Studies on Root-Knot Nematode Disease on Tomato Plants in New Valley Governorate, Egypt

By

Shaimaa Nagy Riad Sef El Deen

B.Sc. Agric. (Plant Pathology), Assiut University, 2005
M.Sc. Agric. (Plant Pathology), Assiut University, 2012

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Supervised by

Prof. Dr. Aida M. I. El-Zawahry
Prof. Dr. Hamdy M. El Aref
Prof. Dr. Hanaa S. Zawam

Examined by:

Prof. Dr. El-Shawadfy M. Mousa
Prof. Dr. Ashraf E. Khalil
Prof. Dr. Aida M. I. El-Zawahry
Prof. Dr. Hamdy M. El Aref

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Summary

Tomatoes yield are reduced by plant-parasitic nematodes (PPNs) can that act as pests on a wide range of important agricultural crops. Root-knot nematodes (*Meloidogyne* spp.) are among the most destructive agricultural pests globally. Therefore, the present investigation was designed to study the survey of the occurrence of plant parasitic nematodes associated with tomato plants cultivated in 7 localitiesin El-Dakhla center, New valley Governorate. Currently, the use of nematicides is being limited, which are expensive, given the increasing concern for human health as well as the environment. Scientists are also looking for other nematode management strategies that aim to reduce pesticide use and to promote non-chemical management practices as much as possible. One of the proposed environmentally friendly options is Induced Systemic Resistance (ISR). It is accepted as one of the most promising methods for controlling plant diseases.

The present work was conducted to study the following main points:

1- Survey studies on plant parasitic nematodes associated with tomato plants cultivated in New Valley Governorate**.**

2- Extraction and identification the plant parasitic genera.

3- Identification the species of *Meloidogyne* by: (perineal pattern technique, Isozyme characterization and species specific markers (SCAR).

4- Genetic characterization of *M. incognita* and *M. javanica* using RAPD-PCR markers and sequence-related amplified polymorphism (SRAP).

5- Study of the susceptibly of twelve local tomato cultivars to root-knot nematode, (*M. incognita* and *M. javanica*).

6- Molecular marker screening of tomato resistance genes (*Mi* gene) for root-knot nematodes (*Meloidogyne* species) using PCR analysis**.**

7- Induction of systemic resistance in tomato plants using some abiotic agents against root-knot nematode**.**

Results of our study can be summarized in the following:

1- A total of 175 soil and root samples were collected from the major cultivated tomatoes grown in seven localities (El shekhwally, El maasara, Mutt, El moshea, El gededa, El kasr and Beet kholo) in El-Dakhla center, New Valley Governorate. Samples were processed for nematode extraction and identification. Results showed that, 10 genera of plant-parasitic nematodes were found in the soil and root samples of tomato plants. These genera are *Meloidogyne*, *Aphelenchus*, *Pratylenchus*, *Rotylenchulus, Tylenchorhynchus*, *Heterodera*, *Helichotylenchus*, *Merlinius*, *Trichodorus* and *Ditylenchus* .The genus *Meloidogyne* was the most prevalent where found in 6 localities.

2- Perineral patterns, Isozyme characterization and SCAR amplification analysis observed that two different root-knot nematode species which identified as *M. incognita* and *M. javanica*.

3- RAPD-PCR analysis was used to determine the genetic variability and relationships between the nematode isolates and species. Five RAPD primers namely OPA01, 03, 05, 07 and 08, were used to differentiate between three isolates of *M. incognita* (isolates No. 4, 6 and 7) and five isolates of *M. javanica* (isolates No. 1, 2, 3, 5, and 8). Over all RAPD primers**,** the dendrogram showed that all tested isolates of *M. javanica* were separated from *M. incognita* isolates in two clusters within an overall branched-off 58.3% genetic similarity.

4- Four SRAP primer combinations were used to determine the genetic variability and relationships between 3 isolates of *M. incognita* (isolates No. 4, 6 and 7) and 5 isolates of *M. javanica* (isolates No. 1, 2, 3, 5, and 8). Over all SRAP primer combinations, the four SRAP primer combinations are more reliable than single primer .The dendrogram separated the isolates of *M. javanica* from *M. incognita* isolates, each of them in one cluster within a branched-off 48.2% genetic similarity.

5- Studying the susceptibility of twelve tomato cultivars to the *M. incognita* and *M. javanica* showed that the screened tomato cultivars infected with *M. incognita* were rated as six highly resistant (Imbrial, 745, GS, 010 Zaman and Fayroz), three resistant (Zooma, Super strain B American and Elien), two moderate resistant (65010 and 162) and one susceptible (Super strain B Australian) as a host category which were decided based on the root egg masses index (EI). While the evaluation of the ability of tested cultivars to infection with *M. javanica*, five cultivars (Imbrial, 745, 010, Fayroz, and Elien) exhibited highly resistant (HR), six cultivars (65010, Gs, Zooma, Super strain B American, Zaman and 162) exhibited moderate resistant and one susceptible (Super strain B Australian).

6- Total and non- reducing sugars, total and free phenols and protein contents were studied in all twelve tomato cultivars infected with *M. incognita* and *M. javanica*. Results showed the amounts of total and non-reducing sugars differed relatively due to different cultivars. A significant increase in amounts of total phenols was noticed in all infected tomato plants comparing with healthy

control except Elien and 745 which recorded low amounts. The most of cultivars showed significant reduction in total protein.

7- The impact of the previous tomato cultivars infected with *M. incognita* and *M. javanica* on the ability to stimulate peroxidase (PO) and polyphenol oxidase (PPO) activities. Data revealed that there were different effects on the activity of enzymes.

8- Twelve tomato cultivars were screened for *Mi* gene using PCR analysis. The *Mi* gene was detected in four cultivars Imbrial, 745, super strain B American and Fayroz while not detected in the other varieties.

9- The effects of nine chemical compounds on the induction of local resistance in susceptible tomato cultivar, Super strain B Australian infected with *M. incognita* and *M. javanica* were investigated under greenhouse conditions. All the tested treatments showed significant decrease in the number of second stage juveniles (j2s) in soil, number of galls, egg masses and females in root system and inhibited the nematode reproduction factor (RF). The best results attributed to the treatment with Citric acid followed by L-arginine and Gibberellic acid.