PLANT PARASITIC NEMATODES ASSOCIATED WITH BRINJAL (SOLANUM MELONGENA) IN SOME AREAS OF BANGLADESH

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ABSTRACT


A survey was conducted during 2011-2014 to identify plant parasitic nematodes associated with rhizosphere soils and roots of brinjal (Solanum melongena). Soil and root samples were collected from brinjal fields in the districts of Gazipur, Tangail, Kishoregonj, Manikgonj and Mymensingh. The nematode was extracted following Baermann Funnel technique. Temporary mounts of the extracted nematodes were prepared and morphological characters and necessary morphometrics were determined under a compound microscope. Based on morphological characters and morphometrics, nematodes associated soil and roots of brinjal were identified up to genera or species level using appropriate key books. The plant parasitic nematodes associated with rhizosphere soils and roots of brinjal were Aphelelenchus avenue, Cephalenchus emarginatus, Helicotylenchus indicus, Hoplolaimus indicus, Meloidogyne incognita, Pratylenchus pratensis, Pratylenchus zeae, Tylenchorhynchus claytoni, Tylenchus sp., Ditylenchus melongena, Xiphinema americanum and Zygotylenchus guevarai. Except M. incognita other nematode species of brinjal have been reported first time from Bangladesh. Morphological characteristics have been described.

Key words: Nematode, parasite, brinjal

INTRODUCTION

Brinjal or eggplant (Solanum melongena) is a popular vegetable and important cash crop in Bangladesh. Per hectare yield of the crop is very low in comparison to China, India and world average (Anon. 2004a). Brinjal is attacked by more than 40 species of plant parasitic nematodes throughout the world (Romero and Arias 1969, Patel et al. 2007, Haidar et al. 2008, Zakir and Bora 2009, Anwar and McKenny 2012).

In India, Ditylenchus melongena, Helicotylenchus, Hoplolaimus, M. incognita, Pratylenchus, Radopholus, Rotylenchus, Rotylenchulus reniformis, Trichodorus and Tylenchorhynchus have been identified as pests of brinjal (Patel et al. 2007, Verma et al., 2013). In Pakistan, Helicotylenchus spp., M. incognita, M. javanica, Meloidogyne spp., Pratylenchus spp. and Xiphinema spp. have been recorded as major nematode pests of brinjal (Anwar and Chaudhry 1973, Shakeel et al. 2012). A study was conducted by Audamou et al. (2013) in Niger and identified Meloidogyne, Tylenchorhynchus, Helicotylenchus, Scutellonema, Rotylenchulus, Pratylenchus and Xiphinema as nematode pests of brinjal. From Syria, Haidar et al. (2008) reported ten plant parasitic nematodes of brinjal namely Meloidogyne, Pratylenchus, Paratylenchus, Tylenchus, Rotylenchus, Helicotylenchus, Tylenchorhynchus, Longidorus, Ditylenchus and Xiphinema. Available reports reveal that plant parasitic nematodes cause considerable damage to brinjal in India (Anowar et al. 1986, Patel et al. 2007, Verma et al. 2013), Pakistan (Shakeel et al. 2012), Niger (Audamou et al. 2013), Nigeria (Bhatti et al. 2013) and Spain (Romero and Arias 1969).

REPORTS ON NEMATODE PESTS OF BRINJAL ARE SCANTY IN BANGLADESH. OCCURRENCE OF ONLY ROOT-KNOT NEMATODE (MELIODOGYNE SPP.) HAS SO FAR BEEN RECORDE

MATERIALS AND METHODS

The survey was conducted in the districts of Kishoregonj, Mymensingh, Tangail, Manikgonj and Gazipur in Bangladesh during of 2011-2014. Brinjal is extensively grown in those areas. Rhizosphere soil and root samples of brinjal were collected from the fields of the selected districts from 20 places of each field at a depth of 15-20 cm. All 20 soil samples of each field was mixed together to have a composite sample. About 2.5 kg subsamples were drawn from each composite sample. Nematodes were extracted from soil and root samples following Baermann funnel method (Mian 1994). Temporary mounts of the extracted nematode were prepared and observed under a compound light microscope. Morphological characters and morphometrics of individual nematode specimens were recorded. For identification, related sets of CIH

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RESULTS AND DISCUSSION

Nematodes identified

During the survey, a total of 12 nematode species under 11 genera were associated with rhizosphere soils and roots of brinjal. The nematode species were *Aphelenchus avenae*, *Cephalenchus emerginatus*, *Ditylenchus melongena*, *Helicotylenchus indicus*, *Hoplolaimus indicus*, *Meloidogyne incognita*, *Pratylenchus pratensis*, *Pratylenchus zeae*, *Tylenchorhynchus claytoni*, *Tylenchus sp.*, *Xiphinema americanum* and *Zygophyllum guevarai*.

*Aphelenchus avenae*

For identification of *Aphelenchus avenae*, CIH Description of Plant-parasitic nematodes was consulted (Hooper 1974a). Female body is cylindrical with slight arcuate when killed by heat, maximum wide at vulval point, gradually tapering towards ends, posterior body behind vulva is narrower than anterior region. Morphometrics of female are $L = 120-127 \ \mu m$, $a = 30.4$, $b = 5.7$, $V = 70-75\%$. Stylet length is $13.5-15.5 \ \mu m$. Head is bluntly rounded and not offset from the body. Vulva is a transverse slit. At mid-body lateral field is widest. Esophagus with cylindrical procorpus, median bulb well developed squarish, conspicuous, rectangular to oval shape having refractive crescentic valve plate. Ovary is monodelphic, prodelphic and outstretched. Esophageal lumen of dead nematode is straight and dorsal esophageal gland orifice is not visible because it opens in side the median bulb. Tail is $1.77$ times of anal body diameter and tail tip is bluntly rounded (Plate I).

*Cephalenchus emerginatus*

The nematode was identified based on characteristics described by Hooper (1974b). Body of adult female is relatively slender, small, only $500-580 \ \mu m$ long, vermiciform, narrow only a little anterior but posterior to the bulb it tapers sharply forming a narrow long tail with a pointed terminus. Cuticle is fairly thick and annules slightly coarse. Cephalic framework mode rately set off and round. Lateral field has six lines. The stylet is relatively long compared to body length with rounded knobs. Stylet is well developed with round knobs. Esophagus is tylenchoid, basal bulb is not overlapping the intestine. Vulva is a transverse slit at $70-72\%$ of body from the anterior end. Ovary is monodelphic prodelphic and outstretched (Plate II).

*Helicotylenchus indicus* (Spiral nematode)

The species of spiral nematode was identified consulting morphological and morphometrical characteristics described by Siddiqi (1972). Adult female body is vermiciform with tapering towards both terminuses, length is $660-850 \ \mu m$, $a=28-33$, $b = 5.3 - 6.2$. Posterior region of the female body forms a coil on thermal death. Annulations are distinct, not interrupted by lateral lines. Lateral fields are about one-sixth of body width, continuing to tail terminus, marked with four incisures. Lip region is hemispherical, cephalic framework is well developed, head slightly set off and conoid. Stylet is well developed, anteriorly tapering and knob is rounded. DGO is situated at less than half of stylet length behind the knob. Esophagus is tylenchoid with oval shape median bulb. Basal bulb overlaps anterior part of intestine from ventral side. Tail is, conoid with a narrow terminus and mucronate. Ovary is didelphic amphidelphic and outstretched. Vulva is transverse slit like at 65-70% of the body from anterior. Male is similar to female except less coiled body shape. Tail is elongate with mucron. Spicule is 20-25 μ (Plate III).

*Ditylenchus melongena* (Stem nematode)

The nematode genus was identified consulting the description of Estling (1974) and Haider et al. (2008). Females are slender transparent, almost straight when relaxed or killed by heat. Labial framework is not well developed; lip region flattened and cap-like, not offset. Stylet is $111-13 \ \mu m$ long with distinct basal knobs. Lateral fields with four incisures. Tail terminus is sharply pointed. Measurements of female showed that $L = 1020-1400 \ \mu m$, $a = 24.0$, $b = 5.2 - 39.5$, $V = 76 - 87\%$. Dorsal esophageal grand orifice (DGO) is very close to stylet knob. Median bulb is fusiform. Basal bulb overlaps intestine mostly dorsally. Ovary is monodelphic and prodelphic. Tail shape is more or less conoid with pointed tip (Plate IV).

*Tylenchorhynchus claytoni* (Stunt nematode)

Descriptions of the species used for identification by Loof (1974b) were also used in the present investigation to identify the nematode. Adult female body is cylindrical, with weakly curve ventrally when relaxed. The body is more tapering towards posterior end. Body length is $680 - 750 \ \mu m$ with coarse transverse striae. Lateral field consists of 4 longitudinal lines. Lip region of the nematode is rounded and offset by slight constriction. Stylet is slender with round basal knobs. Median bulb is oval; its valve located halfway along esophagus. Isthmus is long and narrow, terminal bulb pyriform, with conspicuous dorsal gland nucleus. Vagina is less than one-half body width long. Ovary is didelphic, amphidelphic, outstretched. Rectum is about one-half of anal body width. Tail is tapering towards end (Plate V).
Plate I. Microphotograph of *Aphelenchus avenae* [A: Adult female; B: Anterior view of female]

Plate IV. Microphotograph of *Cephalenchus emerginatus* [A: Adult female, B = Anterior gerion and Posterior part of the nematode].
**Hoploaimus indicus** (*Lance nematode*)

*Hoploaimus indicus* was identified consulting the description of Khan and Chowla (1975). Adult female body is vermiform, cylindrical, tapering towards both ends, especially towards the anterior end and an open C-shaped after death due to heat. Female body length is 1020-1302 μm, ‘a’ and ‘b’ values are 23-28 and 7.1-8.2, respectively. Esophagus tylenchoid, stylet strong with backwardly projected knobs. Ovary is didelphic and outstretched. Head is distinctly set off. Tail is shorter (22.1-22.4 μm) than anal body diameter (25.5-26.5 μm) with round tip. Anus is circular, 2.0-2.2 μm diameter, present on 18-20th annule from tail terminus. Annules on the tail terminus are anastomosed irregularly. Lateral field represented by two very indistinct striae, annulation continues round the body. Vulva is conspicuous, transverse slit, 10.0-12.0 μm wide with two distinct lips (Plate VI).
Plate VI. Microphotographs of *Hoplolaimus galeatus* [A = Adult female, B = Adult male, C = Anterior region and D = Posterior region showing short hemispherical tail]

**Root-knot nematode (Meloidogyne incognita).**
The morphological and morphometrical characteristics of egg, larvae, the mature females, and perineal pattern of mature female were the basis of identification (Taylor and Sasser 1980, Barker *et al.* 1985, Eisenback 2010). Matured eggs are elliptical in shape containing J₁ larvae (Plate VII A). Second stage larvae with prominent fat droplets, 210 to 3950 μm long, head region not offset. Stylet 15 to 25 μm in length, basal knobs set off, rounded to transversely elongated. Tail 25 to 65 μm in length, tip rounded and lateral lines four with incisures (Plate VII B). Third (J₃) and fourth stage (J₄) and immature females were found in the root galls of brinjal (Plate VII C). The perineal pattern is oval to rounded 90 to 100 μm in length and 82 to 100 μm in width. Generally high with dorsal arch. Anus anteriorly located 15 to 30 μm distance from vulval slit and anus located 14 to 20 μm distance from tail terminus. Lateral lines are not prominently demarcated by breaks and forked striae. Striae are distinct and wavy. Lateral fields weakly demarcated and not disrupted by the lateral lines. Tail terminus is smooth (Plate VII D).

**Xiphinema americanum (Dagger nematode)**
The genus was identified comparing the features described by Siddiqi (1973). Female body is vermiform, slightly tapering towards both ends, cuticle finely annulated. Adult female is 1400 to 2000 μm long. The most important identifying character is long stylet with flanges extension and more than 100 μm long. Lip region is hemispherical in shape and slightly expanded. Tail rounded with greater curvature dorsally and terminus conoid. It is needle like and about 72 μm long. Esophagus is divided into two parts having narrow corpus and cylindrical basal region. Vagina at right angles to body axis covering 40% of the body width. Vulva is situated at 50-54% of body length (Plate VIII).

**Pratylenchus pratensis (Lesion nematode)**
The species of lesion nematode was identified consulting the description of Loof (1974a). Female body is vermiform, more or less straight when killed by heat or on relax and 50-68 μm long; ‘a’ = 26-35, ‘b’ = 6.5-7. Stylet has three well separated knobs. DGO is present at less than one-third of stylet length behind the knobs. Esophageal lumen is not straight, median bulb is broadly oval in shape. Basal bulb overlaps the intestine ventrally. Excretory pore is located at anterior to the esophago-intestinal junction. Ovary is monodelphic prodelphic; uterus with large oval to rectangular spermatheca filled with sperm received from the male partner. The vulva is transverse and about 72-77% from the head. Post-uterine sac is slightly longer than body width. Tail with 25-28 annules and the terminus is slightly curve ventrally (Plate IX).
Pratylenchus zeae (*Lesion nematode*)

The nematode was identified consulting the description of Fortuner and Tom (1976). Female body is vermiform, almost straight on death by heat, marked by very faint annules and 450-475 μm long. Lateral field with 4 incisers. Lip region is not set off from the body. Tip of the head is bluntly round. Stylet is 16-17 μm long, basal knob anteriorly flattened. DGO locate 3...
µm behind stylet base. Basal bulb of esophagus is
overlaps intestine ventrally. Ovary single and
prodelphic. Post-uterine sac is short, 2 body width
long. Vulva is at 70-76%. Tail tapering, terminus is
almost pointed and narrowly sub-acute (Plate IX).

**Zygotylenchus guevarai**

The genus was identified comparing the characters
described by Siddiqi (1974). Female is vermiform,
slightly tapering towards both extremities, slightly
arcuate ventrally when relaxed due to thermal death.
Cuticle with distinct annulations, lateral field with 4
incisures, without arealation. Esophagus is tylenchoid,
basal bulb elongate, lobed, and extending over intestine
ventrally and laterally. Style is strong with round basal
knobs. Cephalic frame-work is sclerotized, round, low,
anteriorly flattened, conoid, labial disc squire. Tail
elongate, cylindrical, terminus broadly rounded. Ovary
two, vulva sub median, characterized by a transverse
slit with slightly raised lips (Plate X).

**Tylenchus** sp.

*Tylenchus* was identified using description of Andrassy
(1977). It is a small nematode body length less than 1.0
mm. Tail is elongate conoid to filiform. Stylet with
distinct knobs. Median bulb is prominent with vulvular
apparatus. Basal bulb is abutting with cardia over the
intestine. Ovary is monodelphic prodelphic. Vulva lip
is raised and well posterior to middle of body. Tail
filiform with pointed terminus (Plate IX).

Results of the present survey reveal that at least
12 species of plant parasitic nematodes are associated
with soils and roots of brinjal may attack brinjal in
Bangladesh. Most of them have also been reported
from India (Anwar *et al.* 1986, Patel *et al.* 2007,
Vermam *et al.* 2013), Pakistan (Bhatnagar *et al.* 1969,
Anwar and Choudhry 1973, Maqbool 1986, Shakeel
*et al.* 2012) and other countries (Romero and Arias 1969,
Audamou et al. 2013, Bhatti et al. 2013) as pests of brinjal. Available reports from Bangladesh reveal that all of the genera of nematodes were found to be associated with soils and roots have been reported on other crops of the country (Timm and Ameen 1960, Mian 1986, Mian and Zahid 1986, Mian 1987, Mian and Tsuno 1988). Except root-knot nematode, existence of other 11 plant parasitic nematodes of brinjal has not yet been reported earlier from Bangladesh. So, these may be reported from the country for the first time.

Plate XII. Microphotographs showing adult female (A), anterior region (B) and posterior region (C) of Tylenchus sp.

LITERATURE CITED


