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TRIALS ON PRODUCING TOMATO HYBRIDS SUITABLE FOR GREENHOUSE CONDITIONS IN EGYPT

By

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B.Sc. Agric. Sci. (Horticulture), Faculty of Agriculture, Ain Shams University, 2003
M.Sc. Agric. Sci. (Vegetable Crops), Faculty of Agriculture, Ain Shams University, 2017

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Approval Sheet

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ABSTRACT

Wafaa Saber Elsadek. Trials on Producing Tomato Hybrids Suitable for Greenhouse Conditions in Egypt. Unpublished Ph.D. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2022.

This investigation was conducted at Kaha Research Farm, Qalyubia Governorate, affiliated to the Horticultural Research Institute, Agricultural Research Center, Egypt, during three seasons (from 2018 to 2021). The study aimed to evaluate the performance of twenty exotic indeterminate genotypes of tomato (*Solanum lycopersicum* L.) to determine its suitability of cultivation under greenhouse conditions. The study material was obtained from two globally known gene banks namely, the Centre for Genetic Resources of the Netherlands and U.S. National Plant Germplasm System (GRIN-Global) of United States Department of Agriculture. One locally registered hybrid, Asya was used as the check. The experimental layout was complete randomized block design with three replications. The investigation consisted of two parts; the first part was to evaluate the performance of 15 exotic indeterminate genotypes of tomato. While, the second part to hybridization between the best five genotypes and obtain all possible hybrids. Data were collected for vegetative, flowering and fruit characteristics as well as the number of fruits and both early and total yields per plant. Highly significant differences were observed among the exotic genotypes and the check for all studied characteristics.

The results of part A of the study revealed that the mean check values of fruit weight, firmness and pericarp thickness were significantly high, and several of the exotic genotypes exceeded the check values for vegetative, flowering, and yield characteristics under study. The genotypes coded as G.21 (Allround), G.18 (Alicante), G.6 (Marsol), G.7 (Harzer Kind) and G.3 (Robar) are promising for their overall

performance in the total yield per plant and can be recommended for further exploitation to produce hybrids.

The results of part B of the study, based on overall performance versus to the check hybrid, the hybrid H.13 showed the highest early yield. While, the hybrid H.15 gave the highest total yield per plant, so these hybrids can be further exploited. The parents P1 and P3 showed good performance in the studied yield characters, so they could be exploited to improve the yield in breeding programs. Number of clusters per plant, number of flowers and fruits per cluster, fruit set percentage, number of fruits and early yield per plant were found to have significant influence on yield per plant. Which indicate that yield could be increased by improving these traits.

Keywords: Indeterminate tomato, Exotic genotypes, Evaluation, Heterosis, Combining ability and Correlation.

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CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

MPH%	Mid-parent heterosis
GCA	General combining ability
SCA	Specific combining ability

INTRODUCTION

Tomato, a member of the family Solanaceae, is considered a dominant vegetable crop grown and widely consumed throughout the world. In addition, tomatoes are particularly appreciated for their nutritional properties, resulting from its content of vitamins A, C, lycopene, flavonoid and other minerals that are good for human health **(Bhowmik *et al.*, 2012; Akhtar and Hazra, 2013)**. Moreover, it has special taste with diverse edible methods besides its significant importance in processed products across the globe. Tomatoes are originated in Central and South America (including tropical, sub-tropical and temperate regions). It is the largest vegetable crop in the world next to potato.

In Egypt, tomatoes are cultivated in open fields and/or under greenhouse conditions. The cultivated area of tomatoes reaches 428,175 feddans, producing 6,751,856 tons with an average productivity of 15.7 tons per feddan **(FAOSTAT, 2019)**. The number of greenhouses cultivated with tomato reaches 4,100 (1,267,251 m^2) producing 18,021 tons, with an average productivity ranging between 8.5 and 16.3 kg/m^2, according to the statistics of Ministry of Agriculture and Land Reclamation, Egypt in the 2018/2019 season.

One of the main obstacles in the cultivation of the crop in Egypt is the high cost of imported seeds. Other hindrances include the absence of good strains and high-yielding varieties that can improve the yield in breeding programs. Besides, most of the area of tomato crop nowadays is still under F_1 hybrids, which their seeds are imported form developed countries. Therefore, there is dire need for developing high yielding tomato hybrids or suitable true breeding varieties.

Several breeding methods and techniques are required for the development of new commercial varieties. Hybrid technology has become one of the main factors contributing to the significant global rise in

agricultural output over the last few decades. Exploitation of hybrid vigor and selection of parents based on combining ability have been important breeding approaches in crop improvement **(Sharma *et al.*, 2015)**. In Pakistan, the availability of suitable high yielding varieties not only increases the tomato yield and profits of a farmer but also fills the gap in production **(Khan *et al.*, 2017)**. In Egypt, few studies have been carried out for the development of indeterminate tomato lines. Consequently, new indeterminate lines or cultivars suitable for cultivation under a greenhouse with high yield and fruit quality should be developed **(Mahmoud and Khalil, 2019)**. A common observation in most genotypes with superior performances in fruit yield is the high score for one or more yield component traits, including the number of fruits per plant, the number of clusters per plant, fruit weight, and the total yield per plant. The differences recorded by various authors may be due to the differences in the genetic materials and evaluated locations (O**char *et al.*, 2019)**. Tomato production faces the significant problem of low yield due to various biotic and abiotic stresses. Therefore, the introduction and evaluation of exotic tomato germplasm have become necessary to acquire elite materials to develop future breeding programs (**Hassan *et al.*, 2021).**

Several exotic cultivars have excellent adaptation, whereas others are a valuable source of diversity in breeding material. Considering this, the present investigation was undertaken to:

1. Evaluate the performance of several exotic genotypes of tomato for growth and cultivation under our agro- climatic greenhouse conditions to determine their value for use as parents in tomato breeding programs in order to produce hybrids.
2. Generate information and exploitation of hybrid vigor and selection of parents based on combining ability to assess the prepotency of parents in hybrid combination. In addition, taking overview about correlation