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Impact of Commercial Herbicide, Bispyribac-Sodium, on Histological Feature and Functions of Catfish, *Clarias gariepinus* Liver



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Hecommercial herbicide, bispyribac-sodium, is widely utilized in agricultural to control weeds in rice fields. Although, it's efficacy in controlling unwanted plant growth is well established, there are concerns about its potential effects on non-target organisms, such as the fish. Clarias gariepinus is a commonly farmed species of catfish and its health is of economic importance to aquaculture operations. The aim of the present work is to investigate the effects of bispyribac-sodium on the liver functions and it's histopathology in C. gariepinus. The study was conducted over a period of 14 and 28 days, with fish being exposed to varying concentrations of bispyribac-sodium (High and low concentrations). At the end of exposure period, blood and liver samples were collected for analysis the liver functions and its histopathology. Results showed that, exposure to bispyribac-sodium caused significant changes in the liver functions as indicated by altered levels of liver enzymes, including aspartate aminotransferase (ASAT), alanine aminotransferase (ALAT), alkaline phosphatase (ALP), albumin and total proteins. Histopathological examination of the liver tissue declared that exposure to bispyribac-sodium caused hepatic damage including centrilobular vacuolization, degeneration of the hepatocytes and infiltration of immune cells. Results suggested that, exposure to bispyribac-sodium can cause significant harm to the liver of C. gariepinus and raises concerns about its potential effects on the health of other aquatic organisms. Therefore, future studies must be conducted to fully understand the mechanisms underlying these effects and to assess the potential risks posed by bispyribac-sodium to the aquatic environment. Such study highlights the importance of considering the potential effects of agriculture's chemicals on non-target organisms and knowledge for a more holistic approach to weed control in rice fields.

Keywords: Bispyribac-sodium, Clarias gariepinus, liver functions, histopathology.

Introduction

Aquatic environment is exposed to a lot of harmful discharges from various activities such as industrial and agricultural processing, which may have negative effects on the population [1-3]. Direct application, spray drift, runoff, drainage from industry, and wastewater are only some of the methods through which pesticides may enter waterways and have a negative impact on aquatic ecosystems [4-5]. Pesticides are poisonous to live organisms as well as fish [6-7]

These undesirable outcomes result from the direct or indirect release of pollutants into water bodies without sufficient treatment to eliminate toxic elements. Fish are poisoned in two ways by contaminants in the water (plant extracts, heavy metals. and industrial effluents): at high concentrations. the gill epithelium is quickly destroyed, leading to death, and at low concentrations, the main metabolic pathways, including the liver, gills, and kidneys, are inhibited [8].

Bispyribac-sodium is a systemic herbicide commonly used for grass control in agriculture. The

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commercial formulation of bispyribac-sodium, a substance that is water soluble belongs to the pyrimidinyloxy benzoic acid family[9-10]. Its widespread use has raised concerns about its potential impact on the environment and non-target organisms including fish. In recent years, however, studies have shown bispyribac-sodium can have significant adverse effects on the liver functions of *C. gariepinus*.

Toxicological studies of bispyribac-sodiumon *C. gariepinus* because its resistant and able to survive in difficult environmental conditions in addition to its economic importance [5,11-15]. Physiological and biochemical responses may be compromised, resulting in detrimental effects on fish's health [16].Multiple alterations in haematological parameters in fish may be brought about by various

Material and methods

Bispyribac-sodium:

The commercial formulation of the herbicide bispyribac-sodium {2,6-bis (4,6dimethoxypyrimidin-2-yloxy) benzoate}[**26**] is as the following (Fig. 1):

Experimental samples:

Fifty-four C. gariepinus were captured in their natural habitat at ELshakhloba Fish Farm in Kafer El-Sheikh Government, Egypt, with an average body weight of 230±50 g. After being caught, fish were sent to the Zoology Department's Fish Lab at the Animal House, Faculty of Science. Research conducted at Al-Azhar University between May 2020 and July 2020 was used to compile the data shown here.

In the laboratory, fishes were kept in identical glass aquaria, aerated with air pump (Rina, Italy) at temperature of 26.6 ± 6 °C, supplied with dechlorinated water with natural photoperiod (8-16 h light- dark cycle). Six fishes were placed into each glass aquaria ($60 \times 25 \times 40$ cm), however, water in glass aquaria 50 L and left for 4 weeks for acclimatization to ensure their environmental adaptation and maintained good ventilation,humidity range, andnormal temperatures. Mortality was less than 10% during acclimation period and the fish healthy were individually examined and recorded.

Fish feeding regime:

The experimental fish fodder (30% protein floating pellets) was utilized. The percentages composition of basic diet consists of fish meal 60%, soybean meal 46%, wheat bran, rice bran, yellow corn, mono calcium phosphate, fish oil, soya oil, vitamins and minerals mixture. The total energy in the basic diet is over 4070 Kcal/kg, with the protein

environmental circumstances in ecosystems, and there is a direct association between contaminants and the eccentricity of fish blood[7, 17-19].

Histopathological studies in the liver of *C. gariepinus* have been used as a reference for stress by environmental toxic chemicals, since it is organs most impacted by the water contaminants due to its function, position and blood supply [20-23]. Processes of detoxification and biotransformation depend heavily on the liver, which is one of the most sensitive organs and can degrade toxic compounds [24-25].

The purpose of this work was to examine the effects of bispyribac-sodium, a frequently used herbicide in Egyptian agriculture, at sub-lethal doses on the liver functions of C. gariepinus and its histological alternations.



Fig.1.Structural formula of Bispyribac-sodium

content at 29.8 percent, the fat content at 7.5%, the ash content at 12.4 percent, and the water content at 6.9 percent. The food was provided twice daily around between 9:00 AM and 3:00 PM with 3 % of the total body weight.

Acute toxicity study (LC₅₀):

To study Acute toxicity, fishes were exposed to five different concentrations fora period of 96 hoursunder static conditions, according to OECD NO [203] (2019). Mortalities, visible abnormalities and behaviour of the fish were observed and the concentrations that kill 50% of the fish (LC₅₀) were determined and recorded [27].

Five concentrations of bispyribac-sodium (0.59,0.88,1.31,1.97 and 2.95 mg/ L) in a geometric series were used for estimation of LC_{50} . The commercial formula of bispyribac-sodium is exposed for 96 h. at $26\pm1C^{\circ}$ and mortality was recorded at the end of 96 h. LC_{50} was calculated according to the following formula:

$Log m = log D_a + d. (f+1)$

Where:

log m = represents the log of LC₅₀. **log D**_a = represents the log of the smallest used five concentrations. **d** = represents the logarithm of the constant ratio between dosage levels.

f = represents a constant factor obtained from Weil's (27).

Experimental design:

To study long term toxicity, 48 fishes were divided into the following groups.

Group 1: Fishes, fish of this group without any treatments(12 fishes).

Group 2: Sixfishes were treated with 1/10 Lc₅₀(0.11 mg/L)of bispyribac-sodium herbicide for 14 days.

Group 3: Sixfishes were treated with 1/30 Lc₅₀(0.37 mg/L)of bispyribac -sodium herbicide for 14 days.

Group 4: Sixfishes were treated with 1/10 Lc₅₀(0.11 mg/L)of bispyribac -sodium herbicide for 28 days.

Group 5: Sixfishes were treated with 1/30 Lc₅₀(0.37 mg/L)of bispyribac -sodium herbicide for 28 days.

- **Group 6**: Sixfishes were recovered the treatment 1/10 Lc₅₀ of bispyribac -sodium herbicide with change the water without exterminator for 14 days.
- **Group 7**: Sixfishes were recovered the treatment 1/30 Lc₅₀ of bispyribac -sodium herbicide with change the water without exterminator for 14 days.

Morphological and behavioural changes:

Clinical symptoms and lesions indicative of pathology were looked for in the experimental fishes in accordance with Noga[28]. In the glass tanks, researchers kept close attention to the fish's movements, colour changes, and respiratory and neurological symptoms.

Blood sampling collection:

Fish must be individually anesthetized by clove oil before sample collection to facilitate handling. They were blotted dry, and blood was collected by amputating the tail after being gently released into a tough containing clove oil (50 μ /L) to render it immobile.

The ablation of the tail was performed with a single, powerful stroke. After severing the fish's caudal peduncle, the initial blood was drained and thrown away. After that, a second heparinized disposable syringe was used to capture the freely leaking blood. While still in the process of collection,

Bispyribac-sodium is seen as being extremely movable, made primarily to get rid of weeds, highly harmful to aquatic life (vertebrates and invertebrates) and potentially dangerous to the environment. the blood was transferred to the Eppendorf without anticoagulant, mixed with a thin, blunt glass rod, and centrifuged at 4000 rpm. Biochemical measurements, including total protein, albumin, and enzyme activity, required serum to be kept at -4 degrees Celsius (ASAT, ALAT and ALP).

Biochemical studies:

- Serum levels of aspartate aminotransferase (ASAT), alanine aminotransferase (ALAT), alkaline phosphatase (ALP), total protein, and albumin were taken into account in this biochemical study.
- The levels of ASAT and ALAT in the serum were measured using a kit from the ElitechCompany, France [29].
- **3-** The mentioned procedure was carried out utilising a kit from Elitech diagnostic Company to measure serum ALP [30].
- 4- Total protein in the serum was measured using a kit purchased from Elitech diagnostic Company [31].
- **5-** A kit from Elitech diagnostic Company was used to measure albumin in the blood [32].

Histopathological studies:

Fishes were sacrificed after 14, 28 and 14days recovery. The samples were dissected and the livers were rapidly and carefully excised. The removed organs were washed with saline solution, dried with filter papers and then fixed in 10 % normal formalin for 48hr. After being dehydrated in ethyl alcohol, they were cleaned in xylene and then imbedded in paraffin wax blocks. Microtome serial slices were cut at 3-5 m. (Leica RM 2125, Leica Bio systems Nussloch GmbH, Germany). Hematoxylin and eosin staining was used to identify common histological characteristics in tissue sections[33]. Slides were examined by light microscope (Olympus Tokyo, BH-2, Olympus, and Japan) and photographed.

Statistical analysis:

The data was analysed statistically using IBM's SPSS/PC (version 20) software, a social science statistics tool. One-way ANOVA was used to analyse the data, and the results were presented as the mean S.E. (ANOVA). The cut-off for statistical significance was (P 0.05).

<u>Results</u>

Calculation of LC₅₀:

The calculated 96h acute LC_{50} of bispyribacsodium to *C. gariepinus* was 1.1 mg/L according to the calculation of data reported in Table 1.

Concentrations of BPS (mg/L)	No.of fish	Dead fish	Mortality%
0.88	6	0	0%
1.31	6	6	100%
1.97	6	6	100%
2.95	6	6	100%

TABLE 1.	Mortality	percentage	in the	fish	samples	according	to	different	concentrations	of	bispyribac-
	sodium										

Liver functions of *C. gariepinus* affected by different concentrations of bispyribac-sodium:

Results revealed that, the used concentrations of bispyribac-sodium (0.11 & 0.037 mg/L) caused a

significant decrease in albumin level after 14 and 28 days of treatment when compared with the control. Meanwhile, after the recovery period, it returned gradually to the normal the range at the lowest concentration (TABLE 2).

TABLE 2. Impact of different concentrations of bispyribac-sodium on the serum albumin (g/dL)of C.gariepinus after 14, 28 days and the recovery periods

Treatment Exposure time	Control	High concentrations	Low concentrations
14 days	1.74 ± 0.02	$1.37 \pm 0.04*$	$1.44 \pm 0.05*$
28 days	1.68 ± 0.03	1.46±0.01*	$1.46 \pm 0.02*$
Recovery (14 days)	1.61 ± 0.03	1.44±0.02*	1.51 ± 0.05

Results (TABLE 3) revealed that, the total protein in the serum of *C. gariepinus* treated with sub-lethal concentrations of herbicide did not show any significant changes after the recovery period, compared with the control. Meanwhile, the present study declared a significant reduction in protein level after 14 and 28 days of treatment with bispyribacsodium.

TABLE 3. Impact of different concentrations of bispyribac-sodium on serum total protein (g/dl) of C.gariepinus after 14, 28 days of exposure and the recovery periods

Treatment Exposure time	Control	High concentrations	Low concentrations
14 days	4.44 ± 0.27	3.60±0.04*	3.98±0.07*
28 days	4.00 ± 0.07	3.01±0.24*	3.00±0.23*
Recovery (14 days)	4.41±0.13	4.46±0.46	3.86±0.17

The present study exhibited a significant increase in serum ASAT, ALAT and Alkaline phosphatase (ALP) activities in the catfish, C. *gariepinus* treated with the sublethal concentration of bispyribac-sodium when compared with control one at all groups after exposure to 14 and 28 days, respectively. After the recovery period, however, serum ASAT and ALAT activities in the catfish exhibited a significantly increase, while ALP showed non-significant change (TABLES 4-6).

 TABLE 4. Impact of different concentrations of bispyribac-sodium on serum ASAT enzyme activities (U/L) of C. gariepinus after 14, 28 days of exposure and the recovery periods

Treatment Exposure time	Control	High concentrations	Low concentrations
14 days	73.13±3.68	103.18±6.08*	143.42±3.17*
28 days	74.32±1.91	104.16±2.08*	134.63±6.21*
Recovery (14 days)	76.70±2.24	117.69±4.09*	131.84±9.43*

Treatment Exposure time	Control	High concentrations	Low concentrations
14 days	7.73±0.21	14.45±0.96*	11.19±0.58*
28 days	8.64±0.49	11.58±0.32*	14.69±0.59*
Recovery (14 days)	8.27±0.30	13.83±1.15*	14.34±1.64*

 TABLE 5. Impacts of different concentrations of bispyribac-sodium on serum ALAT activities (U/L) of C.

 gariepinus after 14, 28 days of exposure and the recovery periods

 TABLE 6. Impact of different concentrations of bispyribac-sodium on serum ALP activities (U/L) of C.

 gariepinus after 14, 28 days of exposure and the recovery periods

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Treatment	Control	High	Low		
Exposure time	Control	concentrations	concentrations		
14 days	11.13±0.66	16.25±0.85*	13.20±0.29*		
28 days	10.44±0.26	12.2±0.19*	12.75±0.48*		
Recovery (14 days)	10.75±0.85	17.00±0.71*	10.34±0.26		

Histological changes in the liver of *Clariasgariepinus*:

a-Normalstructure of the liver:

Normal *C. gariepinus* liver cells (hepatocytes) are organised into cords that are divided by sinusoids that branch out of the central vein, as shown on a histological slide. Sinusoids are less in number and bordered by endothelial cells with extremely conspicuous nuclei; they are found in an uneven pattern among the polygonal hepatocytes. The sinusoid lining does not include Kupffer cells. Fenestrated sinusoidal lining cells exist above the space of Disse, a transitional region between sinusoid cells and hepatocytes that is rich in microvilli and adipocytes. The nucleus of a liver cell is a round, transparent sphere that typically only contains one nucleolus. Liver cell cytoplasm was found to contain significant amounts of lipid and glycogen(Figs. 2&3).

b- Histological changes in the liver:

Marked degeneration of the hepatocyte's cords and random distribution in the liver of *Clarias gariepinus* treated with bispyribac-sodium at low concentration (0.037) mg/L after 28 days were observed. Mild vacuolationwas noticed in hepatic cells concomitant with pyknotic nuclei. In addition, focal necrosis, increase in cytolysis, infiltration of inflammatory cells between hepatocytes and hemorrhage were noticed in some regions. Moreover, dilated blood vessels filled with inflammatory cells and degeneration of pancreatic aciniwere observed in the liver tissues (Figs. 4&5).

Fishes exposed to bispyribac-sodium at high concentration (0.11) mg/L for 28 days, however, exhibited a completely degeneration of hepatic cord

and blood sinusoids. Vacuolated cytoplasm, hepatocyte necrosis, haemorrhages were also observed in the degenerated and atrophied tissue. Congestion of blood vessels with more inflammatory cells, pyknosis of nuclei appeared and moderate to severe infiltration of the periductular spaces by mononuclear leucocytes (Figs. 6&7).

c- Histological observations after the recovery periods:

Recovery period of the fishes treated with the lowest concentration of bispyribacsodium for 14 days indicated several histopathological alterations in the liver tissue of *C. gariepinus* including marked degeneration of the hepatocyte's cords and blood sinusoid, cytoplasmic ribosomal basophilia with sever vacular degeneration. Also, congested dilated central vein with inflammatory cells and highly infiltration with chronic inflammatory cells and focal necrosis area were clearly detected(Figs. 8&9).

The recovery period for fishes treated with the highest concentration of bispyribacsodium for 14 days showed remarkable normal tissue architecture, cord arrangement and vascular structures with little mild vacuolated cytoplasm. Furthermore, moderate intracellular hemorrhages, necrosis area and pyknotic nuclei were observed in the fish liver (Figs. 10&11).



Fig. 2. Photomicrograph of the normal liver (control) of *C. gariepinus*, showing normal blood vessels, normal hepatocytes (No.H.) and Kupffer cells (ku.ce.) (H&E x400).



Fig. 4. Photomicrograph of the liver of *C. gariepinus* treated with the lowest concentrations of bispyribacsodium for 28 days showing infiltration of chronic inflammatory cells between hepatocytes (C.I.Ce.H.), hemorrhage (He), the cytoplasm is mild vacuolated (Cy.V.) and the nuclei continue to be pyknotic (Ni.P.)(H&E x400).



Fig. 6. Photomicrograph of the liver of *C. gariepinus* treated with the highest concentrations of bispyribacsodium for 28 days showing congestion blood vessels, hemorrhages (He.), congested blood vessel with inflammatory cells (Co.B.Vs. &I.Ce.) and highly vacuolated in cytoplasm (Hg.V.Cy) (H&E x400).



Fig. 3. Photomicrograph of the normal liver (control) of *C. gariepinus* with normal pancreatic acini (No.Pc.Ac.) (H&E x400).



Fig. 5. Photomicrograph of the liver of *C. gariepinus* treated with the lowest concentrations of bispyribacsodium for 28 days showing degeneration of pancreatic acini (D.Pa.Ac.) and Focal necrosis (F.N.) (H&E x400).



Fig. 7. Photomicrograph of the liver of *C. gariepinus* treated with the highest concentrations of bispyribacsodium for 28 days showing hepatocyte necrosis (H.N.), degeneration of hepatic cord and blood sinusoid (Di.B.Si.) and pyknosis (P.) (H&E x400).



Fig. 8. Photomicrograph of the liver of *C. gariepinus* treated with lowest concentration of bispyribac-sodium after the recovery period for 14 days highly infiltrated with chronic inflammatory cells (Hg.In, &C.I.Ce.), focal necrosis area (F.N.Ar.) and degeneration of the hepatocytes cords and blood sinusoid (D.B.Si.) (H&E x400).



Fig. 10. Photomicrograph of the liver of *C. gariepinus* treated with highest concentration of bispyribac-sodium after the recovery period for 14 days showing sever focal necrosis (F.N.), the cytoplasm is mild vacuolated (Cy.V.) mild dilated bid vessel with inflammatory infiltration (Di.B.Vs. &Ir.In.) (H&E x400).

Discussion

A variety of aquatic biota, including fishes, may be at danger due to the widespread and intensive use of pesticides in agriculture [34]. This is especially true with herbicides. Fish habitats are among the water body resources that have been contaminated by herbicides and their deterioration [35, 36]. Herbicide residue contamination has emerged as a significant danger to aquatic life in the last several decades [37]. Pesticides that get bio-accumulated in fish are then bio-magnified as they go up the food chain, posing a



Fig. 9. Photomicrograph of the liver of C. gariepinus treated with the lowest concentration of bispyribacsodium for 14 days showing cytoplasmic ribosomal basophilia with sever vacuolar degeneration (Cy.R.Ba.&S.V.D.) and congested dilated central vein with inflammatory cells (Co.Di.Cn.Vn.) (H&E x400).



Fig. 11. Photomicrograph of the liver of *C. gariepinus* treated with highest concentration of bispyribac-sodium after the recovery period for 14 days showing pyknotic nuclei (Ni.P.), haemorrhages (He.) (H&E x400).

danger not just to fish but to human health as a whole [38].

The fish's health might be jeopardised because of disruptions in their physiological and biochemical reactions [16]. The metabolic reaction of fish may be altered in a number of ways according to the presence of contaminants and the variety of ecological circumstances [17-19].

Fish are particularly vulnerable to the toxic effects of xenobiotics, and the behavioural symptoms

they display point to changes in biochemical parameters, especially those involved in carbohydrate and protein metabolism [35–39]. Fish in this research that were exposed to sub-lethal concentrations of bispyribac-sodium exhibited aberrant swimming, behaviour, and higher deformities when compared to the control group.

Transporting substances throughout the fish's body is a crucial role of plasma protein, which includes globulins, fibrinogens, and albumins. They help in nutrient delivery, defence, buffering, and energy production [40].Proteins are essential for cellular structure and function, especially under stressful situations. Fish utilised proteins as a fuel source during detoxification, therefore any toxicant effects or alterations to proteins have a negative impact on fish physiology and fish behaviour because proteins create enzymes that carry out various physiological activities.

Albumin is produced in the liver and has multiple roles, including maintaining a healthy colloidal osmotic pressure in the blood and facilitating the transport of various chemicals. These include both exogenous chemicals like drugs and toxicants and endogenous metabolites like fatty acids, hormones, and bilirubin. Reduced albumin and globulin levels in the blood are an indicator of impaired protein synthesis or liver damage caused by toxins [42, 43]. Elalfy et al. [44] and Abdel-Daim et al. [45] found similar outcomes, but Sharafeldin et al. [46] and Fathy et al. [47] found different ones. High renal excretion and impaired protein synthesis owing to hepatic dysfunction both contribute to falling albumin levels [48, 49]. Protein metabolism, the process by which blood and structural protein are converted to energy, may be accelerated in response to the increased energy requirement of the organism to counter stress in the presence of toxicants [50, 51].

Disruption in the activity of enzymes crucial to metabolic processes in fish is an early sign of toxic effect [52, 53]. Diseases in fish induced by pollution in the environment are typically diagnosed using liver enzymes called ALAT, ASAT, and ALP. That's why these signs of stress are taken seriously [37]. ASAT and ALAT are of non-functional enzymes that are generally found in the cells of many organs including liver, heart, gills, kidneys, muscle and are used to evaluate liver function and some other organs [54].Changes in endoplasmic reticulum mass are mirrored by ALP activity. It has been found in the cell membrane, where it may have a role in the transfer of metabolites [55]. In addition, ALP is mostly a membrane-bound protein, and any change in membrane characteristics due to contact with xenobiotics might affect ALP function [56]. Injuries to the liver may enhance the permeability of cell

membranes, which may explain why ASAT, ALAT, and ALP enzyme activities are elevated in the cytoplasm of liver cells [57, 58]. The findings matched those of other researchers [46–47] and others [59–60].

Damage to the liver or an increase in transamination is indicated by elevated activity of serum ASAT and ALAT. The increased energy requirements of fish under herbicide challenge have been linked to a rise in transamination [61, 62].Furthermore, elevation in ALP values is caused by the stress of bispyribac-sodium. The significant elevation in the activity of ALP in the plasma may attribute to tissue damage of the target organs that produces the enzyme such as the liver and the kidney.

The present investigation showed that, the catfish, Clarias gariepinus treated with bispyribac-sodium for 28 days and let go recovery without toxic for 14 days with marked degeneration of the hepatocyte's cords and random distribution and mild vacuolation noticed in hepatic cells concomitant with pyknotic nuclei. In addition, focal necrosis, increase in cytolysis, infiltration of inflammatory cells between hepatocytes and hemorrhage were noticed. Moreover, dilated and congestion blood vessels filled with inflammatory cells and degeneration of pancreatic acini were showed. Furthermore, severe infiltration of the periductular spaces by mononuclear leucocytes, interstitial oedema and atrophy of hepatic sinusoids were occurred with leukocytosis and hemosiderin granules.

These observations agree with that recorded byPacheco & Santos [63] who found that, exposure to contaminated water leads to vacuolization of the hepatocytes which is a sign of a degenerative process that suggests metabolic damage. Also,Rahman*et al.* [64] detected severe necrosis, appearance of large number of vacuoles in cytoplasm and pyknotic nuclei in the liver of *Channa punctatus* and *Anabas testudineus* after intoxication of diazinon.

Furthermore, Fernando *et al.* [65] reported that, nuclear level impact of bispyribac-sodium on the fish, *Poecilia reticulate* was significantly higher number of damaged nuclei in liver tissue was noted in herbicide exposed fish Similar findings are compatible with the recorded histopathological lesions, which revealed a notable degeneration and necrosis of hepatocytes coincided with increasing in ASAT and ALAT activities [66-69] and confirming that, it may be attributed to liver injury [70-71].

Conclusion

The present study highlights the importance of considering the potential effects of the used chemical in agricultural on non-target organisms and knowledge the need for more holistic approach to weed control in rice fields. Liver was unable to recover completely after 14 days and displayed some deformities ranging from moderate and severe. So, the recovery periods must be to longer to detect the herbicide residues and its dangerous effects.

Recommendation

We recommend limit in the use of bispyribacsodium in the rice crop care. The current study supported that the recovery period must be longer than the exposure time to delete the devastating effects.

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Conflict of Interest

The authors declare no competing interests.

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Author's contributions

Amro M.M. Ragab: methodology, investigation, visualization. Sabry M.A. Shehata: writing—original draft, statics and formal analysis, methodology, investigation. Mohamed H.M. Ghanem: writing, methodology, visualization, writing—review and editing and Abdelhameed A. Nahas: formal analysis, methodology, conceptualization, editing.

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تأثير مبيد الحشائش التجارى (بيسبيريباك الصوديوم) على التركيب النسيجي و وظائف الكبد للسمك القطى (كلاريس جاربينس)

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تعد أسماك القراميط من أكثر الأسماك شيوعا فى عملية الإستزراع السمكى فى حقول الارز لما له من له من أهمية كبيرة فى مقاومة الظروف البيئية مثل الإرتفاع فى درجات حرارة المياه، العكارة و عمق المياه كما أن له أهمية إقتصادية كبيرة فى حيث وفرة الإنتاج والقبول لدى المستهلك، خاصة الأفراد متوسطى الدخل وذات الدخل المحدود وعليه تهدف الدراسه الحاليه إلى تقييم الآثار الناجمة عن إستخدام التوسع فى استخدام مبيد الحشائش التجارى بيسبيريباك الصوديوم على الوظائف الفيسيولوجية والتراكيب النسيجية المرضية لتركيزات مختلفة من هذا المبيد لتحديد التركيزات الاقل خطورة على صحة الأسماك والحيوان.

اظهرت النتائج تغيرات ملحوظة فى مستويات الإنزيمات الكبدية (إنزيم الأسبارتك ناقل مجموعة الامين،إنزيم الالانين ناقل مجموعة الامين وإنزيم الفوسفاتيز القلوي)، الألبومين والبروتين الكلي. كما اوضحت الدراسات النسيجية المرضية لأكباد هذه الاسماك تغيرات ملحوظة فى النسيج الكبدى ممثلة فى الخلايا الكبديةو التجويف وارتشاح الخلايا المناعية.

أشارت النتائج إلى أن التعرض لمبيد بيسبير وباك الصوديومقد يسبب اضرارًا بالغة لاكباد الأسماك، كما اثبتت الدراسة اثاراً مدمرة لصحة الكائنات المائية الأخرى. مما يستوجب إجراء العديد منالدراسات المستقبلية كمحاولة لفهم الآليات الكامنة وراء هذه التأثيرات،وآثاره على البيئة المائية بشكل عام ومن ثم اعادة النظر في الإستخدام المفرط للمواد الكيميائية بشكل عام فى المنظومة الزراعية بغية الوصول إلى نهج أكثر أمانافى مكافحة الحشائش والنباتات

الكلمات الدالة: بيسبيريباك الصوديوم، كلاريس جاربينس، وظائف الكبد، هيستوباتولوجي.