LARVICIDAL ACTIVITY OF A MEDICINAL PLANT ECBALLIUM ELATERIUM AGAINST CULEX PIPIENS LARVAE

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Abstract - In Algeria, Culex pipiens (Diptera: Culicidae) is the species of mosquito which has the most of interest because of its broad geographical distribution, its abundance and its harmful effect, especially in the urban areas. Plants seem to be alternative sources, instead of conventional pesticides, because they are safe and have low toxicity to non target animals. The purpose of the present study is to evaluate the larvicidal activity of a medicinal plant, Ecballium elaterium, against Culex pipiens mosquito, under laboratory conditions. The toxicological assays were carried out using the plant infusion, with different concentrations (15, 30, 60 and 100g/l), on the fourth instar larvae of Culex pipiens, for 24 hours as recommended by World Health Organization (WHO), to determine the two lethal concentration LC50 and LC90 which are 25.53 and 156.8 g/l respectively. The obtained results showed a highly significant effect of this plant with all tested concentrations, with concentrtion response relation-ship mortality, for the treated larval stage.

Keywords - Culex pipiens, Ecballium elaterium, pesticides, medicinal plant.

I. INTRODUCTION

Mosquitos, are hematophagous insects, present a major concern in terms of economic development and public health. In addition to their harmful effects, they are vectors of several disease-causing agents such as the protozoa (paludism), the viruses (yellow fever, dengue and West Nile) and the nematodes (filariose) which they transmit to humans and the pets [1, 2]. Insects are generally controlled by neurotoxic insecticides, which had undesirable effects on the environment, non-target organisms and human health. The chemical control continues to be the major method of control of vectors [3]. However, more than their neurotoxicity, the chemicals used became less effective because of resistance developed by certain species of mosquitos and insects in general [4, 5]. All these reasons pushed the researchers to propose other alternatives more selective which do not present any toxic effects. The appearance of the biological control, more selective, biodegradable, It is presented by the use of natural ennemies (fish like Gambusia affinis, microbiological insecticides represented mainly by Bacillus thuringiensis, botanical biopesticides such as saponin, Azadirachtin and medicinal plants [6, 7, 8, 9, 10]. The aim of the present study was to evaluate the larvicidal activity of a medicinal plant Ecballium elaterium against mosquito larvae of Culex pipiens.

II. MATERIALS AND METHODS

2.1 Mosquito rearing

The larvae of Culex pipiens were obtained from a laboratory mass colony. The larvae were reared in storage glass jars containing 500 ml of stored tap water and maintained at temperature between 25–27 °C and a photoperiod of 14L:10D. They were fed daily with a mixture of biscuit and dried yeast (75:25 by weight), and the rearing water was changed every four days, adults were fed with 10% sugar solution and supplied with blood, using small animals, for the egg maturation [11].

2.2 Plant material

Ecballium is genus of flowering plants (with yellow flowers and green fruits), in the family of Cucurbitacea containing a single species, Ecballium elaterium, also called the squirting cucumber. It is native to Europe, northern africa and temperate areas of Asia. This plant, and especially its fruit, is poisonous, containing cucurbitacins[12] and all parts of the plant can be fatal if ingested. Squirting cucumber has been used as a medicinal plant; the juice of the fruit is antirheumatic and used for liver cirrhosis [13]. It was collected during the winter period from Skikda (North-East of Algeria). The areal parts of the plant were washed with distilled water, shade-dried and ground. The finely ground plant powder was extracted with infusion using hot water, the extraction was continued till visibly no further extraction is possible.



Figure 1: Ecballium elaterium.

2.3 Toxicity bioassay

The larvicidal efficacy of Ecballium elaterium was determined against Culex pipiens. The toxicological essays were carried out with four concentrations equivalent to 15, 30, 60 and 100 g/l of the medicinal plant Ecballium elaterium against newly exuviated fourth instar larvae (L4) of Culex pipiens, under the laboratory conditions.

The bioassays and the control series were realized with three repetitions of 25 larvae for each used concentration, prepared in a separate jar containing 500 ml of breeding water. After an exposure time of 24 hours of the larvae, according to the world health organization recommendations [14], to the extract, the water is changed and the food is added every three days until the emergence of the adults. The mortality of the control and treated series is recorded daily and followed during the other developing stages until the emergence of adults.

2.4 Statistical analysis

The mortality percentage was subjected to correction using the Abott formula [15] when the mortality was observed in the control series. After the toxicity data were subjected to probit analysis [16], to determine the lethal concentrations (LC50 and LC90) of the treated larvae of the tested species, with confidence limits (95%) of supper confidence limit (UCL) and lower confidence limit (LCL) values, slope, and regression equation of the concentration-mortality lines were calculated [17].

III. RESULTS

The toxicological study is related to the treatment of the newly ecdysed fourth instar larvae of Culex pipiens using various concentrations (15, 30,60 and 100 g /l) of Ecballium elaterium.

The results obtained, following the treatment, are presented by the average (m ± SE) of mortality expressed as a percentage. According to table 1, the obtained results showed a highly significant effect of this plant with all tested concentrations, with dose response relation-ship mortality (p=0.000).

Table 1: The observed mortality (%) of different mosquito larval stages of Culex pipiens exposed to different concentrations of the plant extract Ecballium elaterium. SD= Standard deviation. Values are mean±SD of 3 replicates.

C R	C	15 g / l	30 g / l	60 g / l	100 g / l
R1	8	40	56	60	100
R2	4	48	52	68	88
R3	4	40	60	60	80
m ± SE	5,33 ± 2,3	40,66 ± 1,15	56,0 ± 4,0	62,66 ± 4,61	89,33 ± 10,06

Because of the mortality observed in the control series with highest result of 5.33%, it was corrected in the treated ones and is presented in table 2.

Table 2: The corrected mortality (%), using the Abott formulation, of different mosquito larval stages of Culex pipiens exposed to different concentrations of the plant extract Ecballium elaterium. SD= Standard deviation. Values are mean±SD of 3 replicates.

C R	15 g / l	30 g / l	60 g / l	100 g / l
R1	34.78	52.17	56.52	100
R2	45.83	50.0	66.66	87.5
R3	37.5	58.33	58.33	79.16
m ± SE	39.37 ± 5.75	53.5 ± 4.32	60.50 ± 5.40	88.88 ± 10.48

The equation and the regression line were determined, after the transformation of the corrected mortality to probit and the tested concentrations in decimal logarithms.

The coefficient of determination (R^2 = 0.8508) reveals an equally positive relation between the probit and the decimal logarithms of the tested concentrations (Figure 2).

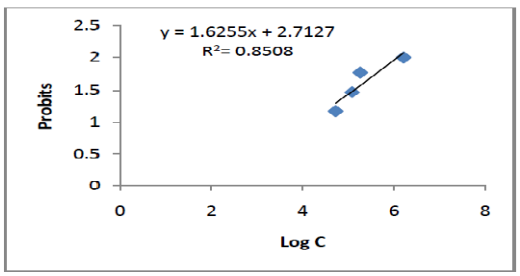


Figure 2: The equation of regression of probits (Mortality %) according to the decimal logarithms (log.x) of concentrations for the fourth larval stages (L4) of Culex pipiens.

For the concentrations tested, the highest larvicidal activity was observed with the highest one 100 g/l of Ecballium elaterium extract against Culex pipiens larvae with the LC50 and LC90 values of 25.53 and 156.8 g/l respectively (Table 3). The lethal concentrations (LC50 and LC90) were estimated at the 95% confidence limits LC50 (LCL=Lower CL-UCL=Upper CL) and LC90 (LCL-UCL) estimated from the linear regression (Figure 2). The LC50 and LC90 with their confidence limits, the regression equation and the slope values were also calculated and presented in table 3.

Table 3: Toxicity of of Ecballium elaterium extract against Culex pipiens fourth instar larvae (LC50, LC90, LCL, UCL g/l).

Linear regression	y = 1.6255x + 2.7127
Slope	4.09
LC50 g/l-confidence limit 95%	25.53 [19.34-33.69]
LC90 g/l-confidence limit 95%	156.8 [118.78-206.97]

IV. DISCUSSION

Medicinal plants, also called medicinal herbs, have been discovered and used in traditional medicine practices since prehistoric times. They synthesise hundreds of chemical compounds for functions including defense against insects, fungi, diseases and herbivorous mammals.

In the present work, the larvicidal effect of a local medicinal plant Ecballium elaterium was evaluated against the fourth larval stage of the most abundant mosquito species Culex pipiens in Algeria. The treatment with this plant extracts at different concentrations (15, 30, 60 and 100 g/l) show a toxic effect expressed by a high mortality compared to the controls. The lethal concentrations LC50 and LC90 were also determined which are 25.53 and 156.8 g/l respectively.

The medicinal plants are strongly used as alternatives for the conventional pesticides. Their extracts showed a toxic effect against different insects like mosquitos [9, 18, 19, 20, 21] because of their active constituants. Ecballium elaterium, and especially its fruit, is poisonous, containing cucurbitacins which are responsible of its larvivdal activity [12].

CONCLUSION

According to the obtained results of the plant, Ecballium elaterium which shows a high larvicidal activity on Culex pipiens larvae, it can be recommended to be used as an alternative for mosquito control with other medicinat plants cited in the study.

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