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First Report on the Root-Knot Nematode *Meloidogyne enterolobii* (Yang and Eisenback, 1988) Infecting Guava (*Psidium guajava*) in Udham Singh Nagar of Uttarakhand, India

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A B S T R A C T

Guava orchards of Uttarakhand were facing sudden decline and tested root samples revealed the incidence of root knot nematode. The nematode infested plant manifested a drastic reduction in plant growth, absence of fine roots, a poorly developed root system, and a decline in yield quality and quantity. Severely infested plant shows small leaves, leaf browning, leaf drop, growth inhibition whereas roots are distorted by small and large multiple galls leading to sudden death of tree. The infected seedlings were accompanied by severely galled roots, possibly attributable to root-knot nematodes. Uttarakhand is reported for the first time with incidence of decline in growth of guava caused by the nematode, *Meloidogyne enterolobii*. Collected root samples of infected guava plant and isolated mature females were observed and studied. The perineal patterns of most specimens were similar to those in the original description of *Meloidogyne enterolobii*.

Introduction

The plant parasitic nematodes are posing serious threat to the cultivation of many vegetables and fruit crops including Guava (*Psidium guajava* L.). Presently, guava is suffering from a variety of sudden declining symptoms in Tarai region of Uttarakhand (Plate-5). An investigation were planned to assess the presence and prevalence of root knot nematode in the region, especially district Udham Singh Nagar. The root knot nematode, *Meloidogyne enterolobii* was found from all the samples collected from Guava orchard of four different places of the district, which may pose a serious threat to the guava cultivation of the state. This is the first report of such infestation in Udham Singh Nagar district of North India.

Guava (*Psidium guajava L.*) is one of the important commercial fruits in India and known as poor man fruit. It is the fourth most important fruit after mango, banana and citrus. Guava (*Psidium guajava* L.) is native to South America and the West Indies but it is also grown other parts of the tropics and subtropics including India where it is considered to be important hardy crop grown in neglected soil. Guava is prone to attacked by a range of diseases from root to the crown and fruits due to wide range of variation in the climatic

conditions. A number of plant pathogens of have been reported including fungi, bacteria, algae and nematodes, are found to cause various types of diseases. A new species of root-knot nematode i.e. *Meloidogyne enterolobii* is an emerging problem in guava and has been reported from Tamil Nadu in recent years and wide spreading now across the Country (Poornima *et al.*, 2016).

Current problem were taken into consideration and an investigation was planned and conducted on the presence of any such disease by nematode on Guava in Udham singh nagar, Uttarakhand. Representative samples of root and soil were collected from Horticulture Reserch Centre, G.B. Pant University of Agriculture and Technology Pantnagar, Khelakher (Farmer orchard), Bazpur (Farmer orchard) and Govt. Potato seed Production Farm, Kashipur area.

The nematode infested trees of guava plant show above-ground decline symptoms including a drastic reduction in plant growth, before death of tree, leaves shows bronzing (Plate-1), stunting of plant, reduced fruit number and size, whereas below ground symptoms showed relatively large galls, absence of fine roots, a poorly developed root system (Plate-2), declining in yield quality and quantity. Severely infested roots are distorted by small and large multiple galls, after tearing of the infected roots brown colored degradation is visible. These symptoms in mature plants were possibly attributable to root-knot nematodes. The roots of such infected mature plants were used for detailed study. The egg masses were observed inside the galled tissues and the galled fine roots were stained with 0.1 per cent lacto phenol-acid fuchsin solution. Stained infected roots showed the presence of red colored egg masses, several long necked females (Plate-3). Examining under 40x microscope, small, stained, pear shaped females of root knot nematodes often in cluster were present in the parenchymatus cavities of the infected roots cortex.

The second-stage juveniles (J2) and adult females were used for identification which was taken from the infected root galls. The process of fixation, dehydration and the mounting of J2 were performed according to (Seinhorst, 1959) whereas the perineal patterns were prepared according to (Riggs, 1990). Morphological identification was performed according to the original description of the species *M. enterolobii* (Yang and Eisenback, 1983 and Rammah and Hirschmann, 1988) based on the distinctive characteristics of RKNs species, such as perineal pattern morphology and head of adult females and body length, tail and hyaline region of J2 (EPPO, 2011).

The identification of the nematode was done in Nematology laboratory of the department of Plant Pathology, Pantnagar Uttarakhand and confirmed by Department of Nematology, Tamil Nadu Agriculture University, Coimbatore and Division of Nematology, IARI New Delhi. On the basis of morphological and microscopic studies, the species was confirmed as *M. enterolobii* from both the laboratories. All the roots samples of the infected plants were found to be infected with nematode *M. enterolobii.*

For observing the perineal pattern, the female were placed on the glass slides with a drop of water and cut posteriorly with the help of a sharp blade or knife. It is then cleaned, covered with neat cover slip and sealed. The prepared perineal pattern of adult females showed an oval shape, dorsal arch usually high and round, weak lateral lines sometimes present, large plasmids, typical characters of the species *M. enterolobii* (Plate-4). There is also a lip region not annulated and an elongated neck. Tail tip was marked with prominent, coarse, well separated striae.

Plate.1 Bronzing symptoms on leaves

Plate.2 Galls on root produced by *M. enterolobii*

Plate.3 Mature female of *M. enterolobii*

Plate.4 Perineal pattern of female of *M. enterolobii*

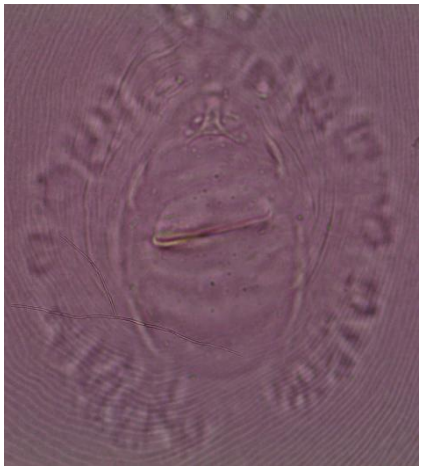

Plate.5 Completely wilted plant

This perenial pattern was similar to the pattern described for *M. enterolobii* by Yang and Eisenback (1983), Rammah and Hirschmann (1988) with some minor variation. The tail of second stage juvenile was relatively thin, long and rounded ending portion and with hyaline region, and sometimes with a lobed terminus. The male head shape for *M. enterolobii* is described as "not set off", while a slightly set off head region was observed as described for *M. enterolobii*. The present population thus was identified as *M. enterolobii* and the variation may be due to enviornmental condition or stress. *Meloidogyne enterolobii* is considered as very damaging due to its wide host range, high reproduction rate and induction of large galls (Castagnone-Sereno, 2012). Severe damage caused by *M. enterolobii* has been reported for *Psidium guajava* (guava; da Silva and Krasuski, 2012 and Martins *et al.*, 2013), *Lycopersicon esculentum* (tomato) and *Citrullis lanatus* (water melon; Cetintas *et al.*, 2007, Kiewnick *et al.*, 2009 and Ramirez-Suarez *et al.*, 2014) and *Enterolobium contortisiliquum* (pacara earpod tree, Yang and Eisenback, 1983). Compared with other root-knot nematode species, *M. enterolobii* displays virulence against several sources of root-knot nematode-resistance genes and therefore is considered particularly aggressive.

Being an sedentary endoparasite it can be easily disseminated with diseased soil, infected planting material. Several nurseries preparing the seedling by sowing guava seeds in polybags contain infested soil, after 1-2 years this rootstock used for airlaring, finally such plant provided to farmers are harboring this nematode and thus introducing the nematode to new uninfected area. So, there is an urge to seriously conduct a systemic survey of *M. enterolobii* in guava orchard and nurseries and provide a guideline for its management.

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