Research Article

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BIOACTIVITY OF *NICOTIANA GLAUCA* GRAHAM (SOLANACEAE) AND ITS TOXIC EFFECTS ON *CULISETA LONGIAREOLATA* (DIPTERA; CULICIDAE)

Benhissen Saliha [1]*, Rebbas Khellaf [1], Habbachi Wafa [2] and Masna Fatiha [3]

[1]Department of Natural and Life Sciences, Faculty of Sciences, Mohamed Boudiaf University, M'Sila 28000, Algeria

[2]Laboratory for the eco-biology of marine and coastalines environments, Biology department, Faculty of Sciences, Badji Mokhtar University, Bp ,12Annaba 23000, Algeria

[3]Laboratory of Desertification and Climate, Amar Telidji University, 03000, Laghouat, Algeria

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***Corresponding author**
E-mail: s.benhissen@yahoo.com

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ABSTRACT

Nicotiana glauca (*N. glauca*) (Solanaceae) is an ornamental plant. It has insecticidal properties. However, these uses cannot compensate for the overall negative impacts of this plant. This study was aimed to evaluate the larvicidal effect of the aqueous extract of *N. glauca* leaves on the 4th stage larva of *Culiseta longiareolata* (*Cs. longireolata*). *N. glauca* leaves were harvested, dried and powdered using an electric mill. Hot aqueous extraction was done with 150 g powdered leaf in 1000 mldistilled water. The dry extract was partitioned in various beakerswith 20 larvae, and the three concentrations 14.85 g / l, 25.66 g / l and 62.4 g / l were determined. The preliminary results showed that used extract has a high efficiency compared to natural substances of plant or microbial origin. This efficiency is expressed by the calculated toxicological parameters which are successively LC50 and LC90, with 26.87 and 55.14g/l, As for lethal times 0.46 and 1 days respectively. *N. glauca* can be considered among the plants with important insecticidal effects in biological control against mosquitoes. Preliminary toxicity tests on *Cs. longireolata* have confirmed its toxicity for these vectors.

Keywords: aqueous extract, plant, mosquito, toxicological parameters.

INTRODUCTION

Today, pesticide need and the pesticide industry are changing[1]. There is a growing requirement to produce more toxicologically and environmentally benign pesticides, and natural products often fill this need[1]. There is a strong desire to use "greener" chemistry in pest management, especially in urban settings and in the production of edible horticultural crops[1].

Current researches try to find other natural available products, which is less toxic for this struggle. It turns to focus more on natural compounds from plants to develop new molecules bioinsecticides. In Morocco, the use of plants against invasion of mosquitoes is a very common practice[2]. In Algeria, the studies on the insecticidal activity of plant extracts against the mosquito larva are very limited [3,4]
Aqueous tobacco (*Nicotianatabacum*, *N. glauca* or *N. rustica*) extracts containing the alkaloid nicotine have long been used to control crop insect pathogens[5,6]. Nicotine is well known to exert its insecticidal effect by interacting with nicotinic acetylcholine receptors[7]. The insecticide usually is marketed as a liquid concentrate of nicotine sulfate[1].

Within its range *N. glauca* is an occasional plant of dry, naturally and anthropogenically disturbed areas such as river banks, track sides and abandoned quarries. It is found mainly in semi-arid environments from low to high altitudes (0-3500 m), but never at wet localities[8].

In this study, we are interested in the direct effects of this plant on the most abundant species of Culicidae in Algeria: *Cs. longiareolata*. The study aims to investigate the effects of the insecticide on mortality of *Cs.longiareolata*.

MATERIALS AND METHODS

Insects

The mosquito *Cs. longiareolata* Macquart (Diptera: Culicidae) is common and abundant in temporary pools in the Middle East and Africa. Oviposition is nocturnal and involves, with rare exceptions, the deposition of all of a female's eggs in a single egg raft[9].Its development cycle last 10 to 14 days and includes four stages: egg, larva, pupa and adult. Pre-imaginal stages (egg, larva and pupa) are adapted to the aquatic lifestyle while the imaginal stage (imago) is aerial[10].

Mosquito Rearing

The larva used in this study provokes a mass livestock of adults collected in urban areas of M'sila, East Algerian city. Livestock is kept in laboratory cages (20 x 20 x 20 cm) at a temperature of 25 ± 2 °C, humidity of 75 ± 10% and a 12-hour scotophase. A mixture of biscuit and dried yeast insures the nutrition of larvae while the adults feed on dried raisins.

Plant material

Were collected this plant in the South area of M'Sila (Algeria). This plant grows in semi-dry rangeland. The plant was authenticated by the botanist Dr. Errol Véla of Montpellier university. The voucher specimen(SB/KR, 001) is maintained in the botanical laboratory of the department (Figure 1).

N .glauca has been used as an insecticide, but its use is empty due to the development of more specific and less poisonous insecticides[11].

Extraction

The extracts from fresh leaves of the plantwere carried out by decoction in distilled water for 1 hour and 30 minutes. After preliminary tests, the concentrations used are 14,85g/l, 25,66 g/l and 62,4 g/l.

Treatment

Treatment of *Cs. longiareolata* was inspired by the technique of standardized sensitivity tests of the World Health Organization. The tests are carried out in beakers with a capacity of 500 ml each containing 20 fourth-stage larvae of *Cs. longiareolata* (L4) in 200 ml of spring water, with one of these concentrations 14,85 g/l/, 25,66 g/l or62,4 g/l of the extract. Each concentration is applied to 3 repetitions, with a preparation of 20 larvae of *Cs. longiareolata*a control.

The variable measured daily, is the number of dead individuals (L4 larvae, nymphs and adults).

Figure 1: *Nicotiana glauca* Graham (Plant, Flowers, leaves; photos: K. Rebbas, 29.4.2016)

Statistic analysis

Lethal concentrations and lethal times (LC50% LC90%, LT50% and LT 90%) were calculated using the Finney's (1971)[12] mathematical method. Data are normalized and processed according to the tables of Bliss and calculations were performed on XLStat 2009.

RESULTS AND DISCUSSION

The effect of *N. glauca* on the mortality of *Cs. Longiareolata*

The fourth-stage larvae of *N. glauca*are are sensitive to *Cs. longiareolata*. This sensitivity is reflected by higher or lower mortality rates depending on the concentrations used, and especially according to the time of exposure to the extract (Table1). The mortality rate ranges between 15.0%and 45 % for the lowest concentration (14.85 g/l) while it reaches 93.3 % when the larvae are exposed to the highest concentration (62.4 g/l). The 4th stage larvae of *C. longiareolata* exposed during one, two and three days to the treatment have mortality rates correlated with the doses used. Mortality rates were not significantly different. On the contrary, the mean mortality of individuals after three days of treatment is significantly different.

Table 1: Mortality rate (%) of *Cs. longiareolata* individuals treated with different concentrations of *N. glauca*at different exposure times

Days / Concentration	1	2	3	F obs	*P*
62.4 g/l	93.3	98.3	100	3.55	0.09
25.66 g/l	43.3	53.3	73.3	0.31	0.74
14.85 g/l	15.0	25.0	45	0.57	0.59
Fobs	1.740	2.970	6.090		
P	0.250	0.120	0.03*		

The comparison of variances is done at the significance level α = 0.05 and mortality rates are corrected by the Abbott formula

Toxicological parameters of *N. glauca*

The results also show that there is a strong positive correlation between recorded mortality rates and the exposure time and/or the concentration of the extract used against mosquitoes (Table2).

To ensure a 50% mortality of the insects after 1 day, the concentration of *N. glauca* must be equal to 26.87 g/l, on the contrary, 55.14 g/lof *N. glauca* insures the mortality of 90% (Table 2A). When it is the second day, the calculations show that the LC50 is 21.98g/l %, while the LC90% is of 41.77g/l. After the 3rd day of treatment, the LC50 and LC90% did not exceed 17.13g/l and 27.16g/l.

On the lethal times, the concentration 14.85g/l *N. glauca* can eliminate 50% of the population of *Cs. longiareolata* in the 8.55

day and 90% during 103.9 days of treatment (Table2B). When 25.66 g/l of *N. glauca* extract is applied, LT50% is 1.39 days, while the LT90% is 9.03 days. On the highest concentration (62.4 g/l), the calculated lethal times (LT50% and LT90%) are less important since they do not exceed 0.46 days and1 day respectively.

Table 2: Toxicological parameters of *N. glauca* aqueous extract in individuals treated with *Cs. longiareolata*(A: Exposed Time; B: used concentration)

A			
Time (days)	**1**	**2**	**3**
Regression line	y= -0.86+4.1 x R^2= 0,99	y= -1.16+4.59x R^2= 0,98	y= -2.86+6.37x R^2= 0,96
LC50% (g/l)	26.87	21.98	17.13
LC90% (g/l)	55.14	41.77	27.16
B			
Concentration (g/l)	**14.85**	**25.66**	**62.4**
Regression line	y= 3.90+1.18 x R^2= 0.92	y= 4.77+1.58 x R^2= 0.87	y= 6.29+3.84 x R^2= 0.54
LT50% (D)	8.55	1.39	0.46
LT90% (D)	103.9	9.03	1

Natural toxins are a source of new chemical classes of pesticides, as well as environmentally and toxicologically safer molecules than many of the currently used pesticides[1]. Several studies investigated the toxicity of products generated from plants against mosquito larvae. We include the works of Merabti et al. who showed larvicidal activity of *Citrullus colocynthis (*L.) (on the fourth stage larvae *Cs. longiareolata*[3]. On *Culexpipiens*, Habbachietal have successfully tested the larvicidal activity of aqueous extract of *Daphne gnidium* (*Thymelaeaceae*) and *Peganumharmala* (*Zygophyllaceae*)[4].

This work demonstrates the potency of *N. glauca* extract as an effective larvicide against *Cs. longiareolata* larvae; it was highly toxic to mosquito larvae. The high rates of larval mortality observed at 62.4 g/l within 24 hours with LC50 value 26.87 g/lindicate the high toxicity of the extract.

N. glauca their main alkaloid nicotine, is a very violent poison that acts on the nervous system. Also has toxic properties with respect to insects. Various biological activities have been reported for *N. glauca* as insecticidal[11], antiinflamatory[13], Phytopharmacy[14]. Our results confirm the findings of Maedotet al.when showed a toxic effect of *N. glauca* against hematophagous insects[15].

CONCLUSION

This study indicates that the aqueous extract of *N. glauca* has toxic properties and its use as a larvicide against mosquitoes should be explored. It is worthwhile to study extensively the larvicidal properties of this plant's and identifying the active components responsible for larval mortality, and then test them in field trials in order to assess their potential as an alternative to synthetic chemical larvicides.

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