J. Plant Prot. and Path., Mansoura Univ., Vol. 4 (5): 493 - 507, 2013

BIOLOGICAL ACTIVITY OF TWO CRUDE EXTRACTS FROM *Bauhinia purpurea* AGAINST *Spodoptera littoralis* (BOISD.)

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ABSTRACT

Effects of butanol and petroleum ether crude extracts of *Bauhinia purpurea* on *Sopdoptera littoralis* were studied by feeding method for the concentrations of 5, 10, 50 and 100 ppm. The results showed reduction in the pupae weight values of *S.littoralis*, these values were between 196.40 to 136.67 mg while it weighed 257-260.33 mg in the control. The inhibition of the adult formation percentages were ranged between 43.33 to 93.33 %. The fecundity, fertility and spermatophores numbers were studied and the mating possibilities were carried out for the adults resulted from the treated larvae with the previous tested concentrations of petroleum ether crude extract of *Bauhinia* and compared with the control. The numbers of eggs laid were reduced and ranged from zero to 285.13 eggs per female, while it was 1186.52 eggs per female in the control with hatchability percentages ranged from zero to 87.2%, while it was 97.6 % in the control. The histological studies illustrated heavily destruction of the reproductive structure of male and female when the both extracts of *Bauhinia* were applied. Also, The nutritional indices were calculated, the relative growth rate (RGR) values were reduced between 38.77 to 22.44 mg/day, while it recorded 58.4 - 84.45 mg/day in the control. The efficiency of conversion of digested food (ECD %) values were reduced between 60. 96 to 91.32, while it recorded 166.03 - 201 in the control. The feeding deterrence index (FDI) values at 100 ppm were 41.64 % with butanol and 42.38% with petroleum ether crude extract of *Bauhinia*. On the other hand, the effect of butanol crude extract of *Bauhinia* on chitin formation caused inhibition in the larval growth of the cotton leafworm. The chitin formation ratio value displayed 31.505 mg/gm for the control, while it was 18.723 mg/gm for the *Bauhinia* butanol extract at the concentration of 50 ppm.

Keywords: *Bauhinia* extracts, *Spodoptera littoralis*, nutritional indices, fecundity, fertility, spermatophores and chitin formation.

INTRODUCTION

Spodoptera littoralis (Boisduval) (Lepidoptera: Noctuidae) is a polyphagous caterpillar damaging plants of economic importance in Southern Europe, Africa and the Middle East (Abo-El-Ghar et al., 1986). During recent years, some plants have been receiving global attention and their secondary metabolites have been formulated as botanical pesticides for plant protection since they do not leave residues toxic to the environment, have lower toxicity to mammals and medicinal properties for humans (Duke, 1985 and El-Sabrout, 2009). Botanical insecticides offer a more natural, “environmentally friendly” approach to pest control than do synthetic insecticides. Screening of plant extracts for deleterious effects on insects is one of the approaches used in the search for novel botanical insecticides (Secoy and Smith, 1983; Arnason, et al., 1993 and Isman 1995).

Plants substances are known to cause reproductive sterility in insects. Some of these compounds inhibit ovarian growth, testes growth and development, while others appear to induce fundamental changes in the

chemical structure of nucleic acids (DNA and RNA). But it is clear that all chemosterilants are extremely hazardous compounds (El-Zoghby, 1975, 1980; El-Zoghby et al*.,* 1985, 1987; El-Zoghby, 1992-a;b and El-Sabrout, 2009).

MATERIALS AND METHODS

1-Insect rearing:

A susceptible strain of the cotton leafworm, *Spodoptera littoralis* (Boisd.) (Lepidoptera: Noctuidae), was reared under the laboratory conditions of 25 ± 3 ºC and 70 ± 5% R.H. on castor oil leaves, *Ricinus communis* L., (Family: Euphorbiaceae), according to El-Zoghby (1980). Egg-masses were confined in sterilized jars and tapped with muslin covers. Upon hatching, fresh and clean castor oil leaves were provided as food. Jars were daily cleaned out where fresh leaves were substituted for the used ones. Upon pupation, pupae were sexed prior to moth emergence. Adult moths were supplied by 10 % sugar solution in which a cotton wick was immersed for feeding. In addition, two leaves of *Nerium oleander* were provided as oviposition sites. Deposited egg-masses were daily collected and the hatched larvae were reared again for another generation.

2-Plants crude extracts:

Bauhinia purpurea, Fam. Leguminasae (Fabaceae) is an ornamental tree contains flavones (high percent), coumarin and kenon. Its flowers were extracted by petroleum ether and by butanol. The tested materials were provided by the Faculty of Pharmacy, University of Alexandria.

3-Feeding assay:

Feeding assay with the no-choice test technique was used against the newly moulted sixth instar larvae of cotton leafworm by preparing leaf disks of 5 cm in diameter from the leaves of fresh castor oil leaves.

The two crude extracts of *Bauhinia* were dissolved in ethanol. For each crude extract, four concentrations were used (5, 10, 50, 100 ppm) and control. Six replicates were carried out in each replicate 5 larvae were released in a plastic dish (9 cm in diameter) which contained treated discs. The larvae were allowed to feed for 72 h on treated discs which changed every 24 h and then fed on untreated discs. Moistened cotton pad was placed in each dish to sustain humidity. The control treatment was conducted with ethanol only. It means that 150 larvae were used for each tested crude extract and control. All larvae were then kept under room temperature. The no-choice test was performed according to the method of Morimoto et al., (2006)

4-Food consumption experiments:

The petroleum ether and butanol crude extracts of *Bauhinia* were investigated on food consumption and utilization by the newly molted sixth instar larvae of the cotton leafworm. Known weights of fresh castor oil discs (2.5 cm in diameter) treated with different concentrations (in ppm) of crude extracts and alcohol solvent (30 larvae for each concentration) were offered to the newly molted six instar larvae. All larvae, faeces and unconsumed food were weighed every 24 hours through 24, 48 and 72 hours feeding period. The nutritional indices were namely the relative growth rate (RGR) (Miller &

Miller, 1988), efficiency of conversion of digested food (ECD) according to Klein & Kogan, (1974). The nutritional indices were calculated according to the formulae of Farrar et al., (1989) as follow:

I = weight of the food consumed = consumed food ÷ No. of larvae.

ΔB = change in body weight = (final weight – initial weight) ÷ No. of larvae.

F = weight of the faeces produced during the feeding period ÷ No. of larvae.

RGR = relative growth rate = ΔB ÷ feeding period.

ECD = efficiency of conversion of digested food = ΔB ÷ (I –F) × 100.

To measure the activity of different crude extracts, we used feeding-deterrence index which suggested and calculated by **Isman et al., (1990)** as: (FDI) = The feeding-deterrence index = [(C – T) ÷ C] × 100. (C is the consumption of control disks, and T is the consumption of treated disks). The following criteria were adopted to categorize the tested plants:

FDI% < 20% No feeding deterrence

FDI% ≥ 20% - 50% > Weak feeding deterrence

FDI% ≥ 50% - 70% > Moderate feeding deterrence

FDI% ≥ 70% Strong feeding deterrence.

5-Criteria parameters for the tested materials:

a) Percentages of inhibition of the adult formation were calculated for both crude extracts of *Bauhinia*

b) The mating efficiency was also studied by implementation of the crosses between the survived adults as follows:

Treated female × Treated male (TF × TM); Treated female × Untreated male (TF × UTM); Untreated female × Treated male (UTF × TM); Untreated female × Untreated male (UTF× UTM)] and the average number of eggs laid per female as well as egg hatchability were recorded and calculated for the adults emerged from *S. littoralis* larvae fed on fresh disk of castor oil leaves treated by petroleum ether crude extracts of Bauhinia.

c) The pupal weights 24 h after pupation of *S. littoralis* larvae treated by both crude extracts of *Bauhinia* were recorded (Ramos-López et al., 2010) and (Schmidt et al., (1997).

6-Histology sections:

The testes and ovarioles of adults resulted from *S. littoralis* larvae fed on fresh disk of castor oil leaves treated by both the crude extracts of *Bauhinia* were dissected and kept in 10 % formalin after dissection. Histological procedures were achieved at the Pathology Department, Faculty of Medicine, University of Alexandria, according to the method of Khalil et al., (1977) and Junqueira & Carneiro (1980).

7-Measurement of chitin body wall:

This experiment was conducted on the newly molted sixth instar larvae of cotton leafworm. Larvae were fed for the interval of 72 hours on both control fresh discs and discs treated with 50 and 100 ppm of butanol crude extract of *Bauhinia*. The procedures followed were after Hughes et al., (1989). The ruptured larvae were weighed in the same age with the control larvae, anaesthetized by chilling, decapitated and dissected along the ventral surface. The gut, fat body and other internal tissues were removed. After rinsing under water, the body wall of each larva was placed in 3 ml of 10 %

(w/v) potassium hydroxide (KOH) at 100ºC for 4 hours, then allowed to stand overnight at room temperature. The remaining chitin from each larva was waited thoroughly with cold water. The trachea and spiracles were removed and the chitin extracts were oven-dried overnight at 80ºC. After equilibration to room temperature, the extracts were weighed individually. In this way, the ratio of chitin dry weight to the larval fresh weight could be determined for the individual larva, as follows:

$$\text{Ratio of chitin formation} = \frac{\text{Chitin dry weight}}{\text{Larval fresh weight}}$$

8-Statistical analysis:

Statistical analysis was fulfilled using (ANOVA) one-way F-test and calculated the LSD test statistically significant at $p \leq 0.05$ according to Snedecor & Cochran (1974).

RESULTS AND DISCUSSION

Many biological effects of Bauhinia extracts on *Spodoptera littoralis* were applied by feeding method:

1- Effect of adult formation:

Data of table (1) show the effects of the crude butanol extract and petroleum ether extract of *Bauhinia* on adult formation, when the sixth instar larvae of *S. littoralis* were treated with feeding method. It is clear that when the same range concentrations of 5, 10, 50, and 100 ppm were tested in both *Bauhinia* extracts, the statistical analysis of the obtained data emphasized that there were significant differences between the inhibition of adult formation percentages except at the high concentrations 50 and 100 ppm. When the results of butanol extract of *Bauhinia* were compared with those of petroleum ether extract of *Bauhinia* at the same concentration, it was found that the effects of butanol extract were stronger on inhibition of adult formation comparing with petroleum ether extract.

Table (1): Inhibition of the adult formation percentages when the *Bauhinia* extracts (Butanol and Petroleum ether extracts) were applied by feeding method on the sixth instar larvae of *S. littoralis*.

Concentrations (ppm)	Inhibition of adult formation% by	
	Butanol crude extract of *Bauhinia*	Petroleum ether crude extract of *Bauhinia*
Control (0)	0.00 ± 0.00^{b}	0.0 ± 0.00^{c}
5	56.67 ± 3.33^{c}	43.33 ± 8.82^{b}
10	76.67 ± 3.33^{b}	46.67 ± 12.02^{b}
50	83.33 ± 6.67^{ab}	50.00 ± 0.00^{ab}
100	93.33 ± 3.33^{a}	70.00 ± 5.77^{a}

F: F test f (ANOVA); Statistically significant at $p \leq 0.05$; Different super scripts are significant.

The daily observations of the development of the larvae treated with *Bauhinia* crude extracts (Butanol and Petroleum ether extracts) proved that there are many larval-pupal intermediates and some pupae were reduced in

size at higher concentration (100 ppm) when compared with control and other lower concentrations. Formation of larval-pupal intermediates were illustrated in figure (1 B). Abnormal adults were found as abnormalities of the wings and the mouth part in figure (2 B). These observations have been observed by Hopkins & Kramer (1992) and Root & Dauterman (1996), also, the results of Martinez & Van Emden (2001) who studied the effect of Azadirachtin on *S. littoralis* and confirmed the present results.

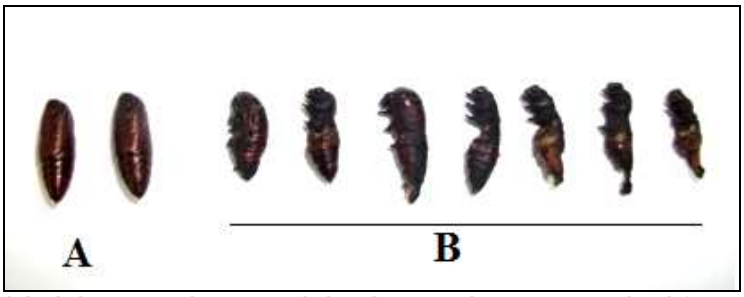

Figure (1): (A): Normal pupae; (B): Abnormal pupae resulted from the larvae fed on fresh discs of castor oil leaves treated by both crude extracts of *Bauhinia*.

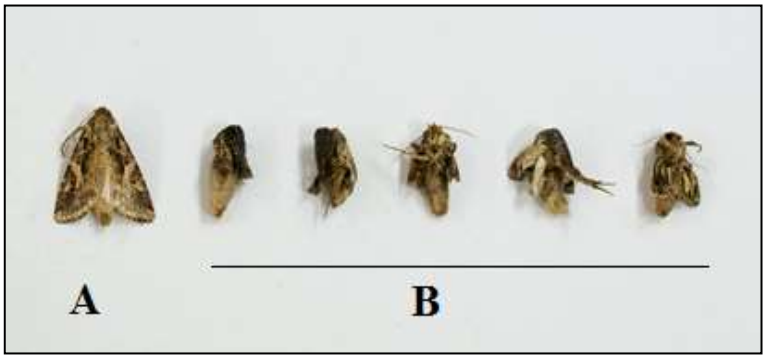

Figure (2): (A): Normal adult; (B): Abnormal adults emerged from larvae fed on fresh discs of castor oil leaves treated by both crude extracts of *Bauhinia*.

2- Effect of the butanol and petroleum ether extracts of Bauhinia on the nutritional indices :

The effects of the crude butanol extract and petroleum ether extract of *Bauhinia* on food consumption and growth of sixth instar larvae of cotton leafworm were studied. The concentrations of 5, 10, 50 and 100 ppm were tested for both crude extracts. Data in table (2) illustrate the relative growth rate (RGR) values were 24.34, 38.77, 27.22 and 24.0 mg per day, in respect, for the butanol extract concentrations, while it was 58.40 mg per day in the control. These values were 84.45 mg per day in the control, and 32.22, 29.89,

26.33 and 22.44 mg per day, in respect, for the tested concentrations for petroleum ether extract. It is noticed that all the treatments caused significant inhibition of growth rate when compared with the control, although there was no significant difference between the lowest concentration (5ppm) and the highest one (100ppm) when the butanol extract was used.

Table (2): Relative growth rate (RGR) when each of the *Bauhinia* extracts (Butanol and Petroleum ether) were applied by feeding method on the sixth instar larvae of *S. littoralis*.

Concentrations (ppm)	Relative Growth Rate RGR (mg/day)	
	Crude butanol extract of *Bauhinia*	Crude petroleum ether extract of *Bauhinia*
Control (0)	58.40 ±0.31[a]	84.45 ±1.28 [a]
5	24.34 ±0.69[d]	32.22 ±0.78 [b]
10	38.77 ±0.39[b]	29.89 ±0.62 [bc]
50	27.22 ±0.97 [c]	26.33 ±2.94 [cd]
100	24.0 ±0.70[d]	22.44 ±2.35 [d]

F: F test f (ANOVA); Statistically significant at p ≤ 0.05; Different super scripts are significant.

The obtained results were confirmed by Pavela and Chermenskaya (2004) who estimated the RGR values when they studied the effect of the *Artemisia vulgaris* extract on the third instar larvae of the *S. littoralis*. They found that the concentration of 0.5% affect on the RGR and recorded 9.16 mg per day. Also, the efficiency of conversion of digested food (ECD%) values were calculated and recorded in table (3), they were 63.07, 91.32, 80.42 and 78.15 in respect, for the used concentrations of butanol crude extract of *Bauhinia*, while it was 166.03 in the control. For the petroleum ether extract, they recorded 77.6, 71.8, 67.39 and 60.96, in respect, for the used concentrations, while it was 201 in the control. It was clearly noticed that the ECD` values were gradually decreased according to the increase of concentration.

Table (3): Efficiency of conversion of digested food percentages (ECD%) when the Bauhinia extracts (Butanol and Petroleum ether) were applied by feeding method on the sixth instar larvae of *S. littoralis*.

Concentrations (ppm)	Efficiency of Conversion of Digested food ECD (%)	
	Crude butanol extract of *Bauhinia*	Crude petroleum ether extract of *Bauhinia*
Control (0)	166.03 ±4.27 [a]	201.0 ±6.03[a]
5	63.07 ±4.64[d]	77.60 ±1.46 [b]
10	91.32 ±2.07 [b]	71.80 ±1.19 [bc]
50	80.42±0.60 [c]	67.39 ±1.32 [cd]
100	78.15 ±1.27 [c]	60.96 ±1.48 [d]

F: F test f (ANOVA); Statistically significant at p ≤ 0.05; Different super scripts are significant.

Finally, the feeding deterrence index (FDI) for the tested concentrations of the butanol crude extract of *Bauhinia* values were calculated and recorded 20.55, 20.97, 28.27 and 41.64, in respect. On other hand, the (FDI) values were 12.63, 15.63, 21.45 and 42.38, in respect, for the crude petroleum ether extract of *Bauhinia*, table (4). According to the criteria of Isman et al*.,* (1990), both crude extracts of *Bauhinia* at 100 ppm are considered a weak feeding deterrence (FDI% ≥ 20% - 50% >) because the data obtained values were less than 50% and higher than 20%. The present results were in accordance with those of Pavela & Chermenskaya (2004) who applied the extract of *Melilotus officinalis* on *S. littoralis* and the results of Liu et al*.,* (2007) who studied the fumigant activity of the *Artemisia argyi* on *Sitophilus zeamais* and *Tribolium cataneum*.

Table (4): Feeding deterrence index (FDI%) when the Bauhinia extracts (Butanol and Petroleum ether) were applied by feeding method on the sixth instar of *S. littoralis* larvae.

Concentrations (ppm)	Feeding deterrence index (%)	
	Crude butanol of *Bauhinia* extract	Crude petroleum ether extract of *Bauhinia*
5	20.55	12.63
10	20.97	15.63
50	28.27	21.45
100	41.64	42.38

F: F test f (ANOVA); Statistically significant at p ≤ 0.05; Different super scripts are significant

3- Effect on the weight of pupae:

The weights of pupae values were determined and illustrated in table (5), they were 160.67, 149.33, 157.33 and 136.67 mg in the tested concentration with butanol crude extract of *Bauhinia* , in respect, while it was 257.0 mg in the control. On the other hand, the petroleum ether crude extract of *Bauhinia* inhibited the weights of pupae and recorded values of 196.4, 185.91, 170.24 and 147.9 mg in respect, for the used concentrations of 5, 10, 50 and 100 ppm, while it was 257 in the control. It was clearly noticed that the weight pupae values were gradually decreased according to the concentration. The higher concentration gave the lower weight value. The present results were in accordance with Ramos-López et al. (2010) and Schmidt et al, (1997) who applied methanolic extract of *Melia azedarach* in similar studies on larval development and reproduction parameters of *Spodoptera littoralis* and *Agrotis ipsilon*, also, they found that at higher concentrations no larvae were reached to the pupal stage.

Table (5): Weights of 24 h aged *S. littoralis* pupae when the sixth instar larvae of *S. littoralis* were fed on castor oil leaf discs, treated by the *Bauhinia* extracts of petroleum ether and butanol.

Concentration (ppm)	Weight of pupae (mg)	
	Crude butanol extract of *Bauhinia*	Crude petroleum ether extract of *Bauhinia*
Control (0)	257.0± 0.33 [a]	260.33± 2.98 [a]
5	160.67± 5.90 [b]	196.40± 3.70 [b]
10	149.33±1.76 [c]	185.91± 3.13 [c]
50	157.33± 2.19 [bc]	170.24± 4.07 [d]
100	136.67± 2.31 [d]	147.90± 1.20 [e]

F: F test f (ANOVA); Statistically significant at p ≤ 0.05; Different super scripts are significant.

4- Effects of *Bauhinia* crude extracts on the reproductive of *S. littoralis*:

a)Effects of butanol crude extract of *Bauhinia* on the mating:

Figure (3) showed that matings were failed between treated males and females emerged from larvae fed on fresh discs of castor oil leaves treated by butanol crude extract of *Bauhinia* or between treated males and untreated females. They failed to separate from each others and died on this condition. It could be due to a malformation of the male genitalia (Navon & Levinson, 1976).

Figure (3): The males and females adults of *S. littoralis* produced from larvae fed on fresh discs of castor oil leaves treated by butanol crude extract of *Bauhinia*, were failed to separate after mating.

b) Effect of the crude extracts of *Bauhinia* on the reproductive systems:

By dissecting the reproductive system of the females produced from the treated larvae with butanol extract, it was noticed that the ovarioles were empty or with few numbers of oocytes when compared with the normal ovary (Fig. 4 A, B). By examining the histological sections of ovary some malformation were observed (Fig. 5 A) such as malformed oocytes, undifferentiated epithelial cells and absence of nurse cells.

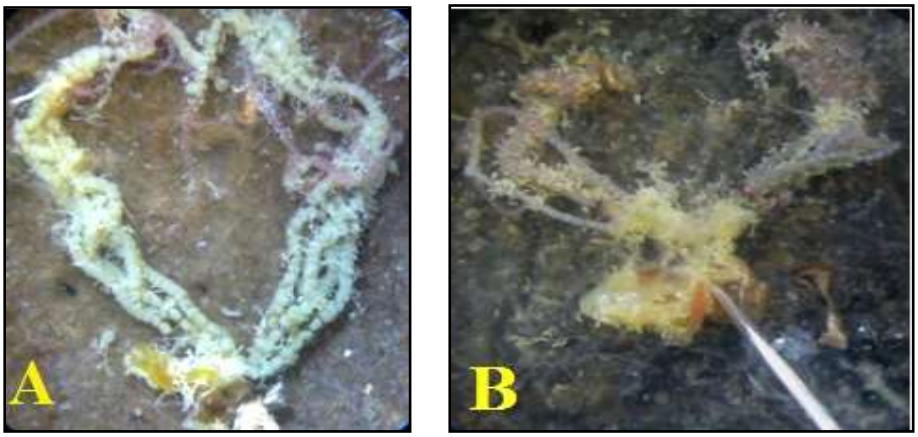

Figure (4): (A): Normal ovary; (B): Undifferentiated ovary resulted from larva fed on fresh disk of castor oil leaves treated by 50 ppm of butanol crude extract of *Bauhinia*.

The histological sections of the testes of a male resulted from larvae treated with butanol extract (Fig. 6 A) showed many vacuoles when compared with the normal testes (Fig. 6 B). The petroleum ether crude extract gave similar effects on the reproductive organs.

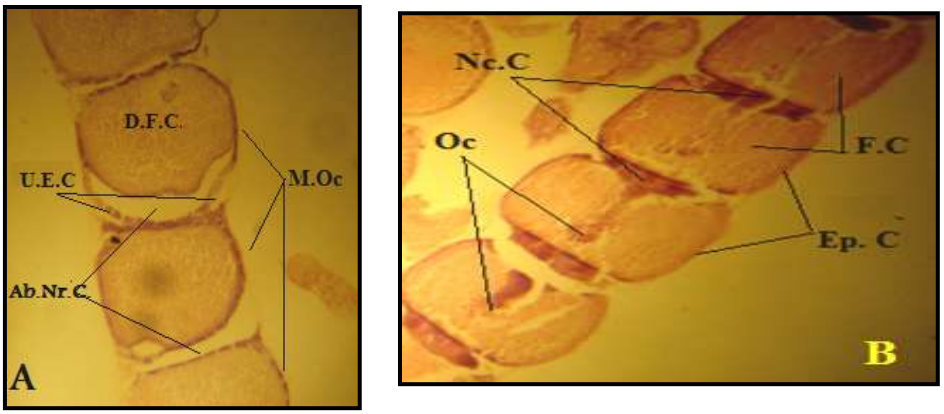

Figure (5): (A): Longitudinal section of the malformed ovary of the female moth resulted from larva treated with butanol crude extract of *Bauhinia*, showing the presence of malformed öocytes with undifferentiated follicular cells (U.F.C), epithelial cells (U.Ep.C) and absent nurse cells (Ab.Nc.C).
(B): Longitudinal section of the normal ovariole of the female moth resulted from untreated larva, showing the öocytes (Oc), follicular cells (F.C), epithelial cells (Ep.C), nurse cells (Nc.C). (100 X).

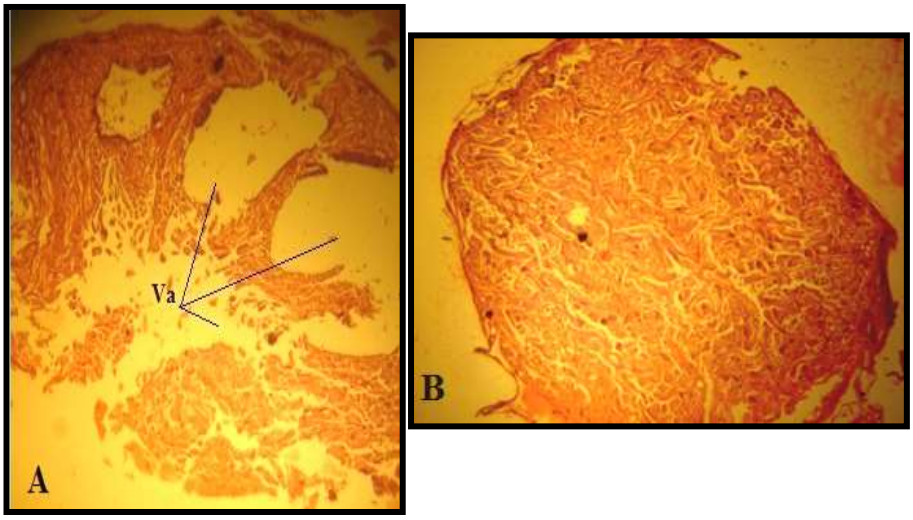

Figure (6): (A): L. S. of testes of a male moth obtained from larvae treated with butanol crude extract of *Bauhinia* showing: Many vacuoles were observed (Va.); (B): L. S. of testes of a male moth obtained from control larvae. (100 X).

c)Effects of petroleum ether crude extract of *Bauhinia* on the fecundity and fertility:

The effects of petroleum ether crude extract of *Bauhinia* on the fecundity and fertility of the survived adults resulting from the treatment of the sixth instar larvae by feeding method, with the concentrations of 5, 10, 50 and 100 ppm are illustrated in table (6). The decrease in hatchability percentage in all crossing possibilities means that the petroleum ether crude extract of *Bauhinia* affected each of female and male adults.

Table (6): Effects of petroleum ether crude extract of *Bauhinia* on the fecundity and fertility of the cotton leafworm adults resulting from the treatment of the sixth instar larvae with feeding application.

Conc. (ppm)	Mating possibilities		Average No. of eggs/ female	Average No. of hatched eggs	Hatchability (%)	Polyandry (Average No. of spermatophores)	
	Female	Male				Normal	Abnormal
5	Treated	Treated	253.2	182.91	72.24	1	-
	Treated	Untreated	266.4	217.3	81.57	1	-
	Untreated	Treated	285.13	218.21	76.53	1	-
10	Treated	Treated	272.3	237.4	87.2	1	-
	Treated	Untreated	123.5	107.5	87	1	-
	Untreated	Treated	261	---	0	-	-
50	Treated	Treated	50.17	---	0	-	-
	Treated	Untreated	76.8	23.21	30.22	2	-
	Untreated	Treated	224.41	---	0	-	-
100	Treated	Treated	97.3	---	0	-	-
	Treated	Untreated	87.5	---	0	1	-
	Untreated	Treated	188.3	---	0	-	1
Control	Untreated	Untreated	1215.7	1186.52	97.6	2	0

Any number of the obtained results is an average of three replicates. Also, there were no spermatophores produced by treated male while the male produced 2 spermatophores in the control, all the untreated males produced normal spermatophores ranged from one to 2 spermatophores as found in the control.

The averages of number of eggs per female resulted from the tested treatments were 253, 272.3, 50.17 and 97.3 while it was 1215.7 eggs in the control. The hatchability percentages scored 81.57, 87 and 30.22% for the eggs produced from treated females in the concentrations of 5, 10 and 50 ppm, while it was zero% in the concentration of 100 ppm. Also, the hatchability percentages for the treated males mated with untreated females were 76.53, 0, 0 and 0% for the concentrations of 5, 10, 50 and 100 ppm, in respect while it was 97.6% in the control.

The present results showed that the reduction in fecundity and fertility after the treatment with petroleum ether crude extract of *Bauhinia* have similar affects when treatment by ecdysone was carried out in other lepidopteran species such as *Helicoverpa zea*, *Platynota idaeusalis* and *Spodoptera exigua,* according to (Smagghe and Degheele, 1994a, b; Carpenter and Chandler, 1994; Sun et al., 2003). On the other hand, Sun et al., (2003) demonstrated that the ecdysteroids play a role in the regulation of oogenesis of lepidopterans, so, it can be expected that ecdysone agonists influence ovarian development after adult eclosion. This is observed in the codling moth, *Cydia pomonella* (Tortricidae: Tortricoidea), where application of tebufenozide and methoxyfenozide to adults results in reduction in fecundity.

5- Effect butanol crude extract of Bauhinia on chitin formation:

The chitin formation ratio was calculated according to the formula of Hughes et al., (1989) and is detailed in table (7). The larval fresh weight before removing its viscera was 0.465 gram in the control, while it recorded 0.235 gram in the *Bauhinia* butanol extract at the concentration of 50 ppm. The value of chitin from the body wall of *S. littoralis* larvae recorded 31.505 mg/gm for the control, while it was 18.723 mg/gm for the *Bauhinia* butanol extract at concentration of 50 ppm. The obtained results indicated that the *Bauhinia* butanol extract retarded the chitin formation in the sixth instar larvae of the cotton leafworm. Also, the obtained data emphasized that the *Bauhinia* butanol extract inhibited the larval growth of the cotton leafworm, which indicates that the tested extract could be considered a larval growth inhibitor and also an inhibitor of chitin synthesis.

Table (7): Assaying of the chitin of body walls of the cotton leafworm larvae fed on discs treated with butnol extract of *Bauhinia*.

Concentration	Larval fresh weight before removing its viscera (g)	Chitin dry weight* (mg)	Chitin formation ratio (mg /g)
Control	0.465	14.65	31.505
50 ppm	0. 235	4.4	18.723

* **Dry weight excluding head capsule.**

These interpretations are in accordance with the findings of many authors such as Hughes et al*.,* (1989) who worked on the inhibition of growth and development of the tobacoo hornworm, and Martinez et al*.,* (2001) who studied the effect of Azadirachtin on *S. littoralis*. Also, the results of Root & Dauterman (1996) confirmed the present results. They found that the high doses of cyromazine caused ruptures in the cuticle earlier than the lower doses. They also reported that the slower larval growth could mean less food consumed and accordingly, a smaller ingested dose of the chemical. Hopkins & Kramer (1992) approved that the epithelial cells of rectum were heavily destroyed. They attributed the higher incidence of ruptures to the weaker cuticle which is the result of the diversion of limited sclerotization precursor pool from the pathway of sclerotization to that of melanization. Many studies were carried out to illustrate the mode of action of the insect growth regulators on chitin formation. Cyromazine exhibited elongation, increased turgor pressure, fluid-filled vesicles on the cuticle and cuticular lesions (Friedel et al., 1988; Hughes et al*.,* 1989 and Reynolds & Blakey, 1989).

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" التأثيرات البيولوجية لمستخلصيين من نبات خف الجمل على دودة ورق القطن "

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لقد تمت دراسة التأثيرات البيولوجية لكل من مستخلص البيوتانول و البترولييم إيثر لنبات خف الجمل *Bauhinia purpurea* و ذلك على دودة ورق القطن بطريقة التغذية بتركيزات 5, 10, 50, 100 جزء في المليون.

و لقد أوضحت النتائج قلة قيم أوزان عذارى دودة ورق القطن حيث تراوحت هذة القيم ما بين 196.40 إلى 136.67 ملليجرام بينما كان متوسط وزن العذارى في الكنترول ما بين 257- 260.33 ملليجرام.

هذا كما تراوحت النسب المئوية لتثبيط تكوين الحشرة الكاملة ما بين 43.33 إلى 93.33% . و لقد تم أيضاً دراسة كمية البيض للأنثى و إخصابه و عدد الاسبرماتوفورات و كذلك امكانيات التزاوج المختلفة للذكور و الاناث الناتجة من معاملة يرقات دودة ورق القطن بالتركيزات السابقة لمستخلص البترولييم ايثر و الكنترول، أيضاً لوحظ قلة متوسط عدد البيض الذي تضعه الانثى و الذي تراوح ما بين صفر إلى 285.13 بيضة / أنثى، بينما كان متوسط عدد البيض 1186.52 بيضة / أنثى للكنترول، ومع حساب نسبة الفقس وجد أنها تراوحت ما بين صفر إلى 87.2% بينما كانت 97.6% في الكنترول.

أوضحت الدراسات الهيستولوجية التدمير الشديد لكل من الجهاز التناسلي للذكر و الانثى عند تطبيق كل من مستخلصي البيوتانول و البترولييم ايثر لنبات Bauhinia ، بالاضافة إلى أن حساب مؤشرات التغذية و التي منها معدل النمو خلال فترة التغذية (المعاملة) (RGR) و التي قلت قيمتها و تراوحت ما بين 38.77 إلى 22.44 ملليجرام / يوم تغذية بمقارنتها بالكنترول و التي تراوحت ما بين 58.4 إلى 84.45 ملليجرام / يوم تغذية. بينما تراوحت قيم كفاءة تحول الغذاء المهضوم (ECD%) ما بين 91.32 إلى 60.96 و التي قلت عن الكنترول الذي تراوحت فيه القيم ما بين 166.03 إلى 201.01 ، و حساب دالة مانع التغذية (FDI%) لتركيز 100 جزء في المليون و كانت قيمة 41.64 مع مستخلص البيوتانول و 42.38 % مع مستخلص البترولييم إيثر لنبات Bauhinia.

و من ناحية أخرى، سبب مستخلص البيوتانول لنبات Bauhinia تثبيط تكوين الكيتين ليرقات دودة ورق القطن المعاملة ، حيث وجد أن معدل تكوين الكيتين 31.505 ملليجرام / جرام يرقة للكنترول بينما كانت 18.723 ملليجرام / جرام يرقة معاملة بمستخلص البيوتانول لنبات Bauhinia عند تركيز 50 جزء في المليون.

قام بتحكيم البحث

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