THE EFFECTS OF GIBBERELLIC ACID (GA_3) ON THE MORPHO-ANATOMICAL CHARACTERISTICS AND DNA BANDING PATTERN OF TOMATO *LYCOPERSICON ESCULENTUM* VAR. IMPROVED POPE (*SOLANACEAE*)

A Master's Thesis
Presented to
the Faculty of the Graduate School of Education, Arts and Sciences
De La Salle University-Dasmariñas
Dasmariñas, Cavite

In Partial Fulfillment
of the Requirements for the Degree
Master of Science in Biology

JANET PACHOCO MACAWILE
October, 2002

ABSTRACT

Name of Institution: De La Salle University – Damarinas
Dasmarinas, Cavite

Title **The Effects of Gibberellic Acid (GA_3) on the Morpho-Anatomical Characteristics and DNA Banding Pattern of Tomato *Lycopersicon esculentum* var. Improved Pope (*Solanaceae*)**

Author JANET PACHOCO MACAWILE

Address(home) : Blk D-2 Lot-7 Brgy. San Nicolas-1, Dasmarinas, Cavite

Degree : Master of Science

Major : Biology

Date Started : October, 2001

Date Completed : February, 2002

STATEMENT OF THE PROBLEM:

The study aimed to determine the effects of gibberellic acid (GA_3) on the morpho-anatomical characteristics and DNA bands of *Lycopersicon esculentum* var. Improved Pope.

Specifically, the study answered the following questions:

1. What are the effects of GA_3 on the external morphological characters of *L. esculentum* in terms of:

1.1.size of fruit

1.2. weight of fruit

1.3. average lengths of stems

2. What are the effects of GA_3 on the average numbers of the following :

2.1. mature fruits

2.2. leaves

3. What are the effects of GA_3 on the vascular tissues of the stem in terms of:

3.1. Arrangement of xylem and phloem

3.2. Diameter of xylem vessels

4. What are the effects of GA_3 on the DNA banding pattern of *L. esculentum* as shown by gel electrophoresis?

SCOPE AND DELIMITATION:

The study focused on determining the effects of gibberellic acid (GA_3) on the morpho-anatomical characteristics, i.e. size and weight of fruit, average length of stem, numbers of fruits and leaves, and DNA banding pattern of *L. esculentum.* The study was conducted in the months of October 2001 up to February 2002.

METHODOLOGY:

The study employed the experimental type of research. A total of 180 of tomato seeds were immersed in 0, 100, 200 and 300 ppm of gibberellic

acid, respectively, for 24 hours. These seeds were sown and grown under the natural environment characterized by fair weather condition, occasional rainy days, and temperature ranging from 28ºC to 35ºC. The effects of different concentrations of gibberellic acid were examined on the morpho-anatomical structures and DNA bands of tomatoes.

The data was collected after 12 weeks of sowing for the morphological characteristics while tissues were observed after the preparation of the transverse section of the stem.

The morphological and anatomical parameters used were the size and weight of fruits, average length of stem and cross section of the stem. The average number of the mature fruits and the leaves were also counted. Furthermore, the DNA bands of each plant was recorded by measuring the size of DNA bands in every treatment and comparing indices of treated plants to Control.

One way analysis of variance (ANOVA) was employed to determine the significant effects among the treatments.

MAJOR FINDINGS:

The results of this experimental study are as follows:

1. In the morphological characteristics, 200 ppm GA_3 concentration was significantly effective in promoting the biggest size of fruit with a mean diameter of 40.36, increasing weight of fruit with a mean of

32.00 grams, and promoting stem elongation with the longest mean length of 106.30 cm.

2. A total of 79 high number of mature fruits were also exhibited by this treatment at 200 ppm gibberellic acid concentration.
3. In the histological characteristic, as the concentration of Gibberellic acid increases, the number and diameter of xylem also increases. The 300 ppm GA_3 concentration produced the most number of xylems with a mean number of 349.30, and widest diameter of xylem with mean diameter of 162.50 um.
4. In the DNA banding pattern, 300 ppm GA_3 concentration has significantly affected the size of DNA molecules of tomato with 5,459 base pairs compared to the Control. The same result was obtained in the Similarity Index, the higher the GA_3 concentration, the lower the similarity index of the GA_3 treated plant to the Control. Hence, 300 ppm GA_3 has the least degree of similarity index to Control which was 72.22%.

CONCLUSIONS:

Based on experimental data on the effects of different concentrations of GA_3 to the morpho-anatomical structures and DNA banding pattern of tomatoes, conclusions are drawn as follows:

The 200 ppm GA_3 concentration when applied on tomatoes can cause wide significant effects on tomatoes compared to 300 ppm GA_3 concentration. Among these effects are on their external morphology in terms of big size and heavy weight of fruits, tallest height of tomatoes, and much number of leaves and fruits; on their internal anatomy in terms of wide diameter of tomatoes' xylem and vessels; and on their DNA banding pattern in terms of big size of molecules and least similarity index from Control.

1. Moderate administration of GA_3 concentrations at 200 ppm in tomatoes caused stimulatory effects on the size and weight of fruits and length of stem. On the other hand, high GA_3 concentration (300 ppm) partially stimulated the morphological structures of the plant in terms of the number of fruits and leaves. Partial inhibitory effect in the size and weight of fruits, length of stem and number of fruit yield were revealed by this treatment. These inhibitory effects were comparable enough among treated plants.

2. Low concentration of GA_3 had significantly affected the size and weight of fruits and length of stem compared to the Control. It has also reversed effects on the number of leaves, fruits and vessels.

3. Moderate and high GA_3 concentration produced more number and large diameter of xylem vessels.

4. As the concentration of GA_3 increased, the degree of homogeneity of banding patterns of treated tomatoes compared to the Control decreased. Hence, moderate and high GA_3 concentration exhibited big molecules of DNA.

This study confirmed that GA_3 applied on plants can cause significant effects and can produce best results on the morphology, histology and genetic make-up, when applied in both moderate and high concentrations. However, high concentration can cause opposite/inhibitory effects more than the expected result on the morphological structures of the plant.

RECOMMENDATIONS:

The author recommends future researches to determine other factors that would best help gather information to make this study more reliable. Among these recommendations are:

1. the use of experimental field/area for plants instead of pots;
2. soil analysis to know if it has a combined effect with GA_3 ;
3. DNA analysis to check whether GA_3 affects genetic make-up of the plant; and
4. correlation between the genotypic and phenotypic characteristics of the plant.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES