Effect Of different Concentrations Of Pesticide Colti 5 (Lambda-Cyhalothrin) On Water Flea Daphnia pulex

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Abstract

This search aimed to study the toxicity effects of Colti 5 pesticide on water flea Daphnia pulex age 24 h by determined lethal concentration that killed half number of treated Daphnia (LC50) after 48 h from exposure, after using serial concentrations between (0.01-0.07) mg/l, and try to appear the effects of pesticide on formation of reproductive characteristics of Daphnia after 21 days from exposure to concentrations between (0.01-0.03) mg/l. The results showed that the LC50 was (0.032) mg/l, and the pesticide was decreased from produce individuals with increasing concentration. Also the results showed there was a significant correlation coefficient between the concentrations and percentage of mortalities and between the concentrations and number of individuals that not produce sac of eggs.

Keywords: insecticides, LC50, water flea.

Introduction

Pesticides are used widely around the world to treatment the agriculture and keep the crops safe from insects, also to control the diseases by controlling the vectors such as malaria that transferred by Anopheles sp. (Vatandoost et al., 2005). Both pyrethroids and organophosphorus are mostly used as pesticide than organochlorines such as DDT, because of it have less stability in environment and can metabolism in human body (Heudorf et al., 2003). These pesticides can be found in aquatic environment after use it on the land near from water or from air after deposition.

Pesticides have ability to stay in environment for enough time to effect on aquatic ecosystems, specially aquatic organisms that not target in struggled process like crustaceans (McLoughlin et al, 2009; Davies et al, 2009), for that it have many attention to study their act through the environments. It effects maybe showed as decreasing in fishes specially that feeding on crustaceans, or it appears directly as killing the fish immediately when it found in environment. This maybe reflected on human health which is act as main consumer for fish because the Laboratory studies indicate that numerous of pesticides have potential ability to accumulate in many types of fish (WHO, 1990).

There are many studies that details with effects of pesticides on life form, such as the study of Lawler et al. (2007) that deal with three kinds of Culex mosquitoes replication in rice fields. Which is appeared resistance phases and recommended to use lambda-cyhalothrin pesticide instead of natural predators in biostruggle. While other study detail with Sublethal responses of the fish Oncorhynchus mykiss, Galaxias maculatus, Pseudaphrithis urvillii, and the crustacean Paratyia australiensis to short-term exposures for low concentrations of seven pesticides under known conditions. Which the results indicated that Four from seven maximum acceptable toxicant concentrations (MATCs) appeared physiological responses in
fish. While in case of organophosphates insecticides, the decapod crustaceans Paratya australiensis and Astacopsis gouldi were far away from sensitivity (Davies et al., 2009).

Colti 5 pesticide is the trade name of a substance composed of chemical material called Lambda-cyhalothrin, belongs to the group of pyrethroids (He et al., 2008). Pyrethroids are manmade chemicals that are similar to the natural cyhalothrin insecticides (WHO, 1990). This pesticide is an insecticide that used to struggle different insects like (Aphid, Worm fruits and leaves, Aldobas, Whitefly, Lepidoptera larvae, Coleoptera larvae and adults) which are caused damage for some economic crops such as (Citrus, Palms, Cereals, Vegetables, Cotton, and other crops)(Weston et al., 2005; Oros and Werner, 2005). It can be used in management to control pests or in public health applications to control insects such as Cockroaches, Mosquitoes, Ticks and Flies which may act as disease vectors (WHO, 1990; Weston et al., 2005; He et al., 2008). Also it is a pesticide that kills insect from egg phase (Lawler et al., 2007).

Water flea D. pulex was used in many studies as bioindicator to evaluate the toxicity of some pollutants in aquatic environment (Badea et al., 2010; Wagner and Frost, 2012) because of their higher sensitivity toward contaminants that could be found in lower concentrations, also it is a base of some aquatic food webs in the freshwater environment (Cauemette et al., 2012), for that this study aimed to study the toxicity effects of low concentration of Colti 5 pesticide on water flea D. pulex, specially that can be inter to aquatic environment after used it or maybe aquatic environment is a final fate of it.

Materials and Methods
Culture of D. pulex
Water fleas were culturing and incubating in glass bowl has dimension (25 x 30 x 36) cm and feeding on mixture from algae and alfalfa plant. The environment of incubator was known in temperature (20±2) and pH (7.1-7.8). This organisms collected from river by using algae to attract it after several days from attempt in water of the Euphrates river. D. pulex were breded and abounded in laboratory environment to have the largest number of natural members that can be exposure to different concentrations from pesticide.

This study was conducted from 1-3-2010 to 1-5-2010, which is used young Daphnia that have age less 24 h in toxicity treatments because of their sensitivity. Daphnia then watched after 48 h from exposure for 21 days, and the stability of Daphnia in the bottom of glass was taken as a signal of complete mortality (Barros et al., 2007).

Calculate the LC50
To study the toxicity of pesticide, the LC50 was found after using series of concentrations between (0.01-0.07) mg/l in addition to control sample. The individual of D. pulex put in container 250 ml fill with water and pesticide as 30 individual with three replicates for each concentration. The young D. pulex (age less than 24 h) were taken for 21 days of acute exposure to study the effect of pesticide on Daphnia reproduction, which is composed of 10% of animals age (Wells, 1999). To calculate lethal concentration for median lethal concentration (LC50), the equation of straight line [Y= bx + a (a= intercept, b= slope)] has been used (Kitvatanachai et al., 2005) after the data corrected with Abbott equation (Abbott, 1925).

Experimental design and statistical analysis
A completely randomized design (CRD) was used. Data were analyzed statistically by using less significant differences (LSD) at 0.05 after subjection to the analysis of variance
Results and Discussion

The results appeared a significant differences and a significant correlation factor between concentration of pesticides and percentage of mortalities (Table 1). Which is mean the Colti 5 pesticides have effect on life of D. pulex when it found in water in low concentrations, this mean according to U.S. Environmental Protection Agency, the presence of the pesticide was important to cause the mortality of Daphnia (EPA, 2000). Also the results showed that toxicity of Colti 5 pesticide was increases to water flea with increasing the concentration of pesticide in aquatic environment.

Results indicated to LC50 was 0.032 mg/l (Figure 1), which could be refer to the Colti 5 pesticide has higher toxicity on the individuals of Daphnia in low concentrations, or in another meaning it has high toxicity to aquatic organisms when it reach to the source of water, and these toxicity increases with increasing concentration (Table 1). This could be pointed to the high efficiency rate of pesticide in spite of it didn’t stay stable (He et al., 2008) in environment for long time. Because these crustaceans have ability to absorb the pesticides much more than the target that could have developed some sort of resistance (Hoang et al., 2011), so the Colti 5 pesticide can occur other negative effects on other life forms in water even when present in lower concentrations.

The view also showed survival Daphnia were have less movement and unable to feed with Transparent yellow color that indicated to think this pesticide tend to accumulate in large quantity inside Daphnia body. This amount maybe larger than Daphnia could disposal or metabolite and because of that some individuals dead. There are some studies indicted that pesticides have potential ability to accumulate in tiny concentrations inside organisms (WHO, 1990), while other study indicated that pesticide has high potential to bioconcentrate in fish and shellfish, macrophytes and invertebrates (He et al, 2008). This accumulation can contribute in increasing of oxidative stress (Stephens, 2005) in sensitive Daphnia organs which usually cause death. Which is lead to believe in spite of short life time of Colti 5 in environment (He et al, 2008), it can makes many problems to some aquatic life as change the phenotype (Lawler et al., 2007; Tilden et al., 2011) or insert change (Caumette et al., 2012) in food chain.

Table (2) showed survival Daphnia after period of exposure to Colti 5 that can’t formation sac of eggs. which is may be due to direct the energy and metabolism toward survival instead of reproduction (Biesinger and Christensen, 2011; Winner and Farrell, 2011), or the pesticide work on destroyed the eggs (Lawler et al., 2007). Also the results appeared a significant correlation factor (Figure 2) between the concentrations and average of individuals that couldn’t formation sacs, which means the elevation of concentration decreases in ability of water flea to produce sac of eggs, which lead to decrease in number of individuals production. In another case, the view pointed to the smallest size of treated Daphnia than control, this could be return to trying Daphnia to adapt with amount of pesticide, or the pesticide prevent Daphnia from able to feed (Leal et al., 1997).

Conclusions

1- The Colti 5 pesticide had toxicity on life form even when it found in lower concentrations and can prevent Daphnia reproduction.

2- The pesticide can be more dangerous in concentration higher than that in this study and more effective in aquatic environment.
Table (1) Represents the percentage of mortality that produce from exposure the water flea *D. pulex* to different concentrations from pesticide.

<table>
<thead>
<tr>
<th>Concentration of pesticide mg/l</th>
<th>The percentages of Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>17.5</td>
</tr>
<tr>
<td>0.02</td>
<td>27.3</td>
</tr>
<tr>
<td>0.03</td>
<td>45.5</td>
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<tr>
<td>0.04</td>
<td>74.8</td>
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<tr>
<td>0.05</td>
<td>82.56</td>
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<tr>
<td>0.06</td>
<td>95.4</td>
</tr>
<tr>
<td>0.07</td>
<td>98.73</td>
</tr>
</tbody>
</table>

LSD= 1.627,  r = 0.0327

Figure (1) The value of half lethal concentration (LC₅₀) mg/l of pesticide for individual of *D. pulex*.

Table (2) Average of *D. pulex* individuals that not carried eggs sac when it exposure to different concentrations from pesticide.

<table>
<thead>
<tr>
<th>Concentration of pesticide mg/l</th>
<th>Average of individuals number that not carried sac of eggs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.01</td>
<td>11</td>
</tr>
<tr>
<td>0.02</td>
<td>15</td>
</tr>
<tr>
<td>0.03</td>
<td>26</td>
</tr>
</tbody>
</table>

r=0.189
Figure (2) Average of *D. pulex* individuals that not carried eggs sac when it exposure to different concentrations of pesticide.

References


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