Name of Candidate:	Dina Abd El-Zaher Ahmed Afifi	**Degree:**	Ph.D.
Title of Thesis:	Biochemical and Toxicological Studies on The Effect of Some Plant Extracts on Pink Bollworm, *Pectinophora Gossypiella* (Saunders), in Relation to Their Phenolic Contents		
Supervisors:	Dr. Adel Sayed Afify, Dr. Alia Mohamed Abd El-Hafez and Dr. Amr Ahmed Mostafa		
Department:	Agricultural Biochemistry		
Branch:		**Approval:**	

ABSTRACT

The present study aimed to determine the efficacy of extracts from five selected plants (pomegranate peels, olive leaves, mulberry leaves, acacia pods, and guava leaves); in relation to their phenolic contents; on the pink bollworm (*P. gossypiella*).

1. Extractability of Phenolic Compounds in Various Solvent Systems

Among the plant samples studied, mulberry leaf extract showed the lowest level of PCs, while acacia pods extract contained the highest amount. On the other hand, moderate phenolic levels were found in extract of pomegranate peels, guava leaves and olive leaves. Data also revealed that the PCs varied tremendously according to the used solvent system. The extracting solvents could be arranged according to its efficacy in extracting of PCs as follows: acetone > ethanol > ethyl acetate > *n*-butanol > methanol.

2. Insecticidal Activities of Plant PCs Extracted With 80% Acetone

Results indicated that the mortality rates increased with the increasing of the used concentration and the period after treatment. Based on the LC_{50} values, it could be arranged the tested extracts according to their toxicity in a descending order as follows: pomegranate peels and olive leaves > mulberry leaves > acacia pods and guava leaves. Data also demonstrated that the anti-herbivore effects of the tested extracts on the pink bollworm larvae cannot be directly predicted from their content of PCs as quantified in extracts.

3. Insecticidal Activities of Reference Phenolic Compounds

Data indicated that the larval mortality percentages had a positive relationship with both the concentration of PCs and the period after treatment. Regarding the toxicity index of reference PCs, it could be arranged the tested compounds in descending order as follows: Guaiacol > catechol > resorcinol, orcinol, phloroglucinol, and hydroquinone > tannic acid. Compilation between these results and chemical configurations of PCs reveals structure-activity relationships.

4. Behavioral Bioassay

Antifeedant tests showed that the consumption rates for all plant PCs were low compared to the control, except for mulberry. Statistical analysis showed that the PBW larvae survived similarly on the control and plant PC diets, where the plant PCs did not significantly alter larval weight. Correlation tests failed to found a significant correlation between the concentration of the plant PCs and feeding reduction. Residual contact tests showed that the pomegranate PCs was less harmful when contacted to larvae. It caused only 10% mortality after 2 days of treatment. On the other hand, PCs of olive and mulberry leaves showed 63.6 and 60% mortality. These percentages were higher than those achieved by the feeding method (50%). When larvae were exposed to PC residues of acacia pods and guava leaves, mortality percentages were nearly close to those achieved in feeding method (50%). Regarding the percentages of mortalities induced by the LC_{50}, it could be noted that, pomegranate PCs brings their effect by alimentation while, PCs of olive and mulberry leaves gave their effects by contact. PCs of acacia pods and guava leaves acting via contact and ingestion.

5. Effect of Plant PCs on Larval and Pupal Stages

In the present study, PCs of pomegranate peels, acacia pods and guava leaves caused significant retardation in larval development. Conversely, olive PCs shortened larval period significantly. On the other hand, mulberry PCs did not affect larval period. Significant prolongation in the pupal period was also detected as a result of treatments with PCs of pomegranate peels, olive leaves and acacia pods. Conversely, shortened pupal periods were achieved as a result of treatment with mulberry and guava PCs. Accordingly, PCs of pomegranate peels, acacia pods, and guava leaves

prolonged the periods required to reach the adult stage, but PCs of olive and mulberry leaves shortened it. Pupation percent was slightly affected when larvae were fed on a diet containing PCs of pomegranate peels, olive leaves, mulberry leaves, and acacia pods. Data demonstrated that the larval and pupal weights were remained unaffected throughout the various plant PCs treatments. Data also declared that plant PCs did not affect sex ratio, except in the case of mulberry PCs where it directed to the female side.

6. Effects on Adult Stage

Data clearly showed that the average of eggs number was significantly decreased in the case of pomegranate peel, acacia pod and guava leaf PCs, while insignificantly decreased in the case of olive and mulberry leaves PCs. In respect of egg hatchability percent, statistical analysis proved insignificant difference between treated and untreated insects. Generally, in all treatments, the produced females had low reproductive capacity than control. In comparison with untreated insects, the pink bollworm adult longevity was not affected after treatment with PCs of pomegranate peels, olive leaves, acacia pods, and guava leaves. While, feeding of larvae on diet containing mulberry leaf PCs significantly affected adult longevity significantly.

7. Histological Studies on the Effect of Plant PCs on Larval Midgut

The microscopically examination showed that the peritrophic membrane nearly disappear as a result of treatment with all plant PCs. Pomegranate peel and olive leaf PCs exhibited further changes in the gut where the epithelium cells is to some elongated, disorganized and disintegration. Whilst, in the case of guava PCs, these cells became thick. Lesions in the epithelial cell lining of the midgut were also observed. However, this effect differed dramatically between treatments since lesions in larvae fed pomegranate peel PCs were markedly numerous, and the basement membrane was occasionally exposed. Although these lesions were appeared in the other treatment, the basement membrane did not affect.

8. Effect of Plant PCs on Total Protein and Carbohydrate Contents

The obtained results indicated that total proteins content significantly increased when larvae were fed on diets containing plant PCs extracted with 80% acetone. On the other hand, results showed that the plant PCs did not significantly affect total carbohydrate contents.

9. Effect of Plant PCs on Certain Enzyme Activities

Data demonstrated that peroxidase activity of pink bollworm larvae was significantly increased relative to control in the case of PCs of olive leaves, acacia pods, and guava leaves. On the other hand, mulberry leaf PCs caused significant decreased in the enzyme activity while, pomegranate peel PCs did not lead to any significant change. With respect to β-glucosidase activity, high activity was observed in the case of pomegranate peel PCs. As results indicated, mulberry leaves and acacia pods showed the lowest enzyme activities. On the other hand, olive and guava leaf PCs did not significantly affect the enzyme activity. Feeding on diet containing LC_{50} of guava leaf PCs caused a significant increase in the acid phosphatase activity. On the contrary, PCs of olive leaves and acacia pods caused significant decreases. With respect to PCs of pomegranate peels and mulberry leaves, insignificant increases were recorded. Results demonstrated that alkaline phosphatase activity was highly affected by the treatment with all plant PCs. α-Esterase activity of pink bollworm larvae was significantly inhibited only by olive leaf PCs treatment. Contrarily, PCs of each mulberry leaves and acacia pods increased the enzyme activity. Treatments with PCs of each of pomegranate peels and guava leaves did not cause significant variances relative to control. Date demonstrate that PCs of acacia pods caused significant decrease in β-esterase activity while, PCs of mulberry leaves caused significant increase. Insignificant values in enzyme activity were observed after treatment with PCs of pomegranate peels and leaves of olive and guava. Results revealed that mulberry leaf PCs significantly increased GST activity. Otherwise, treatment with olive leaf PCs significantly reduced GST activity. On the other hand, treatment with PCs of pomegranate peels, acacia pods, and guava leaves did not cause significant differences in the GST activity of pink bollworm larvae.

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