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TOXIC EFFECT OF BIFENTHRIN INSECTICIDES ON THE LIVER ENZYMES IN *CHANNA PUNCTATUS* (BLOCH.)

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Abstract

Pollution levels in today's world are rapidly rising, endangering not just the natural world but also human and animal health. Dangerous contaminants include things like metals, human waste, and agricultural runoff with pesticides. Treatment of Channa punctatus (Bloch.) with bifenthrin insecticide for 7, 15, 30, 45, and 60 days resulted in significant increases in the levels of Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), and Alkaline Phosphatase (ALP), as compared to the control group.

Keywords **:** *Channa punctatus,* bifenthrin, Alanine Aminotransferase, Aspartate Aminotransferase, Alkaline Phosphatase

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Introduction

The amount of pollution in the modern world is rising quickly, which is dangerous for both human and animal health as well as the environment. Heavy metals, residential sewage, and agricultural runoff including pesticides are among the pollutants deemed harmful (Sagar *et al*., 2017). Both freshwater and marine aquatic habitats are affected by these contaminants. Pesticides make up a sizable component of these. In light of the world's steadily growing population, it is vital to solve problems related to food scarcity. One of the main Sustainable Development Goals (SDGs) and Millennium Development Goals (MDGs) is to end hunger. Pesticides are one of the many methods and chemicals used today to increase agricultural production. They are used to prevent, kill, and repel pests that harm crops, lower yields, and degrade food quality (Ullah *et al*., 2019). Pesticides from agricultural areas cause the water quality to decline, endangering the health of aquatic species and biodiversity. Although the types and quantities of these pesticides are always changing, their use is steadily rising worldwide. Different classes of these pesticides, such as insecticides, fungicides, herbicides, nematicides, rodenticides, acaricides, etc., are used against various target populations. In terms of employability, however, pesticide use outperforms the other classes (Ullah *et al*., 2018). There are several types of insecticides used, including synthetic pyrethroids and organophosphates. Because organophosphates have severe neurotoxic effects on mammals, their use was gradually phased out. As a result, the use of synthetic pyrethroids increased (Werner and Moran, 2008). According to the report's findings (van den Berg *et al*., 2012), pyrethroid use increased with time, reaching more than 1500 MT in 2009 from 100 MT in 2000.

In the 1970s, synthetic pyrethroids (an artificial version of the decorative plant *Chrysanthemum cinerariaefolium*) were created. They were initially used for agricultural purposes, such as to protect food, but over time, they were also used for a variety of non-agricultural purposes, such as controlling animal ectoparasites, lice shampoos, mosquito repellents, and insect control sprays (Velisek *et al*., 2009; Brander *et al*., 2016a; Brander *et al*., 2016b). Due of their little hazardous effects on birds and mammals, the usage of synthetic pyrethroids is continuously increasing. These insecticides are used the second-highest (Wang *et al*., 2017). Numerous investigations assessed and verified the occurrence of synthetic pyrethroids in various biospheres. Some research (Ueyama *et al*., 2009; Corcellas *et al*., 2012; Wielgomas and Piskunowicz, 2013) and aquatic organisms have proven their presence in human breast milk and urea.

According to Wang *et al*. (2017), bifenthrin is a moderately dangerous (class II) chemical that the WHO has approved for usage in the general population. One of the main sources of food and nutrients for humans is fish. The nutritional value of various fishes is influenced by their biochemical makeup, which includes things like proteins, carbs, vitamins, and minerals (Sagar *et al*., 2018). The *Channa punctatus* (Bloch) is chosen for the current investigation due to its simplicity in handling and availability. When travelling through a river that receives trash from nearby human settlements and industry, the fish "*Channa punctatus* (Bloch)" are the most vulnerable of all aquatic creatures to such pollution. The fish's tissues are easily damaged by water contaminants. By disrupting its neurological system, the pyrethroid pesticide bifenthrin is mostly used to combat red imported fire ants. It is extremely poisonous to aquatic life. It is permitted to be sold for everyday use even though it is categorized as a restricted use chemical in the US, provided that the product has low bifenthrin content.

Material and Methods

Bifenthrin pesticide will be employed for the current study. From ponds near Agra, live *Channa punctatus* specimens were moved. The experiment used fish that were almost the same size and weight to represent a similar age group as a constant factor and to examine the effects of different pesticide treatments. To get rid of any potential skin infections, fish were cleansed in a solution containing 0.1% $KMnO_4$. They were then applied to aquariums that held water after being rinsed with ordinary water. The fish were split into two groups: control group and treatment group. The control group and treated group were then separated into five smaller groups, each with six fish. A total of 6 fish make up the control group (A), whereas 30 fish make up the treated group, divided into 5 subgroups (B, C, D, E, and F), each with 6 fish. On days 7, 15, 30, 45, and 60, respectively, the treated and control groups' rats will be dissected out. After cutting the caudal peduncle of living fish with scissors, blood samples were taken in order to separate the serum for the testing of liver enzymes among all the groups. Liver enzymes; Alkaline Phosphatase (ALP) was estimated by the method of King and King's (1954) while the estimation of Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) was done by the method of Reitman and Frankel's (1957).

Results

According to the current study, fish treated with bifenthrin have elevated liver enzyme levels when compared to fish in the control group. Alkaline phosphatase (ALP), Alanine Aminotransferase (ALT), and Aspartate Aminotransferase (AST) levels significantly and highly significantly increased after 7, 15, 30, 45, and 60 days, respectively, according to the current data.

Table I : Effect of Bifenthrin on Alkaline Phosphatase (U/L) in *Channa punctaus* (Bloch) after 7, 15, 30, 45 and 60 days Exposure

S. No.	No. of days	No. of rats	Range Mean ± S.Em.	
			Control	Treated
1	7 Days	10	87.64–92.89 (90.07 ± 0.48)	99.87–104.81 (102.02 ± 0.48) ↑**
2	15 Days	10	87.64–92.89 (90.07 ± 0.48)	110.24 – 116.87 (114.11 ± 0.58) ↑***
3	30 Days	10	87.64–92.89 (90.07 ± 0.48)	119.44 – 126.81 (123.62 ± 0.62) ↑***
4	45 Days	10	87.64–92.89 (90.07 ± 0.48)	127.63 – 132.44 (130.09 ± 0.48) ↑***
5	60 Days	10	87.64–92.89 (90.07 ± 0.48)	133.01 – 139.45 (135.45 ± 0.66) ↑***

S.Em. = Standard Error of Mean
↑ Increase ** Significant *** Highly Significant

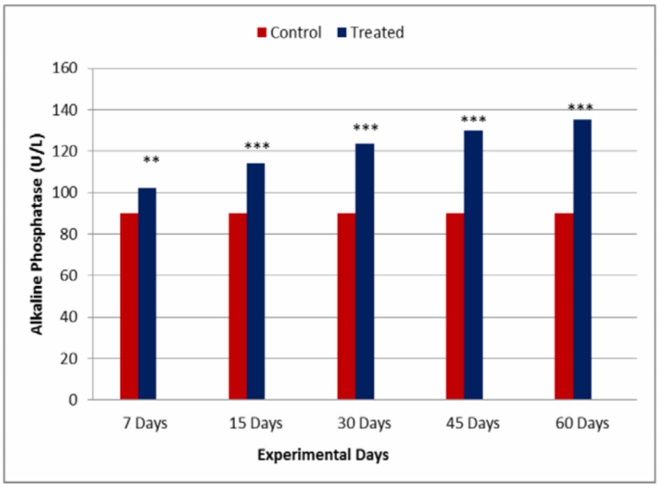

Fig. 1 : Effect of Bifenthrin on Alkaline Phosphatase (U/L) in *Channa punctaus* (Bloch) after 7, 15, 30, 45 and 60 days Exposure

Table II : Effect of Bifenthrin on Alanine Aminotransferase (U/L) in *Channa punctaus* (Bloch) after 7, 15, 30, 45 and 60 days Exposure

S. No.	No. of Days	No. of Rats	Range Mean ± S.Em.	
			Control	Treated
1	7 Days	10	21.84–33.81 (27.04 ± 1.15)	38.78 – 43.11 (40.67 ± 0.48) ↑**
2	15 Days	10	21.84–33.81 (27.04 ± 1.15)	42.59 – 47.51 (44.66 ± 0.47) ↑***
3	30 Days	10	21.84–33.81 (27.04 ± 1.15)	47.24 – 52.05 (49.68 ± 0.51) ↑***
4	45 Days	10	21.84–33.81 (27.04 ± 1.15)	50.29 – 54.93 (52.80 ± 0.45) ↑***
5	60 Days	10	21.84–33.81 (27.04 ± 1.15)	53.44 – 56.49 (54.86 ± 0.31) ↑***

S.Em. = Standard Error of Mean
↑ Increase ** Significant *** Highly Significant

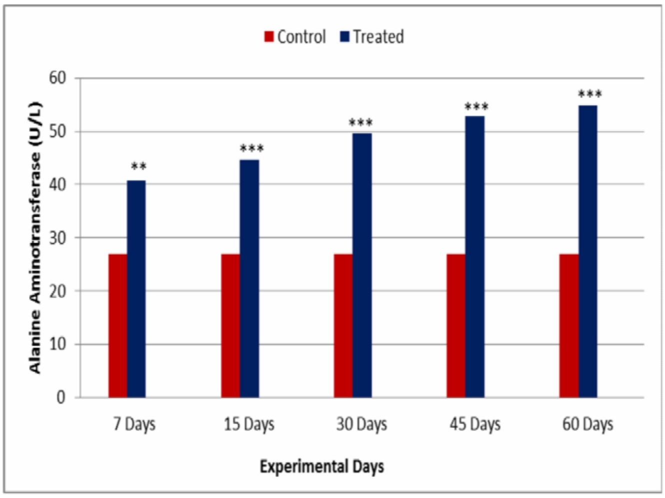

Fig. 2 : Effect of Bifenthrin on Alanine Aminotransferase (U/L) in *Channa punctaus* (Bloch) after 7, 15, 30, 45 and 60 days Exposure

Table III : Effect of Bifenthrin on Aspartate Aminotransferase (U/L) in *Channa punctaus* (Bloch) after 7, 15, 30, 45 and 60 days Exposure

S. No.	No. of Days	No. of Rats	Range Mean ± S.Em.	
			Control	Treated
1	7 Days	10	22.41 - 26.56 (24.61 ± 0.46)	35.87 – 39.81 (37.97 ± 0.43) ↑**
2	15 Days	10	22.41 - 26.56 (24.61 ± 0.46)	39.53 – 47.02 (43.93 ± 0.79) ↑***
3	30 Days	10	22.41 - 26.56 (24.61 ± 0.46)	48.63 – 52.33 (50.68 ± 0.40) ↑***
4	45 Days	10	22.41 - 26.56 (24.61 ± 0.46)	52.69 – 58.29 (54.49 ± 0.56) ↑***
5	60 Days	10	22.41 - 26.56 (24.61 ± 0.46)	55.51 – 61.02 (58.27 ± 0.54) ↑***

S.Em. = Standard Error of Mean
↑ Increase ** Significant *** Highly Significant

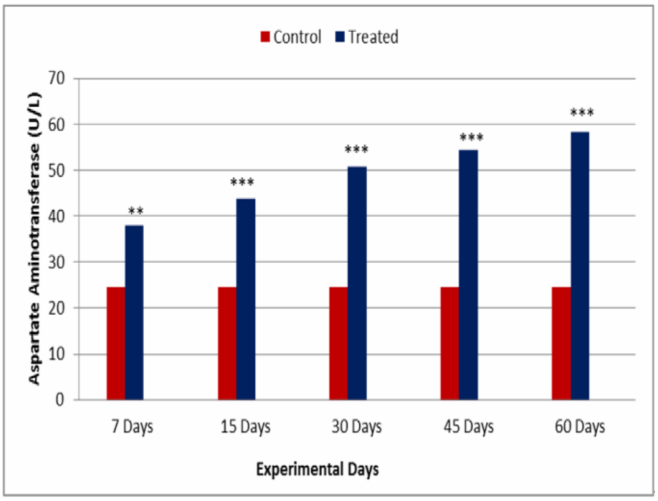

Fig. 3 : Effect of Bifenthrin on Aspartate Aminotransferase (U/L) in *Channa punctaus* (Bloch) after 7, 15, 30, 45 and 60 days Exposure

Discussion

The liver, the body's largest gland, is crucial to metabolism, bile production, blood purification, yolk synthesis, detoxification, glycogenolysis, gluconeogenesis, deamination, and urea formation, among other processes. Any damage to the liver will impede all of these processes. Alkaline phosphatase (ALP), Alanine Aminotransferase (ALT), and Aspartate Aminotransferase (AST) levels in the liver have increased significantly in the current investigation; these enzymes are frequently linked to liver dysfunction or injury. An important part of the metabolism of non-essential amino acids is played by aminotransferases (ALT & AST). The cytosolic enzyme ALT, which is found in hepatocytes, is involved in intracellular metabolism. According to Nafiu *et al*. (2020), AST is primarily found in the liver, skeletal muscles, RBCs, and is associated with mitochondrial damage. ALP is an enzyme that is membrane-bound and may operate as both a hydrolase and a transphosphorylase. It is present on all cell membranes, where active transport takes place. The liver, biliary tract epithelium, bone, and intestinal mucosa all contain high levels of ALP. Through hepatic cell proliferation, serum ALP activity rises in cases of bile duct obstruction and hepatic cell injury (Ahmad *et al*., 2011). It is mostly found in the liver and is essential for the metabolism and production of macromolecules.

Consistent with the current findings At experimental times, diazinon-treated groups had significantly greater aspartate aminotransferase and alanine aminotransferase activity and glucose levels compared to the control group, as reported by Banaee *et al*., 2011. Further evidence that phyruvalate creation contributes more than oxaloacetate formation comes from the observation that SGPT activity was considerably higher than SGOT by Ghanim *et al*., 2020. After four weeks of exposure to fenvalerate, Zebra fish showed altered acid phosphatase and alkaline phosphatase activity in the liver and gills. Furthermore, the results presented here are supported by Bálint *et al*., 1995. The AChE activity of the blood serum decreased by 20% after 3 days of in vivo deltamethrin therapy, whereas the GOT and LDH activities increased by 2.5-fold (72-h sample) and 1.5-fold (6-h sample), respectively, in comparison with the control carp. Six-hour blood samples showed 30% higher glucose levels compared to controls. The measurements showed that the fish were fully recovered after only 24-48 hours in clean water.

Glycogen metabolism also involves alkaline phosphatase in the liver. Glycogen production is stimulated while phosphorylase enzymes are inhibited by this enzyme. Under stress, the liver's alkaline phosphatase activity decreases to satisfy the body's increased energy needs, or the rate of transphosphorylation slows down, or the body's oxidative phosphorylation becomes uncoupled. Alkaline phosphatase activity in the liver of H. fossilis was shown to be diminished following exposure to 0.3-0.5 g L1 cypermethrin, as reported by Saha and Kaviraj (2009). Brain tissue from cypermethrin-exposed Labeo rohita showed decreased alkaline phosphatase activity, as was similarly documented by Das and Mukherjee (2003). However, it has been shown that fish exposed to cypermethrin show an increase in alkaline phosphatase activity (Frat *et al*., 2011; Loteste *et al*., 2013). In addition, Channa punctatus treated to cypermethrin and -cyhalothrin showed increased activities of lactate dehydrogenase (LDH), acid and alkaline phosphatases (Kumar *et al*., 2012). An elevation of alkaline phosphatase in the blood has been linked to liver necrosis and the subsequent release of the enzyme into the bloodstream (El-Sayed *et al*., 2008).

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