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Acalypha indica is a potential source of root-knot nematode infestation in cultivated fields

Z. Khan[1*], B.H. Gawade[1], N.K. Gautam[2] and J. Akhtar[1]

[1]Division of Plant Quarantine, National Bureau of Plant Genetic Resources, New Delhi 110 012, India
[2]Division of Germplasm Evaluation, National Bureau of Plant Genetic Resources, New Delhi 110 012, India

Abstract

Acalypha indica L. is a commonly growing weed in India, which is also known as Indian Acalypha. These plants were growing as a weed in pots wherein okra was planted for experimental purpose. Infestation of the root-knot nematode, *Meloidogyne incognita* was observed on it. Soil and root samples were collected for analyses of nematode infestation. Roots of the infested plants were galled measuring gall index (GI) of 3-4. The population density of second stage juveniles (J_2) in soil varies from 378-752/200cc soil and the roots were harboring 3876-7654 eggs/per root system. The root galling and presence of high population of nematode eggs and J_2 revealed that *A. indica* can be a reservoir for *M. incognita* during non-host cropping and serve as a source of infestation to other hosts in the next cropping season. So, in the light of present findings growers are advised to be watchful for *A. indica* in their fields, and keep the field free from this weed to minimize the infestation of *M. incognita* in the next crop.

Key words: *Acalypha indica*, infestation, *Meloidogyne incognita*, weed.

Acalypha indica L is a common weed, belonging to the family Euphorbiaceae, which grows up to 75 cm tall, an erect and annual herbaceous plant with numerous ascending branches with ovate leaves (Fig. 1). It occurs throughout tropical Africa and South Africa, in India and Sri Lanka, as well as in Yemen and Pakistan. It has possibly been introduced from elsewhere as a weed. It is also used in traditional medicinal system of India, as is reported to possess hepatoprotective, anti-inflammatory, antitussive, antifungal and antibacterial properties and used for wound healing (Gupta, 2010). The definition of a weed is 'any unwanted plant', essentially meaning any plant which interferes with growth and production of a desired plant species (Anderson, 1996). The problem of weed as a host to plant parasitic nematodes is particularly severe in the subtropical and tropical environments where weeds grow year round (Crane et al., 2008). Weed species enable plant-parasitic nematodes to survive in the absence as well as the presence of a crop, providing a nematode inoculum source for the following season. Several common agricultural weeds are known to be excellent hosts of plant-parasitic nematodes (Rich et al., 2009). However, no detail information available regarding the interaction of root-knot nematode and *A. indica*, except a very old record by Kannan (1968) from South India indicating that *A. indica* infested with root-knot nematode, but did not provide any data on severity of infestation. This is reported herewith for the first time from Delhi region in Northern India.

* **Corresponding author:** znema@yahoo.com

Root-knot nematodes (RKNs), *Meloidogyne* spp., are distributed worldwide, and are obligate parasites of the roots of thousands of plant species. All major field crops, vegetable crops, turf, ornamentals, legumes and weeds are susceptible to one or more of the RKN species. This genus is considered the most important among plant-parasitic nematodes, mainly due to wide host range, which is known to exceed 3000 wild and cultivated plant species (Hussey & Janssen, 2002). About 96 nominal species of *Meloidogyne* have been described (Brito et al., 2008), but within the genus, *M. arenaria*, *M. hapla*, *M. incognita*, and *M. javanica* represent 95% of all infestations in agricultural lands (Hussey & Janssen, 2002). Infested plants show typical symptoms, which include root galling, stunting and nutrient deficiency. Infestation of roots by RKNs predisposes plants to the infection by other soil-borne root-infecting pathogens and causes disease complexes. Appearance of galls on plant roots usually indicates nematode reproduction on a weed or crop plant. Generally higher number of root galls, indicates greater nematode reproduction.

Fig. 1: *Acalypha indica* plant showing chlorotic symptoms due to infestation of root knot nematode, *Meloidogyne incognita*

During October-November, 2013 while conducting experiments on screening of some vegetable germplasm for resistance to *Meloidogyne incognita* at National Bureau of Plant Genetic Resources, New Delhi, India, a few number of plants of *A. indica* inadvertently grown in pots containing 500-cc soil infested with *M. incognita* (2-J_2/cc soil) and planted with okra (*Abelmoschus esculentus* Moench) under net house conditions. Out of curiosity *A. indica* plants were uprooted from pots after six weeks of its germination, and then the roots were carefully washed with tap water to avoid the adhering soil and examined under stereoscopic microscope for the presence of root galls and egg mass formation. Root galls per plant root system were counted and root gall index (GI) of 0-5 was used as (0=no gall, 1=1-2, 2=3-10, 3=11-30, 4= 31-100, 5=>100 galls per root system) according to Taylor & Sasser (1978). Micro photographs of root galls and egg masses were taken with Nikon digital sight Fi1 (Nikon, Japan) mounted on the Nikon SM2 1500 stereoscopic microscope (Nikon, Japan). Also, soil of each pot was homogenized and J_2 of the RKN from 200-cc soil were extracted by sieving and decanting methods (Southey, 1986). Nematodes obtained in clear water were killed at 60°C and fixed in 4% formalin. Nematode eggs were extracted from infested roots by shaking roots of each plant in 1% NaOCl for 4min (Hussey & Barker, 1973). The J_2 and eggs were counted under stereoscopic microscope at 40X magnification using counting dish, which was used to estimate population density of RKN.

For taxonomic studies some females and developing stages of nematode were dissected out from infested roots, which were used for species identification of associated RKN. Some specimens of each stage were fixed in formalin glycerin mixture (F:G 4:1) solution and were

processed for dehydration by Seinhorst's rapid method (Seinhorst, 1959) and finally mounted on glass slides in anhydrous glycerin and were examined under a compound light microscope (Olympus BX 51, Japan). The RKN species as *Meloidogyne incognita* was confirmed on the basis of both perineal pattern characteristics of mature females and morphological analysis of other stages i.e. J_2 and males according to Eisenback et al., (1981). All the 10 soil and root samples collected from infested pots yielded high population of *M. incognita* J_2 and eggs. The population density of J_2 in soil varies from 378-752/200cc soil with an average population density of 567±79.8/200cc soil. Whereas eggs obtained from the infested roots were 3876-7654 eggs/per root system with an average density of 5915±1085 eggs/root, which is much higher than the economic threshold level (ETL) of RKNs (1-2 J_2/cc soil). The roots of the plants were galled (Fig. 2 A) measuring the gall index (GI) of 3-4, in addition, brown colored egg masses of *M. incognita* can also be seen on some of the root galls (Fig. 2 B). This suggests that during the off seasons when fields are fallow or when fields cultivated with non-host crops or nematode resistant cultivars, this weed (*A. indica*) may harbor *M. incognita* and serve as a potential source of its infestation in nematode susceptible crops whenever cultivated in the same fields.

Although grasses and weeds can be suitable host for RKNs; however it is generally known that the highest population of RKNs usually emanate from fields that were cultivated with vegetable crops such as tomato, brinjal, cucurbits etc. Our findings indicate that a) the presence of *A. indica* in the fields are likely to compromise effective crop rotation systems for RKNs management; b) without a strong weed management program, the benefits of crop rotation for nematode management can be annulled by weed hosts of RKNs. Therefore, recommendations for crop rotation should also include clear statements about the necessity of controlling host weeds, particularly in those periods between cropping cycles.

It may be concluded that *A. indica* can be an alternate host and serve as a reservoir of *M. incognita* infestation in the fields wherein nematode infestation reported in the previous crops. Transmission of nematode infestation from *A. indica* roots to new host plant in the next season may take place during favourable conditions. Therefore, growers are advised here to be watchful for this weed in the fields, whenever it appears should be rouge out completely along with root system, especially in those fields wherein nematode infestation is reported and management strategies are taken to minimize the damage caused by *M. incognita*.

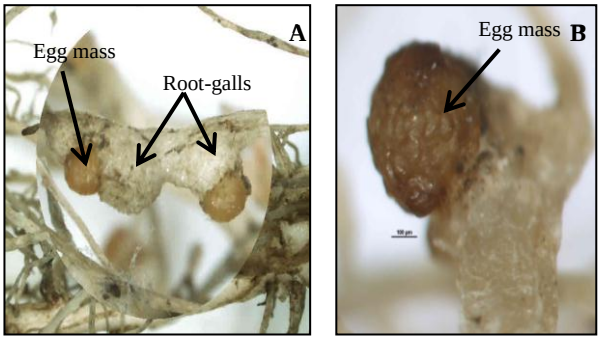

Fig.2: *Acalypha indica* roots infested with root knot nematode, *Meloidogyne incognita*
A: Root galls along with egg mass; B: Brown colored egg mass attached with root gall

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