorded concentrations of cadmium copper, and zinc in kidneys and livers of horses and cattle from different regions of the eastern part of Poland and the highest concentrations for cadmium was found in animals from the industrial town of Lublin . They concluded that the concentrations of cadmium in horses is a good indicator of pollution. Also, our study has a partial agreement with that of ***Hendriks et al., 1995*** who used earth worms and shrews as modeling for monitoring organochlorine and heavy metals accumulation in soils. They recorded bioconcentration of heavy metals and organochlorine in livers and kidneys of these species.

Concerning to the hematological investigations table (5) shows a significant decrease in RBCs ; Hb ; and PCV values in wild rats from Kaha (near the military fac.) followed by that from Abou Zabal near superphosphate fac. in comparison to wild rats from the control area in Meet Radey. In contrast to RBCs and total leucocytic counts showed a highly significant increase in the blood of wild rats from the industrial location in comparison with the control areas .It is evidenced that the increase in total leucocytic count is mainly due to the increase in lymphocytes and neutrophils count. This give indication for the involvement of haemopoietic system due to metal pollution and this manifestation was explored in the histopathology of spleen in this study. Also, several records investigated the role of the examined heavy metals in inducing anaemia e.g ***Part, 1976 for lead and Morgan et al.,1984 ; and Waner and Gur 1993 and Farina et al., 1996*** for cadmium.

Regarding to histopathological findings in the present study, hepatic congestion and hydropic degeneration of hepatocytes with mononuclearinflammatory cellular infiltration of portal area were observed in liver of wild rat from Abou Zabal . In this respect ***Watanabe et al., 1986*** who found similar lesions in liver of mice fed cadmium polluted rice. In addition, vacuolation and coagulative necrosis of hepatic cells were recorded in liver of rats near to the military factory in Kaha. These changes may be due to iron ***(Park et al., 1987 ; String et al., 1988 and Carlton and Mc Gavin 1995)*** ; or due to cadmium ***(Watanabe et al., 1986)*** or mercury ***(Lindh and Johnson 1987)***. Also hepatic fibrosis and biliary hyperplasia were recorded in these animals . This finding was also recorded in the study of ***Abou Salem, 1991*** due to cadmium intoxication in rat.

The examined kidneys of rats from Abou Zabal showed congestion and cloudy swelling with presence of casts within dilated tubules. Meanwhile tubular necrosis and mononuclear inflammatory cellular infiltration were seen in the kidneys of rats cached from Kaha . The aforementioned pathological changes could be attributed to cadmium, lead or mercury intoxication. This was mentioned in ***Jubb et al., 1993 and Carlton and McGavin 1995*** and confirmed in the investigation of ***Nichlson and Osborn 1983 and Lindh and Johnson 1987.***

Microscopically, examined testis showed congestion and perivascular edema. Similar lesions were also recorded by ***Abou Salem, 1991*** in cadmium intoxicated rats. In addition, testicular degeneration and inflammatory cellular infiltration of degenerated tubules were also noticed . Jubb et al., 1993 recorded similar lesions due to lead , mercury and cadmium. However, Saxena et al., 1989 and Nagashima et al., 1996 found that mercury intoxication induced similar changes in testis.

Concerning to the examined heart lymphocytic myocarditis evidenced by congestion , myocardial hylinosis and lymphocytic cellular infiltration was microscopically observed particularly in wild rats from Kaha.

The examined brain revealed congested blood vessels , perivascular hemorrhages and gliosis. Nearly similar lesions were also reported by Abou Salem ,1991 who recorded similar changes with satilitosis in rats due to cadmium intoxication. Moreover, neural necrosis was also recorded. This lesion may be due to mercury or lead intoxication that supported by results of ***Carlton and McGavin 1995 and Nagashima et al., 1996.***

Catarrhal bronchopneumonia was prominent in the lungs of rats from AbouZabal. In addition, thrombosis, hemorrhages and haemosiderosis with compensatory alveolar emphysema were notice in lungs of rats from Kaha . This pulmonary lesions could be attributed to cadmium .Our opinion was confirmed by ***Farina et al.,1996.***

Splenic congestion and haemosiderosis were detected in examined spleen of rats cached from both localities. Feature of myeloproliferative disorder changes in spleen represented by hypercellularity, nuclear and cellular pleomorphism of lymphoid cells with aggregation of numerous megakaryocytes was recorded. These changes were also described by ***Moulton 1978*** in erythroleukaemic form of meyloproliferative disorder in the cat . In addition, these cells were seen in the interstitial tissues of kidneys. These changes with presence of debris laden macrophages in the germinal center of splenic follicle clarified the disturbance in haemopiotic system that was recorded in our hematological examination.

It could be concluded that, the examined point source of pollution and similar industrial establishment are extremely hazardous and having a major contribution in the adverse effect on all surrounding environment either plants , water , animals and human being inhibiting near to these localities. Therefore , filters and other protective measures should be applied for these sources of pollution. In addition , newly constructed industrial establishments should built a way from the places where people and animals inhabit as well as from any agricultural places and their discharges should be treated before allowing to come out into the water sources.

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