



UNIVERSITI
TEKNOLOGI
MARA

Fakulti
Sains Gunaan

**SUBMISSION FOR EVALUATION
FINAL YEAR PROJECT 2 - RESEARCH PROJECT**

**PHYSIO-CHEMICAL PROFILING AND BIOACTIVITY OF *ANNONA SQUAMOSA*
EXTRACTS FOR APHIDS PEST REPELLING**

Name : Nur Aleeya Natasha binti Ramli
Student ID : 2023305787
Program : AS245
Course code : FSG671
Mobile Phone :
E-mail : aleeya0458@gmail.com

** Please attach the Turnitin summary report, with your name clearly stated, at the end of your report and submit it together.*

Approval by Main Supervisor :

I certify that the work conducted by the above student is completed and approve this report to be submitted for evaluation.

Supervisor's name : Dr Non Daina binti Masdar
Date : 11/2/2026
Turnitin Similarity % : 18%
Signature :

< Put this form as the front page of your report >

**PHYSIO-CHEMICAL PROFILING AND BIOACTIVITY
OF *ANNONA SQUAMOSA* EXTRACTS FOR APHIDS
PEST REPELLING**

NUR ALEEYA NATASHA BINTI RAMLI

**BACHELOR OF SCIENCE (Hons.) APPLIED
CHEMISTRY FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA**

(FEBRUARY 2026)

This Final Year Project entitled “**Physio-chemical profiling and bioactivity of *Annona Squamosa* extract for aphids pest repelling**” was submitted by Nur Aleeya Natasha binti Ramli in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Applied Chemistry, in the Faculty of Applied Sciences and was approved by

Non Daina binti Masdar
Supervisor
B. Sc. (Hons.) Applied Chemistry
Faculty of Applied Chemistry
Universiti Teknologi MARA
02600 Arau
Perlis

Farhana Othman
Project Coordinator
B.Sc (Hons.) Applied Chemistry
Faculty of Applied Science
Universiti Teknologi MARA
02600 Arau
Perlis

Dr Nur Nasulhah Binti Kasim
Head of Programme
jjkmSc. (Hons) Applied Chemistry
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Date: _____

ABSTRACT

PHYSIO-CHEMICAL PROFILING AND BIOACTIVITY OF *ANNONA SQUAMOSA* EXTRACTS FOR APHIDS PEST REPELLING

Aphids (Aphidoidea) are very devastating pests in agriculture since they inject toxins, suck sap, and transmit phytopathogenic viruses that reduce the crop yield. Although synthetic insecticides are very effective, their prolonged usage has a risk to human health and environment, thus there is a need to utilize sustainable biopesticides. This study provides profiling of *Annona squamosa* (sugar-apple) seed and pulp-extracts to assess their use as environmentally friendly pesticide. The objective of this study is to extract bioactive compounds from the seeds and fruit pulp of *Annona Squamosa* using Soxhlet and maceration respectively, to profile the proximate analysis, physicochemical and biological properties of the *Annona squamosa* extract and to evaluate the toxicological effect of the extract towards aphids in terms of mortality test, skin color and behavioral changes after exposure in 72 hours. Bioactive compounds were extracted in *Annona squamosa* seeds by using Soxhlet extraction with methanol extract obtained the highest yield which is 10.8% followed by chloroform (8.54%), ethyl acetate (6.54%) and petroleum ether (4.42%). Maceration extraction using ethanol as solvent obtained a percentage yield of 40.16%. The study evaluated physio-chemical, biological, and toxicological characteristics. Proximate analysis showed that pulp contains high moisture content ($78.24\pm 0.47\%$) and ash content (3.17 ± 0.04) than seeds and is slightly acidic with pH value 5 and 6 respectively. The chemical characterization using GC-MS, FTIR, and HPLC methods demonstrated the presence of the main bioactive functional groups and compounds, including polyphenols, fatty acids and terpenoids. Total Phenolic Content (TPC) was determined using Folin-Ciocalteu method. The findings showed that the extracts of *Annona squamosa* pulp are rich in phenolic compounds having the highest TPC value (0.8619 ± 0.0047 mg GAE/g) among the seed extracts. The antioxidant and antibacterial activities of the extracts were assessed using DPPH radical scavenging assays and disc diffusion method respectively. Antioxidant activity showed methanol seed extract and ethanol pulp extract have high antioxidant activity with value of %RSA 83.7628 ± 1.42 and 87.9914 ± 0.33 at 800ppm respectively. The disc diffusion method was used to test the antibacterial efficacy against *Escherichia coli* and *Staphylococcus aureus* showing petroleum ether extracts have highest zone of inhibition with 8.5mm and 10.0mm respectively. Toxicology analysis against aphids populations was carried out and chloroform seed extract has highest percentage of mortality (%100) within 24 hours. No toxicity was reported against the ethanol pulp extract. Overall, the findings highlight the potential of *Annona squamosa*, especially seed extracts as a natural biopesticide with antioxidant, antibacterial and aphicidal effects that can be utilized in the sustainable control of crops.

TABLE OF CONTENTS

ABSTRACT	iii
ABSTRAK	iv
ACKNOWLEDGEMENT	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF SYMBOLS	xi
LIST OF ABBREVIATIONS	xii
CHAPTER 1	13
1.1 Research Background	13
1.2 Problem statement	18
1.3 Research Questions	20
1.4 Objectives	21
1.5 Significance of Study	21
1.6 Expected Outcomes	22
CHAPTER 2	23
2.1 Aphids	23
2.2 <i>Annona Squamosa</i>	24
2.3 Profiling of <i>Annona Squamosa</i>	26
2.4 Proximate Analysis	27
2.4.1 pH	28
2.4.2 Ash content	28
2.4.3 Moisture content	29
2.5 Extraction method	30
2.5.1 Maceration method for pulp	30
2.5.2 Soxhlet extraction for seeds	31
2.6 Chemical analysis	32
2.6.1 Total Phenolic Content	32
2.6.2 Gas Chromatograph-Mass Spectrometry analysis	34
2.6.3 Fourier-Transform Infrared Spectroscopy analysis	35
2.6.4 High-Performance Liquid Chromatography analysis	36
2.7 Bioactivity analysis	37
2.7.1 Antioxidant (DPPH Radical Scavenging Activity)	37
2.7.2 Antibacterial (Disc diffusion method)	38
2.8 Toxicology analysis	40
2.8.1 Mortality test	40
2.8.2 Behavioral changes	41
CHAPTER 3	43
3.1 Introduction	43
3.1.1 Chemicals	43
3.1.2 Apparatus	44
3.1.3 Instrumentation	44
3.2 Sample preparation	45
3.2.1 Sample collection	45
3.2.2 Pulp and seed preparation	45
3.3 Proximate analysis	45