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Effect of some plant extracts on the levels of carbohydrate, proteins and lipids in the body of the 3rd instar larvae of the cabbage worm, Pieris rapae L. (Lepidoptera, Pieridae)

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Abstract: *Effect of four plant extracts (vinca, ak, neem and chinaberry) on the levels of carbohydrate, proteins and lipids were evaluated in the body of the 3rd instar larvae of the cabbage worm, Pieris rapae L. (Lepidoptera, Pieridae). The results indicated that the total carbohydrate content in the body of the larvae decreased when treated with all extracts (69.44, 151, 167 and 173.33 mg % for vinca, chinaberry, neem and ak extracts, respectively), compared with 174.43 mg % for control. Total protein content decreased in the body of larvae when treated with vinca, neem and chinaberry extracts to 118, 155.88 and 183.66 mg %, respectively, but increased in ak extract to 213 mg % compared with 187.66 mg % for control. Total lipid content decreased in the body of the larvae, when treated with all treatments (vinca, chinaberry, ak and neem extracts) to 31.66, 43.66, 68 and 69.33 mg %, respectively, compared with 81.66 mg % for control. These results indicated that the total percentages of these components were high in ak extract than in vinca extract, while the plant extracts of chinaberry and neem had moderate rate.*

I. INTRODUCTION

Effect of four plant extracts (vinca, ak, neem and chinaberry) on the levels of carbohydrate, proteins and lipids were evaluated in the body of the 3rd instar larvae of the cabbage worm, Pieris rapae L. (Lepidoptera, Pieridae). The results indicated that the total carbohydrate content in the body of the larvae decreased when treated with all extracts (69.44, 151, 167 and 173.33 mg % for vinca, chinaberry, neem and ak extracts, respectively), compared with 174.43 mg % for control. Total protein content decreased in the body of larvae when treated with vinca, neem and chinaberry extracts to 118, 155.88 and 183.66 mg %, respectively, but increased in ak extract to 213 mg % compared with 187.66 mg % for control. Total lipid content decreased in the body of the larvae, when treated with all treatments (vinca, chinaberry, ak and neem extracts) to 31.66, 43.66, 68 and 69.33 mg %, respectively, compared with 81.66 mg % for control. These results indicated that the total percentages of these components were high in ak extract than in vinca extract, while the plant extracts of chinaberry and neem had moderate rate.

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II. MATERIALS AND METHODS

- Rearing of *Pieris rapae* L

Larvae and pupae were collected from open field which is known as free of insecticides, reared in the laboratory then adults were maintained under semi- condition of greenhouse (big cage "200 × 250 × 300" cm). The source of food was naturally represented in balm plant (*Ocimum basilicum*), geranium (*Pelargonium gerveolens*) and rose (*Rosa gallica*). Leaves of *Brassicae oleracea* Linn. plant with eggs were transferred to jars (250 cc) and covered with pieces of thin mesh fixed in place with a rubber band. The hatched larvae were provided with fresh cabbage leaves, in incubator of 27± 2 °C and 60 ± 5 R.H. **(Mona 1992) .**

- Preparation of plant samples and extraction:

Leaves of vinca, ak and chinaberry plants were left to dry at room temperature for one month then they were grinded into fine powder. Also, the seeds of neem were grinded into fine powder in an electric mill. Powder of each plant was soaked in a mixture of hexane, acetone and ethanol solvents of equal proportion (1:1:1) in a flask for about one week.

Finally, the flasks shake in a shaker and its contents were filtered. The solvents were evaporated under reduced pressure; the crude extracts were weighted and kept in deep freezer until use.

- Preparing the Stock Solution of the Tested Plant Extracts:

Convenient stock concentrations of each extract were prepared on basis of the tested plant weight and the volume of the distilled water (w/v) in the presence of tween 80 (0.1%) as emulsifier. The stock concentrations were kept in glass stoppered bottles and stored under refrigeration. Four diluted concentrations for each plant extract were used to draw the LC-P Lines. Three replicates were used for each concentration.

- Methods of application:

Under laboratory conditions, cabbage leaves were dipped in the tested concentration and left to dry. The 3rd instar larvae were allowed to feed on the leaves. Three replicates for each concentration were made. Mortality was recorded daily for 7 days after treatment and the living ones of the treatment were examined daily until final mortality, and this mortality was calculated and corrected by **(Abbott´s formula 1925)**. Data were plotted on log dosage Probit Papers and statistically analysed according to **(Finney 1952).**

The same technique was used with water only and the emulsifier as a control.

- Phytochemical Examination:

Previous studies explained that *V. rosea* contains vinblastine and vincristine which are alkaloid, *C. procera* contains calotropin which is glycoside, *A. indica* and *M. azedarach* contain azadirachtin, which is triterpenoid; so phytochemical examinations were made as a result of these theory as follows:

1. Test of Alkaloids and Nitrogenous Basis:
Alkaloids were tested according to the method of **(Linskens and Jacoson, 1994).**

2. Test of Glycosides:
Glycosides were tested according to the method of **Stank *et al.* (1963).**

3. Test of unsaturated sterols and / or Triterpenes:
- Liebermann- Burchard´s test (Liebermann and Burchard, 1890).

- Salkowski´s test: According to **Wall *et al.* (1954).**

- Biochemical effects:
For this purpose, treated larvae of the highest concentrations were used to determine the total carbohydrate, protein and lipid content.

1. Determination of the total carbohydrate content:
Total carbohydrate content was determined as glycogen by the anthrone method that was described by **Seifter *et al.* (1950).**
2. Determination of the total protein content:
Total protein in the whole insect homogenate was determined by the Biuret method **(Wooten 1964).**
3. Determination of the total lipid content:
Total lipid content was determined according to **Knight *et al*. (1972).**

Design of the experiments and statistical analysis of the obtained data were made according to **Le Clerg *et al.* (1966)**. Duncan's new multiple range tests was used for testing the differences between treatments **(Le Clerg *et al.*, 1966)**.

III. Results and Discussions

1- Preliminary screening of phytochemical constituents of tested plants:
Data in **(Table: 1)** indicated that chinaberry leaves contained moderate amount of triterpens while neem seeds contained high amount of triterpenes **(Jacobson 1989, Koul 1990, Schmutterer 1990).**
Also, data showed that vinca leaves contained highly amount of alkaloids **(Rahman *et al.* 1994)**. Ak leaves contained highly amount of glycosides **(Akinloye 2002, Ibrahim 2001)**.
In this respect, examination of the obtained results indicated that the importance role of plant species and parts as well as solvent of extraction in determing the phytochemical constituents of the tested plant extracts.

Table(1):Preliminary phytochemical screening of the tested plant extracts

Plant extract / constituents	Chinaberry (leaves)	Neem (seeds)	Vinca (leaves)	Ak (leaves)
1-Triterpenes	++	+++		
2-Alkaloids			+++	
3-Glycosides				+++

+++ High amount ++ moderate amount

2- Effect of some plant extracts on the levels of carbohydrate, proteins and lipids in the body of the treated larvae of *Pieris rapae* L.:

2.1 Chemical analysis of treated larvae of *Pieris rapae* L.
The effect of plant extracts on total carbohydrate, total proteins and total lipids percentages was shown in **Table (2)**.

Table (2): Effect of some plant extracts on components of the body of 3rd instar larvae of ***Pieris rapae*** L.

Treatments	Total carbohydrate%	Total proteins%	Total lipids%
Vinca	69.00 c	118.00 b	31.66 c
Chinaberry	151.00 b	183.66 a	43.66 c
Neem	167.00 a	155.66 a	69.33 b
Ak	173.13 a	213.00 a	68.00 b
Control	174.43 a	187.66 a	81.66 a

2.2 Total carbohydrate:
The carbohydrate was not affected by all plant extracts for all treatments except the plant extract vinca decreased the carbohydrate content compared with control, 69.44 and 174.43 mg. % respectively.

2.3 Total proteins:
The proteins were not affected by the plant extracts for chinaberry compared with control, 183.66 and 187.66 mg. % respectively .While the plant extracts, vinca and neem were decreased the proteins compared with control, 118,155.88 and 187.66 mg. % respectively. Also the plant extract ak was increased the proteins compared with control, 213 and 187.66 mg. %, respectively.

2.4 Total lipids:
Data in **Table (2)** cleared that the total lipids decreased by all treatments, 31.66 , 43.66 , 68 and 69.33 mg. % with plant extracts vinca , chinaberry , ak and neem , respectively , compared with control 81.66 mg. %

The correlation between phytochemical components of the body of larvae of *Pieris rapae* L. treated with some plant extracts and mortality:

Data represented in **Table (3)** and **Fig. (1)** showed the total carbohydrate, total proteins, total lipids and mortality percentages.

The simple correlation analysis showed that there was a positive correlation between the total carbohydrate, total proteins and total lipids contents in the body of larvae of *Pieris rapae* L. and mortality percentages of the four plant extracts; vinca, chinaberry, ak and neem.

On the other hand , the total carbohydrate was significant with vinca and chinaberry , and high significant with neem and ak extracts . While total proteins were high significant with vinca and neem extracts. The total proteins were significant with ak and non significant with chinaberry extracts. The total lipids were high significant with vinca and neem extracts but significant with chinaberry and ak extracts.

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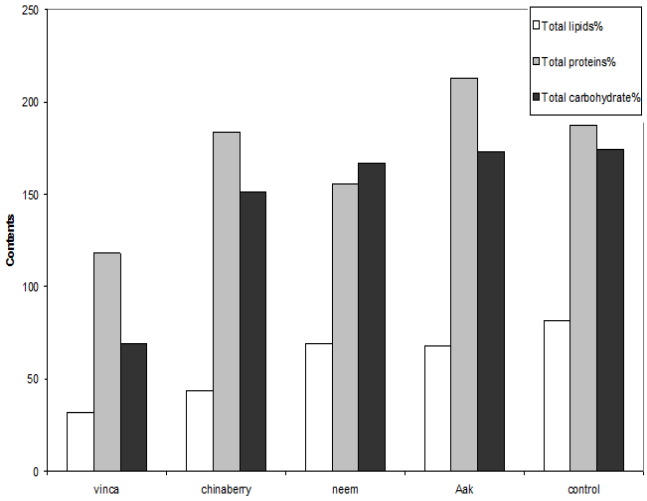
Table (3): The correlation between phytochemical components of the body of 3rd instar larvae of *Pieris rapae* L. treated with some plant extracts and mortality

Components (mg.)	General mortality mean %				
	Vinca	Chinaberry	Neem	Ak	Control
	65%	60%	60%	77.55%	---
Total carbohydrate	69.44	151	167	173.13	174.43
R.	0.965	0.953	0.977	0.989	
Total protein.	118	183.66	155.88	213	187.66
R.	0.998	0.528	0.977	0.714	
Total lipids.	31.66	43.66	69.33	68	81.66
R.	0.982	0.944	0.99	0.922	

Fig. (1): Effect of some plant extracts on the levels of carbohydrates, proteins and lipids in the body of the treated larvae of *Pieris rapae* L



Discussions

1- Preliminary screening of phytochemical constituents of the tested plants:

Results indicated that chinaberry and neem contained achievely highly amounts of triterpenes which known as azadirachtin by **Jacobson 1989**, **Koul 1990** and **Schmutter 1990.**

Vinca contain mainly highly amount of alkaloids with agreement of **Rahman *et al.* (1994)**, who proved that these alkaloids were vinblastine and vincristine.

Also, the results indicated that ak contain mainly highly amount of glycosides, which recorded , by **Akinloye *et al.* (2002)**, as cardiac glycoside.

2- Effect of some plant extracts on the levels of carbohydrat, proteins and lipids in the body of the treated 3rd instar larvae of *Pieris rapae* L.

The results indicated that total carbohydrate, proteins and total lipids suffered considerable reduction in the treated 3rd instar larvae of *Pieris rapae* L. due to the treatment with various plant extracts (vinca, ak, chinaberry and neem) but protein content increased when larvae treated with ak extract, compared with control.

In this connection, our results could be supported by the work of **Taha *et al* (1989)** which recorded a highly significant reduction in the glycogen content of the 4th nymphal instar of *Spodoptera littoralis* previously treated with *V. rosea* acetone extract. Moreover, they observed a significant decrease of the nymphal total lipid and protein contents.

Our results agreed with **Zhang and Chiu (1992)** who found that the activities of proteinases in the larval midgut of *Pieris rapae* L., decreased as the result of treatment of larvae with toosendanin (botanical material from the bark of chinaberry).

Also, our results agreed with **Abo El- Ghar *et al.* (1995)** who showed that, the treatment of 6th instar larvae of *Agrotis ipsilon* with extracts of *Melia azedarach* and *Vinca rosea* resulted in considerable reduction in the total protein, lipids and carbohydrates. **Schmidt *et al.* (1998)** proved that protein content in the haemolymph of *Spodoptera littoralis* and *A. ipsilon* was decreased significantly due to larval treatment with *M. azedarach* extract.

IV. Conclusions

In conclusion, the results obtained in this investigations may encourage further research of practical nature for cabbage leaf worm control in future. Ak extract was recommended in control of this pest. Similar conclusion was previously reported by Chaudhry (1992) & Ibrahim (2001).

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