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Effect of *Pseudomonas aeruginosa* on the Root-Knot Nematode *Meladogyne incognita* Infecting Tomato, *Lycoperiscum esculentum*

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Abstract: Due to environmental concerns and increased regulation on use of chemical fumigants, more management, strategies for control of root - knot nematodes (*Meloidogyne incognita*) are currently being investigated on biological control using microbial antagonists as a potential alternative to chemical nematicides. Among the biological control agents that have been assessed are egg- parasitic fungi, nematode trapping fungi, bacteria and polyphagous predatory nematodes. Microorganisms that can grow in the rhizosphere provide the front line defense for roots against pathogen attach and are ideal for use as biocontrol agents. Fungi and bacteria are two major groups of microbes which are abundant in soil and some of them have showed great potential as bio control agent's nematodes. Hence, the present study has been carried out the effect of *Pseudomonas aeruginosa* on the root-knot nematode *Meloidogyne incognita* infecting tomato, *Lycoperiscum esculentum.* Isolate I and II inoculated tomato plants showed better growth compared to plants infested with *Meloidogyne incognita*. Our result also revealed that, there is a significant increase in plant height, shoot weight, root weight, moisture content and decreased gall index.

Key words: *Pseudomonas aeruginosa* · *Meladogyne incognita* · *Lycoperiscum esculentum* · Biological control measures · Elephant dung

INTRODUCTION

Microorganisms are used as biofertilizers to stimulate plant growth by providing necessary nutrients as a result of their colonization at plant rhizoshere by symbiotic association. Sustainable agriculture relies greatly on renewable resources like biologically fixed nitrogen. Next to nitrogen, 'P' is important nutrient required by plants for its growth. It was estimated that 98% of Indian soil contain insufficient amounts of available to support maximum plant growth [1]. Plant growth-promoting rhizobacteria (PGPR) are naturally occurring soil bacteria that aggressively colonize plant roots and benefit plants by providing growth promotion. Inoculation of crop plants with certain strains of PGPR at an early stage of development improves biomass production through direct effects on root and shoots growth. Inoculation of ornamentals, forest trees, vegetables and agricultural crops with PGPR may result in multiple effects on early-season plant growth, as seen in the enhancement of seedling germination, stand health, plant vigor, plant height, shoot weight, nutrient content of shoot tissues, early bloom, chlorophyll content and increased nodulation in legumes. They help in increasing nitrogen fixation in legumes, help in promoting free-living nitrogen-fixing bacteria, increase supply of other nutrients, such as phosphorus, sulphur, iron and copper, produce plant hormones, enhance other beneficial bacteria or fungi, control fungal and bacterial diseases and help in controlling insect pests [2].

The root knot nematodes are included within the genus *Meloidogyne Goldi*, 1892 and belong to a relatively small but important polyphagous group of highly adapted obligate plant pathogens. Typically, they are distributed worldwide and parasitize nearly every species of higher plant. Due to their endoparasitic way of living and feeding, root knot nematodes disrupt the physiology of the plant and may reduce crop yield and product quality

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and, therefore, are of great economic importance and make control necessary [3]. Root knot Nematodes are major pests of field and vegetable crops. They cause damage to many economically important horticultural crops likes potato, cotton and tomato. Plant parasitic Root knot Nematodes cause considerable looses in both commercial and subsistence tomato production systems and their control remain difficult. Tomato (*Lycopersicon esculentum*) is highly susceptible to Root knot Nematodes; *Meloidogyne incognita* various Nematode antagonistic fungi have been studied for there use as biocontrol agents [4]. Root-knot nematodes occur throughout the world but are found more frequently and in greater numbers in areas with warm and hot climate and short or mild winters. They attack more than 2000 species of plants almost all cultivated plants such as, vegetables, pulse, ornamentals etc., [5]. In India, *M. incognita* is reported almost widely occurring species [6]. Among the root-knot nematodes, *Meloidogyne incognita*, *M. javanica*, *M. arenaria* and *M. hapla* have major agronomic importance and are responsible for at least 90% of all damage caused by these nematodes [7]. Recent studies led up to an increasing attention towards the biocontrol potential of rhizosphere bacteria from several plant species against various plant pathogens including nematodes and viruses [8, 9]. Hence the present study has been done to evaluate the effect of *Pseudomonas aeruginosa* against the root-knot nematode *Meloidogyne incognita* infecting tomato, *Lycoperiscum esculentum.*

MATERIALS AND METHODS

Surface sterilized tomato, *Lycoperiscum esculentum* (PKM - 1) seeds were sown in mud pots of 2 kg capacity containing autoclaved sterilized river soil, garden soil and red soil (2:1:1). After seed germination (three leaf stage), the freshly J_2 root-knot nematode, *M. incognita* were collected from nematode culture on host plant (brinjal) were inoculated with 500 larva by pouring into four holes made around the root zone of tomato. These holes were closed with top soil then distilled water was added. One set of plants was kept uninoculated to serve as control; one set inoculated with nematode only, one set inoculated with bacterial isolate I and another with isolate II (10^6 CFU/ml) and inoculated with nematode. Each treatment was replicated three times. After 60 days of treatment, both the treated, inoculated and control plants were uprooted without any damage to the seedlings and they were thoroughly washed with tap water in order to remove soil and debris particle. Then the shoot length, above ground part was measured with the help of meter scale. The fresh shoot and root of the plants were kept in oven at 80°C for 24 hours and the dried plant weight was measured. The gall index was measured by Sasser *et al*. [10]. Total Nematode juveniles in soil were extracted by decanting and sieving technique [11].

RESULT AND DISCUSSION

Root-knot nematodes are one of the most economically important pest causing severe damages and losses in a wide variety of crops worldwide. Estimates of nematode damage of tomato yield worldwide ranged from 28 to 68%. However, the control of plant parasitic nematodes still essentially relies on crop rotation and chemical nematicides. Unfortunately, chemical nematicides are costly and very toxic compounds which hazards to human health and the environment. Therefore, safe and environmentally friendly alternatives are becoming increasingly important. Microorganisms with the ability to antagonize nematodes represent realistic alternatives to chemical nematicides. It was found that, our Isolate I and II inoculated tomato plants showed better growth compared to plants infested with *Meloidogyne incognita* (Table 1). Our result also revealed that, there is a significant increase in plant height, shoot weight, root weight, moisture content and gall index (Fig. 1) in bacterium Isolate inoculated plants. It is a significant reduction in nematode in Isolate I and II inoculated plants (Fig. 2). Elyousr, (2010) reported that *P. fuorescens and P. aeruginosa* treatments, which reduced root gall index 57-61% after sixty days treatment [12]. The widely recognized mechanisms of biocontrol mediated by plant growth promoting bacteria (PGPB) are competition for an ecological niche or a substrate, production of inhibitory substances and induction of systemic resistance in host plants to a broad spectrum of pathogens and/or abiotic stresses. It was found that, our Isolate I and II inoculated tomato plants showed better growth compared to plants infected with *Meloidogyne incognita* only. Similarly, Shaukat *et al.* [13] reported that *Pseudomonas fluorescens* and *Pseudomonas aeruginosa* reduced *M. javanica juvenile* penetration into tomato plants. San and Shaukat, [14] reported that *Rhizobacteria* have been tested for their biocontrol potential against plant parasitic nematodes. Siddiqui (2009) reported that *Pseudomonas* isolates were better in improving plant growth and reducing galling and nematode multiplication and he is suggested that *Pseudomonas fuorescens* may successfully be used for

Table 1: Evaluation of anti-nematode activity of bacterial isolate I and II on *Meloidogyne incognita* infected tomato growth parameters

S.No	Parameters	Control	Infected	Isolate - I	Isolate - II
1.	Plant height (cm)	25.25±0.53	22.37±0.45	32.48±0.65	30.53±0.39
2.	Fresh weight of shoot (g)	15.59±0.27	17.32±0.82	25.62±0.56	34.51±0.45
3.	Dry weight of shoot (g)	2.61±0.47	4.29±0.67	2.86±0.89	5.84±0.49
4.	Fresh weight of root (g)	7.50±0.92	2.44±0.37	7.05±0.87	7.30±0.72
5.	Dry weight of root (g)	1.34±0.28	0.61±0.15	1.55±0.75	1.61±0.36
6.	Moisture content (%)	86.67	75.20	86.50	82.18

± S.D of three replicates

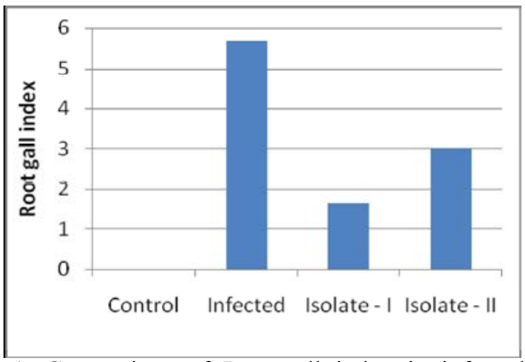

Fig. 1: Comparison of Root-gall index in infected by nematode only and experimental groups (infected and treated)

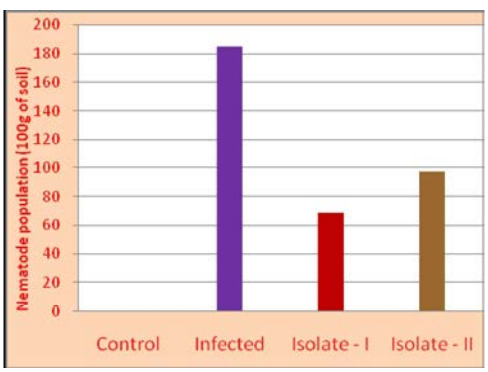

Fig. 2: Nematode population (in infected by nematode only) and experimental groups (inoculated and treated)

the biocontrol of *Meloidogyne incognita* [15]. Our result also revealed that, there is a significant increase in plant height, shoot weight, root weight, moisture content and reduced of gall index in Isolate inoculated plants infected by *M. incognita*.

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