THE INFLUENCE OF GROWTH FACTORS ON THE MICROPROPAGATION OF STRAWBERRY PLANTS

By

SEHAM EZZAT ABED

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This thesis for Sc. M. degree has been approved by:

Dr. Mohamed Khalil Kalil Al Doadoa **…….....**
Prof. Emeritus of Plant Physiology, Faculty of Agriculture, Cairo University

Dr. Ebrahim Sif Elden Ebrahim **……..**
Prof. of Plant Physiology, Faculty of Agriculture, Ain Shams University

Dr. Ola Hussein Abd Elbar **……..**
Associate Prof. of Agricultural Botany, Faculty of Agriculture, Ain Shams University

Dr. Hossam Hassan Ahmed Manaf **……..**
Prof. of Plant Physiology, Faculty of Agriculture, Ain Shams University

Date of Examination: / /2020

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Under the supervision of:

Dr. Hossam Hassan Ahmed Manaf

Prof. of Plant Physiology, Agriculture Botany Department, Faculty of Agriculture, Ain Shams University

Dr. Ola Hussein Abd Elbar

Associate Prof. of Agricultural Botany, Agriculture Botany Department, Faculty of Agriculture, Ain Shams University

Dr. Mona Shaban Abd El Aal

Assistant Prof. of Agricultural Botany, Agriculture Botany Department, Faculty of Agriculture, Ain Shams University

ABSTRACT

Seham Ezzat Abed: The Influence of Growth Factors on The Micropropagation of Strawberry Plants. Unpublished M.S. Thesis, Department of Agriculture Botany, Faculty of Agriculture, Ain Shams University, 2020.

The present investigation was mainly conducted to study the effect of light intensity on culture survival percentage, the effect of some plant growth regulators on the *Fragraia x ananassa* cv. Festival micropropagation, anatomical structure, chemical, and growth parameters. Series of experiments were carried out successively during the years 2016 to 2019.

The highest positive light intensity effect on survival percentage (100%) was observed under dark conditions.

BA treatments on runner tips led to increment in total shoots and the concentration of 0.5 mg l^{-1} BA was the best. Also, concentration 0.5 mg l^{-1} BA recorded the highest value in both of chl a, and chl b.

All TDZ treatments resulted in adventitious shoots development on leaf explants without callus formation. Growth in 1.5 mg l^{-1} TDZ led to an increment in the most morphological parameters compared to the rest treatments. The results showed that 1.5 mg l^{-1} of TDZ treatment significantly increase the number of shootlets per explant (5.0), total shoot (51.3), and the number of leaves/explant (12) as compared with other treatments. Accumulation of chlorophylls, total sugars, and total soluble phenols was enhanced by 1.5 mg l^{-1} of TDZ. This procedure provides a simple and rapid approach to regenerate strawberry plants via direct organogenesis.

The histological observations showed that adventitious shoots initiated from some parenchyma of ground tissue in the midvein zone of the explant, whereas the parenchyma mesophyll and the epidermal cells did not involve in this process. The ontogenesis of adventitious shoots

was described by successive stages with the following distinguishable anatomical structures: meristemoids, bud primordium, shoot apex with leaf primordial, branching of adventitious shoots. After four weeks of culture, cell dedifferentiation was recorded in the midvein parenchyma and forming small groups of divided cells called meristemoid centers. These centers forming new meristematic masses embedded in the ground tissue of the main vein. After six weeks, further development of these masses resulted in the formation of bud primordial with normally organized shoot apical meristems and leaf primordial and arising from the explant as small protrusions. After two weeks from subculture on MS free of TDZ, the adventitious shoots continue to elongate with forming new lateral branches and observed on the adaxial side of the explant.

This study is considered as a *means* to increase the number of plants produced from tissue culture through the *in vitro* leaves culture in addition to the traditional method of propagation with runner tips.

Keywords: Strawberry, *Fragraia x ananassa*, adventitious shoots, Thiodiazuron (TDZ), histological Changes, Micropropagation.

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INTRODUCTION

Strawberry (*Fragraia x ananassa* cv. Festival) is a member of the *Rosaceae* family. It considers one of the most profitable and important crops in Egypt and many countries, because of its delicious taste, low energy food, and well-known source of vitamin C as antioxidants and phenolic compounds, mainly anthocyanin **(Sakila *et al*., 2007)**. It also contains significant levels of anti-carcinogenic material. In addition to fresh consumption, strawberry is widely used in the food industry and the strong demand existed in Europe during the months starting from late November until late March.

Conventional propagation techniques are laborious and expensive with numerous limitations and may not be suggested for effective and commercial multiplication **(Dhar, 1998)**.

Plant tissue culture techniques have become a powerful tool for strawberry propagation on a large scale using the runner tips. However, these techniques have many problems fronted the production such as sterilization inefficiency and browning leads to explant death in the first stage of micropropagation **(Pirttila *et al*., 2008).**

Adventitious shoot regeneration is influenced by some factors including plant genotype, explant type, components of basal medium and type, the concentration of plant growth regulators (**Ćosić *et al*., 2015; Haddadi *et al*., 2013; San *et al*., 2015**). Previous reports recommended that cytokinins are considered the most important regulatory factor for the meristem activities and morphogenesis process **(Werner *et al*., 2003)**. Thidiazuron (TDZ) as a cytokinin was a sufficient plant growth regulator to regenerate adventitious shoots from strawberry leaves and sepals **(Debnath, 2005)**.

There are scarce reports recommended using the *in vitro* leaf explants as a source of strawberry regeneration **(Haddadi *et al*., 2013).**

INTRODUCTION

Whereas it is extensively used in many other plants and produced normal plantlets **(Yepes and Aldwinckle 1994).**

There are few precise histological studies on the development stages during the initiation of direct strawberry organogenesis were reported **(Wang *et al.*, 2015; Bhandari and Roy, 2015).**

The purpose of the present investigation is to study the effect of light intensity on culture survival percentage, the effect of some plant growth regulators on *Fragraia x ananassa* cv. Festival micropropagation, anatomical structure, chemical, and growth parameters.

REVIEW OF LITERATURE

1. Plant Material:

Poling (2012) reported that strawberry plant has a short thickened stem (called a "crown") which has a developing point at the upper end and which structures roots at its base. From a cultural perspective, it has the development of 1-2 "side stems" called branch crowns structure during the pre-winter. Each branch crown will add to the yield of the fundamental crown by delivering its own "blossom group" or what is called an inflorescence. Branch crowns and principle crowns are indistinguishable, and an inflorescence creates at the terminal developing purpose of each crown. The leaves are borne along with the crown on petioles (leafstalks) masterminded in winding design around the crown. Strawberries have compound leaves in which the sharp edge (leveled some portion of the leaf) is partitioned into 3 separate handouts, called a "trifoliate".

Strawberry (*Fragaria* spp.) is a member of the Rosacea family, alongside apples, plums, and a few other significant organic products. It is an enduring, herbaceous, and minute plant, developing low to the ground 3 from a focal crown. Roots reach around 15-30 cm into the ground underneath the crown and live for quite a while. Most cultivars have trifoliate, compound leaves masterminded in a winding around the crown. Strawberries imitate explicitly through seed; they can likewise repeat abiogenetically utilizing their stolons, or sprinters, which grow a few cm away from the 'mother' plant before establishing into the ground at the hubs and building up another crown. A few weeks after the fact, the stolon falls apart and the new 'little girl' clone is free of its 'mother', inevitably developing its blossoms, leaves, and stolon (**Martin and Tepe 2014, and Davis 2015**).

REVIEW OF LITERATURE

As mentioned by **USDA (1999)** the strawberry organic products are plentiful in nutrient C, B1, B2, protein, calcium, potassium, copper, and iron, the greater part of the nutritious components fundamental for the individual.

Strawberries contain an assortment of non-nutritive parts, for example, polyphenolic phytochemicals (flavonoids, phenolic acids, lignans, and tannins). Strawberry phytochemicals are predominantly presented by a broad class of phenolic intensifies that have numerous unnecessary capacities in plants and colossal organic possibilities in humans **(Hakkinen and Torronen, 2000).**

Scalzo *et al.* (2005) mentioned that incredible intrigue has been created in strawberries on account of their amazingly high substance of nutrient C, which makes them a significant wellspring of this nutrient for human nourishment.

The significant class of phenolic mixes is spoken to by the flavonoids (principally anthocyanins, with flavonols and flavanols giving a minor commitment), trailed by hydrolyzable tannins (ellagitannins and gallotannins) and phenolic acids (hydroxybenzoic acids and hydroxycinnamic acids), with dense tannins (proanthocyanidins) being the minor constituents **(Aaby *et al.* 2005).**

As indicated by the accessible information of **Tulipani *et al.* (2008)** who reported that together with vitamin C, folate assumes an urgent job in underlining the micronutrient substance of the strawberry while thinking about that, among organic products, it is one of the most extravagant common wellsprings of this fundamental micronutrient; its substance is considered in the scope of 20 to 25 mg/100 g fresh weight.

Strawberry performs a healthy food choice. In addition, its dietary fiber and fructose substance may add to managing glucose levels by easing back processing, with its fiber content additionally adding to control calorie admission by its satisfying impact. To a lesser degree,