GROWTH AND PRODUCTIVITY OF EGGPLANT AS AFFECTED BY PINK PIGMENTED FACULTATIVE METHYLOTROPHIC BACTERIA

By

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B.Sc. Agric. Sc. (Horticulture), Ain Shams University, 2001

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ABSTRACT

Hossam Eldin Mamdouh Abdelsalam: "Growth and Productivity of Eggplant as Affected by Pink Pigmented Facultative Methylotrophic Bacteria". Unpublished M.Sc. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2019.

Field experiments were carried out during the summer seasons of 2014 and 2015 at the Experimental Farm, Faculty of Agriculture, Ain Shams University, to study the effect of applying pink pigmented facultative methylotrophic bacteria (PPFM) by dipping and foliar spray on vegetative growth and yield of eggplant (*Solanum melongena* L.). The vegetative growth of eggplant responded positively to dipping seedlings in PPFM which gave the highest values of growth parameters, i.e. number of leaves per plant, leaf area, nitrogen & potassium concentration in leaf and total protein in fruit, in the two seasons as compared with control (dipping in water). The application of PPFM as foliar spray, increased significantly plant growth (plant length, leaf number, potassium concentration in leaf, vitamin "C" in fruit and total yield per plant) in the two seasons as compared with the other studied foliar application treatments. The interaction between dipping seedlings in PPFM and PPFM foliar spray at all concentrations gave synergistic effects on growth parameters and yield components of eggplant, during the two growing seasons as compared with either individual foliar application or control plants.

Key words: Eggplant, *Solanum melongena* L., Pink Pigmented Facultative Methylotrophic Bacteria, Foliar spray, Dipping, Growth, Yield.

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Abbreviations used in this Thesis

Abbreviation	Meaning of abbreviation
A.O.A.C.	Association of official agricultural chemists
°C	Degree Celsius
Cm, Cms	Centimeter, Centimeters
cv., cvs.	Cultivar, Cultivars
D.W.	Dry Weight
Fed.	Feddan
g, gm	Gram
Kg	Kilogram
L.A.A.	L Ascorbic acid (Vitamin C)
m	Meter
mm	Millimeter
M.S.	M static software
mg	Milligram
ml	Milliliter
t	Ton
POX	Peroxidase
PPO	Polyphenol oxidase
PCR	Polymerase Chain Reaction
MIA	Microbial Inoculant Activity
MDA	Malondialdehyde
PPFMB	Pink pigmented facultative methylotrophic bacteria
PSB	Phosphorus solubilizing bacteria
LAI	Leaf area index
ABA	Abscisic acid
IAA	Indole-3- acetic acid
HPLC	High-performance liquid chromatography
SVI	Seed vigour index

INTRODUCTION

Eggplant is an important vegetable crop plant used in the preparation of the food in summer and winter. It has a high nutritional value, as it was rich in antioxidants, vitamins and nutrients. It belongs to one of the subsidiaries of the family Solanaceae (Solanaceae) and its scientific name was *Solanum melongena* L. The total area of it in Egypt was 55844 feddan, where feddan productivity was 11227 tons per feddan and therefore the total production is 626967 tons (**Egyptian Ministry of Agriculture, 2014**).

Currently, the demand for eggplant (*Solanum melongena* L.) worldwide has increased. In Egypt, eggplant was considered as one of the most important crops grown in the summer season. The varieties of *Solanum melongena* L. show a wide range of fruit shapes and colors, ranging from oval or egg-shaped to long club-shaped; and from white, yellow, green through degrees of purple pigmentation to almost black. Eggplant fruits contain a considerable amount of carbohydrates, proteins and some minerals and it's known for being low in calories and having a mineral composition beneficial for human health. They are also a rich source of potassium, magnesium, calcium and iron. The hybrids of eggplant have many advantages compared with open-pollinated cultivars in terms of yield and disease resistance. The yield depends upon several production factors. Among these proper, balanced nutrition plays a significant role.

There are many microbes living on the phylloplane which probably lead a saprophytic lifestyle, feeding on materials leached from the leaf and one such example is pink pigmented facultative methylotrophs (PPFMs). These are physiologically an interesting group of bacteria able to grow on methanol, methylamine as well as on a variety of C_2, C_3 and

C4 compounds **(Lidstrom, 1992).** PPFM ubiquitous in nature and frequently reported on various plant species, are a substantial part of the aerobic, heterotrophic microflora of the surfaces of young leaves (**Meena, *et al*., 2012**). They are capable of growing on C_1 compounds such as formate, formaldehyde and methanol, in addition to C_2-C_4 compounds (**Lidstrom, 2001 & Iguchi, *et al*., 2015**). Moreover, they are able to produce plant growth regulators such as cytokinins and auxins (**Omer, *et al*., 2004 & Nadali, *et al*., 2010**) which affect plant growth and different physiological processes. The PPFM can also, induce systemic resistance against diseases and heavy metals (**Madhaiyan, *et al*., 2004**) and degrade a wide range of highly toxic compounds metals (**Jahan, *et al*., 2013**). Methanol is considered a natural product of plant metabolism, as all plant tissues emit methanol (**Gout, *et al*., 2000**) especially during early stages of leaf expansion (**Fall and Benson, 1996**). Some of this methanol is rapidly oxidized in the presence of light to water and CO_2 (**Galbally and Kirstine, 2002**). Generation of CO_2 from methanol can also occur by PPFM (**Lee, *et al*., 2006 & McTaggart, *et al*., 2015**). Increasing CO_2 concentration inside stomata leads to accelerate the rate of photosynthesis and decrease the rate of photorespiration in C_3 plants, because the competition between CO_2 and O_2 for RuBisco enzyme (the enzyme responsible for reducing CO_2 and synthesis of carbohydrates during photosynthesis in C_3 plants) (**Ramirez, *et al*., 2006**). Also, **Kumar *et al.* (2016)** reported that, different aspects of the interaction between methylotrophs and host plants are discussed, including the role of methylotrophs in phosphorus acquisition, nitrogen fixation, phytohormone production, iron chelation, and plant growth promotion, and co-inoculation of these bacteria as biofertilizers for viable agriculture practices. In addition, several beneficial aspects such as stimulation of

seed germination, plant growth promotion, and production of phytohormones have been reported for Methylobacterium (**Santosh, *et al*., 2019**).

Therefore, this study was aimed is to investigate the effect of foliar spray with PPFM and PPFM dipping on vegetative growth, yield and quality of eggplant.

Review of Literature

In order to fulfill the objective of this study, the collected literature will be reviewed under the following main headings:

2.1. Vegetative growth characteristics.

2.2. Chemical constituents.

2.3. Yield and its components.

2.1. Vegetative growth characteristics:

The impact of pink pigmented facultative methylotroph (PPFM**)** on vegetative growth has been studied by many researchers. **Holland (1997)** reported that the invention provided a method for increasing productivity of a plant by spraying PPFMs on a plant. Also, **Lungu *et al*. (2002**) showed that growth had been enhanced by applying pink pigmented facultative methylotroph, PPFM, bacteria on soybean, Glycine max, in experiment conducted in field trials at the UMES experiment station. Soybean cv. Corsica. Soybean seeds were inoculated with an elite strain of *Bradyrhizobium japonicum*, USDA Tal 11 Nod, PPFM and combination of both. Other treatments were foliar spray with PPFM alone at R5, and seed inoculation with bradyrhizobia and later sprayed with PPFM at R5. The highest growth was obtained when soybean seeds were inoculated with *B. japonicum* strain TAL 11 Nod and plants sprayed with PPFM at R5, followed by those *B. japonicum* inoculated and PPFM.

Madhaiyan *et al*. (2004) detected that PPFMs, persistent colonizers of plant leaf surfaces (belong to the genus *Methylobacterium*) are mostly transmitted through seeds.