SOME FACTORS AFFECTING *IN VITRO* PROPAGATION OF STRAWBERRY (*Fragaria x ananassa*)

By

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B.Sc. Agric. Sci. (Horticulture), Fac. Agric., Ain Shams Univ., 2006

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APPROVAL SHEET

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ABSTRACT

This study was carried out during the period from 2010 to 2015 at the Tissue Culture Research Laboratory, Vegetable Research Departments, Horticulture Research Institute, Giza, Egypt. The aim of this work was to improvement of the performance of strawberry plants in tissue cultures. Also hardened the *in vitro* plantlets to the open field. To achieve optimal number of shoots per explant and cluster weight (g) cultured shoot tip on MS medium and Boxus (1974) medium supplemented with 1.0 mg/l BA and 0.1 mg/l IBA. Sweet Charlie cultivar producing more shoot number than Florida cultivar, shoot tip explant producing highest values of number of shoot and cluster weight, MS- medium and Cossio and Menin 1982- medium revealed similar values of number of shoot and cluster weight, the darkness conditions (24 h darkness for 15 days then later normal conditions) showed higher values of number of shoots and cluster weight, 3.0 mg/l TDZ producing highest values of number of shoot and cluster weight when meristem explant is used but when the shoot tip explant used 1.0 mg/l BA producing highest values of number of shoot and cluster weight. The third subculture obtained the best values of number of shoot and cluster weight. Sweet Charlie cultivar plantlets obtained maximum values of plantlet height on hormone free MS medium at half or double strength while Florida cultivar on MS-medium at half strength supplemented with 1.0 mg/l IBA. Elongated shoots of Sweet Charlie and Florida cultivars gave the maximum number of roots and root length on MS medium supplemented with 1.0 mg/l NAA and 30 g/l sucrose. Plantlets of Sweet Charlie cultivar which were produced on 1/10 strength MS solid medium as a pre- acclimatization were successfully hardened by growing in transplanting media consisted of soil: sand: compost (1:1:1 v/v/v).

Key words: *In vitro culture, Strawberry, Type of medium, Plant growth regulators,Cultivars,Subculture,Incubating condition, Acclimatization.*

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LIST OF ABREVIATIONS

Abbreviation	Full name
BA	6-Benzyl adenine
BAP	Benzyl amino purine
cm	Centimeter
cv	Cultivar
g/l	Gram per liter
h	Hour
IAA	Indole-3-acetic acid
IBA	3-Indolebutyric acid
Kin	Kinetin; 6-furfurylaminopurine
mg/l	Milligram per liter
ml	Milliliter
MS	Murashige and Skoog medium
NAA	α-Naphthalene acetic acid
TDZ	Thidiazuron; N-Phenyl-N-1,2,3-thidiazol-5 ylurea
v/v	Volume to Volume
W	Watt
µM	Micromolar

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INTRODUCTION

Strawberry (*Fragaria* × *ananassa Duch*.) is a natural hybrid of *Fragaria chiloensis* and *Fragaria virginiana*. It is a perennial herb belonging to the *Rosaceae* family. Strawberry is a traditionally popular delicious fruit for its flavor and taste. It can be consumed fresh, frozen or processed. According to **The Nutrient Database for Standard Reference (1999)** strawberry fruits are rich of vitamins C, B1, B2, proteins, calcium, potassium, copper and iron which are most essential for human being of the nutritious elements.

Strawberry cultivation is concentrated in the governorates of Ismailia, Qalyubia, Al Sharqia and Al Beheira. According to **FAO (2012)**, strawberry cultivated area in Egypt was 13888.1 Feddan with production of 242297 Tons, and this area is in increasing over the years. Also, in Egypt the exported quantity of strawberry was 74976 Tons and 58721 (1000$), while the imported quantity was 348 Tons and 189 (1000$). Also Egypt occupies fourth place of strawberry world production in 2012 by 5.5% of total world production.

Strawberry is propagated by runners therefore the health of daughter plants depends on their mother plants. On the other hand, Strawberry is affected by numerous viruses that greatly reduce the yield (**Pisi, 2008**). The viruses cause some viral diseases that cause smaller leaves, decreasing in the photosynthesis rate and eventually reducing fresh and dry weight. In complex infections (more than one virus infection), the rate of photosynthesis per unit area also was

profoundly reduced (**Kang *et al.* 1981**). The yield reduction caused by some viruses may be up to 80% **(Thompson and Jelkman, 2003)**. Therefore the runners of strawberry are not always suitable for this type of cultivation due to their vulnerability and susceptibility to pathological agents. The use of meristem culture for virus elimination is employed for a number of species. Furthermore, meristem regenerated plants usually maintain the genetic characteristics of the parent plant **(Nehra and Kartha, 1994)**. Meristems, generally obtained from runners of virus-free plants, are commonly used to establish *in vitro* cultures, which are employed for mass propagation or as a source of plant material for regeneration and transformation experiments **(Boxus, 1992)**. The method for avoiding virus infections was using meristem culture from health mother stocks, as a propagation material, **Sim *et al.* (2007)**. Micro-propagated strawberry plants were comparatively better in different characters, i.e. crown size, number of runners, flowering time and yield of berries, than conventionally propagated runner plants (**Karhu and Hakala, 2007**). Strawberries can be propagated *in vitro* conditions by using tissue culture methods where as micro-propagation is a very useful technique for plant improvement. *In vitro* culture of meristem is a successfully method for mass propagation of strawberry plants in some countries. It was estimated that several millions of plants can be produced within a year from few number of mother plants by using tissue culture technique (**Boxus, 1983**). Micro-propagation was proved to be an alternative tool for rapid mass multiplication, disease free plant production and year around availability of strawberry planting

materials. In micro-propagation, it is desirable to produce plantlets that can grow better after transplanting into the soil. So that, acclimatization is the most crucial stage and process during micro-propagation as *in vitro* raised plantlets are not readily adapted for directly *in vivo* conditions.

The main purpose of this work was to improve the performance of strawberry plants in tissue culture by studying some of factors that affect the growth of strawberry *in vitro*.