

## STATUS OF PHYTOPARASITIC NEMATODES ASSOCIATED WITH SOLANUM MELONGENA IN BANDA DISTRICT OF UTTAR PRADESH, INDIA

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### ABSTRACT

An extensive survey was conducted to determine the plant parasitic nematodes associated with *Solanum melongena*, grown in the Banda district of Uttar Pradesh, India. Eleven genera of plant parasitic nematodes, viz., *Aphelenchoides*, *Helicotylenchus*, *Hemicycliophora*, *Meloidogyne*, *Paratylenchus*, *Pratylenchus*, *Rotylenchulus*, *Rotylenchus*, *Scutellonema*, *Tylenchorhynchus* and *Xiphinema* were found associated with *S. melongena*. Among the 11 genera of the nematodes, *Meloidogyne* was widely spread in all the examined localities of Banda district, except at Atarra. Population density and diversity of nematodes in all the soil samples were not uniform. The genus *Meloidogyne* showed maximum absolute frequency and relative frequency, followed by *Aphelenchoides*, *Helicotylenchus*, *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Scutellonema*, *Xiphinema*, and *Rotylenchus*. The value of absolute and relative densities were highest in *Meloidogyne* followed by the *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus*, *Aphelenchoides*, *Helicotylenchus*, *Rotylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Xiphinema* and *Scutellonema*. Moreover, the highest prominence value was observed for *Meloidogyne* followed by *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus*, *Aphelenchoides*, *Helicotylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Rotylenchus*, *Xiphinema* and *Scutellonema*.

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KEY WORDS: Brinjal, Plant parasitic nematodes, *Solanum melongena*, Status.

### Introduction

Plant parasitic nematodes are ubiquitous and more than 4100 species have been recorded so far, causing agricultural losses estimated at \$80 billion per annum<sup>4</sup>. Among these, root-knot nematodes, *Meloidogyne spp.* are the most important and extremely polyphagous pest species of various agricultural and horticultural crops in both tropical and subtropical areas causing significant crop losses both quantitatively and qualitatively. So far about 63 species of plant parasitic nematodes belonging to 33 genera have been reported from brinjal in different areas.

The root-knot nematodes annually destroy 29–30% of vegetable crops<sup>3</sup>. Brinjal or eggplant (*Solanum melongena* L.) is one of the most commonly grown vegetable crops in India. It has both nutritive and medicinal value. The estimated yield loss caused by *M. incognita* to brinjal is 16.67% in India<sup>8</sup>. In India and abroad, the community analysis of plant parasitic nematodes associated with vegetable crops including brinjal has also been reported earlier<sup>1-3,6,9,15,18,21,22,24</sup>. Moreover, meager

information is available on the frequency of occurrence and /or density of phytoparasitic nematodes associated with brinjal crop.

To the best of our knowledge, so far no information is available on the community analysis of plant parasitic nematodes associated with brinjal growing in Banda district. Therefore, the study was carried out to assess the community structure of plant parasitic nematodes associated with brinjal crop in Banda district of Uttar Pradesh India and determine the identity, frequency of occurrence, population density and prominence value.

### Material and Methods

To determine the community structure of plant parasitic nematode associated with brinjal crop, a survey of 20 different localities viz., Atarra, Barokhar, Bisanda, Chilla, Gazipur, Hardauli, Jalalpur, Jakhni, Jamwara, Jaspura, Kalinjar, Kurrahi, Lakhanpur, Mahua, Naraini, Oran, Palhari, Pangara, Reona and Tarkhari was carried out from February to May 2015 in Banda District. From each field of eggplant, 17-31 soil samples alongwith roots

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TABLE-1: Occurrence of plant parasitic nematodes associated with *Solanum melongena* in Banda district (U.P) India.

Localities	Number of soil sample	Number of samples positive for plant parasitic nematodes											
		Aphelenchoides	Helicotylenchus	Hemicyclophora	Meloidogyne	Paratylenchus	Pratylenchus	Rotylenchulus	Rotylenchus	Scutellonema	Tylencho-rhynchus	Xiphinema	
Atarra	22	0	12	12	0	10	10	0	13	13	0	7	9
Barokhar	27	0	19	16	24	0	13	19	0	0	0	9	11
Bisanda	23	11	0	13	13	10	10	14	11	12	0	0	13
Chilla	19	11	13	0	12	0	0	8	0	12	17	0	11
Gazipur	31	0	23	19	19	0	18	0	8	0	0	0	0
Hardauli	30	19	16	0	27	0	0	18	6	5	11	0	0
Jalalpur	22	0	12	11	21	0	11	11	8	18	10	0	7
Jakhni	31	0	0	14	22	9	11	10	7	0	12	0	9
Jamwara	25	0	8	12	15	0	0	12	6	6	10	0	0
Jaspura	31	0	20	14	19	10	10	16	0	0	15	0	9
Kalinjar	27	23	0	0	17	11	0	0	8	9	15	0	5
Kurrahi	17	12	0	9	16	14	10	0	11	0	0	0	8
Lakhanpur	15	12	0	7	13	0	7	8	9	9	0	0	11
Mahua	25	14	0	15	18	14	11	0	3	5	0	0	2
Naraini	30	17	20	0	19	0	0	14	0	11	13	0	0
Oran	27	13	13	19	19	13	7	10	0	0	12	0	10
Palhari	23	12	13	12	15	17	14	13	12	0	0	0	0
Pangara	25	16	0	16	19	11	0	0	0	7	8	0	4
Reona	31	23	23	0	16	10	15	16	0	9	0	0	5
Tarkhari	23	20	0	0	17	10	18	12	0	12	13	0	3
<b>Total</b>	504	203	192	189	341	139	165	181	102	128	152	117	117

were collected depending on the area of field from a depth of about 5-10 inches with the help of spade. These samples were mixed thoroughly by coning and quartering to form a composite soil sample. About 500 cm<sup>3</sup> composite soil samples collected from each field were kept separately in properly labelled polyethylene bags like host, locality and date of collection and brought to the Nematology laboratory, Department of Botany for the identification and quantification of phytoparasitic nematodes. In lab, these soil and root samples were stored at 5 to 10 °C in refrigerator until they were processed for nematode extraction.

Before the extraction, each composite soil sample was thoroughly mixed and a subsample of 200 cm<sup>3</sup> was processed for nematode extraction by using Cobb's decanting and sieving method followed by

Baermann's funnel technique<sup>20</sup>. After the extraction of nematodes, the nematode genera were identified upto generic level in permanent mounts in dehydrated glycerol under binocular research microscope. The population of each plant parasitic nematode estimated by using Donchaster circular counting dish under a stereoscopic binocular microscope. The counting of plant parasitic nematode was replicated three times. Thereafter, the average population of the nematode present in each locality was calculated. The identification of nematode genera was done by comparing the morphological characteristic features of nematodes<sup>7,16</sup>.

The absolute frequency, relative frequency, absolute density, relative density and prominence value of each nematode genus were calculated<sup>10</sup>.

$$\text{Absolute frequency} = \frac{\text{Number of samples containing a species}}{\text{Total number of sample collected}} \times 100$$

$$\text{Relative frequency} = \frac{\text{Frequency of species}}{\text{Sum of frequency of all species}} \times 100$$

$$\text{Absolute density} = \frac{\text{Number of individuals of species in a sample}}{\text{Volume of sample}} \times 100$$

$$\text{Relative density} = \frac{\text{Number of individuals of species in a sample}}{\text{Total of all individual in a sample}} \times 100$$

$$\text{Prominence value} = \text{Absolute density} \times v \text{ frequency}$$

## Results

The data presented in Table-1 clearly showed that 11 genera of plant parasitic nematodes, viz., *Aphelenchoides*, *Helicotylenchus*, *Hemicyclophora*, *Meloidogyne*, *Paratylenchus*, *Pratylenchus*, *Rotylenchulus*, *Rotylenchus*, *Scutellonema*, *Tylenchorhynchus* and *Xiphinema* were found to be associated with *S. melongena* grown in Banda district. Out of the 504 soil samples, *Meloidogyne*, *Aphelenchoides*, *Helicotylenchus*, *Hemicyclophora*, *Rotylenchulus*, *Pratylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Scutellonema*, *Xiphinema* and *Rotylenchus* were found to be present in 341, 203, 192,

189, 181, 165, 152, 139, 128, 117 and 102 soil samples, respectively. It was further observed that among the plant parasitic nematodes, *Meloidogyne* was found in all the localities of Banda district, except at Atarra. Moreover, out of 20 localities, *Xiphinema* was found in fifteen localities, *Hemicyclophora*, *Pratylenchus* and *Rotylenchulus* were found in fourteen localities, *Aphelenchoides*, *Tylenchorhynchus* and *Scutellonema* were found in thirteen localities and *Helicotylenchus*, *Paratylenchus* and *Rotylenchus* were found in twelve localities

A perusal of Table-2 clearly revealed that among 20 localities, the highest density of *Aphelenchoides*,

TABLE- 2: Plant parasitic nematodes associated with *Solanum melongena* in Banda district (U.P) India.

Locality	<i>Aphelenchoides</i>	<i>Helicotylenchus</i>	<i>Hemicy-cliophora</i>	<i>Meloidogyne</i>	<i>Paratylenchus</i>	<i>Pratylenchus</i>	<i>Rotylenchulus</i>	<i>Rotylenchus</i>	<i>Scutellonema</i>	<i>Tylenchorhynchus</i>	<i>Xiphinema</i>
Atarra	0	54	48	0	49	63	0	59	28	28	19
Barokhar	0	67	79	356	0	27	110	0	0	49	35
Bisanda	33	0	103	390	29	53	91	45	61	0	40
Chilla	43	40	0	294	0	0	89	0	39	56	30
Gazipur	0	48	110	290	0	79	0	56	0	0	0
Hardauli	58	60	0	278	0	0	73	76	40	20	0
Jakhni	0	0	46	234	28	71	89	27	0	39	26
Jalaipur	0	100	57	176	0	41	80	50	38	89	20
Jamwara	0	19	53	275	0	0	39	30	38	37	0
Jaspura	0	50	113	447	40	70	30	0	0	52	19
Kalinjar	47	0	0	269	40	0	0	56	45	40	29
Kurrahi	65	0	40	190	40	40	0	78	0	0	49
Lakhanpur	30	0	30	190	0	57	47	67	26	0	46
Mahua	64	0	50	480	74	74	0	30	45	0	22
Naraini	43	10	0	403	0	0	56	0	18	37	0
Oran	49	48	90	510	50	30	29	0	0	30	30
Palhari	90	88	78	356	38	58	117	45	0	0	0
Pangara	62	0	70	250	49	0	0	0	7	30	38
Reona	68	54	0	287	45	67	133	0	34	0	30
Tarkhari	110	0	0	179	57	51	49	0	29	43	40
<b>Total</b>	<b>762</b>	<b>688</b>	<b>1080</b>	<b>6301</b>	<b>579</b>	<b>851</b>	<b>1062</b>	<b>619</b>	<b>448</b>	<b>602</b>	<b>492</b>

*Helicotylenchus*, *Hemicycliophora*, *Meloidogyne*, *Paratylenchus*, *Pratylenchus*, *Rotylenchulus*, *Rotylenchus*, *Scutellonema*, *Tylenchorhynchus* and *Xiphinema*/200cm<sup>3</sup> was recorded in Tarkhari, Jalalpur, Jaspura, Oran, Mahua, Gazipur, Reona, Kurrahi, Bisanda, Jalalpur and Kurrahi, respectively. However, on the other hand the lowest density of the respective phytonematodes was recorded in Lakhanpur, Naraini, Lakhanpur, Jalalpur, Jakhni, Barokhar, Oran, Jakhni, Pangara, Hardauli and Attara.

The data presented in Table-3 clearly indicated that *Meloidogyne* showed highest absolute frequency and relative frequency, followed by *Aphelenchoides*, *Helicotylenchus*, *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Scutellonema*, *Xiphinema* and *Rotylenchus*. In the respective plant parasitic nematodes, the absolute frequency was recorded as 67.66, 40.28, 38.10, 37.50, 35.91, 32.74, 30.16, 27.58, 25.40, 23.21, and 20.24% respectively and relative frequency as 17.86, 10.63, 10.06, 9.90, 9.48, 8.64, 7.96, 7.28, 6.71, 6.13 and 5.34% respectively.

Among the plant parasitic nematodes associated with *S. melongena*, the highest absolute density was recorded in *Meloidogyne* (157.53%) followed by *Hemicycliophora* (27.00%), *Rotylenchulus* (26.55%), *Pratylenchus* (21.28%), *Aphelenchoides* (19.05%), *Helicotylenchus* (17.20%), *Rotylenchus* (15.48%), *Tylenchorhynchus* (15.05%), *Paratylenchus* (14.48%), *Xiphinema* (12.30%) and *Scutellonema* (11.20%). A similar trend was also observed in relative densities, the maximum being recorded in *Meloidogyne* (46.73%) followed by *Hemicycliophora* (8.01%), *Rotylenchulus* (7.88%), *Pratylenchus* (6.31%), *Aphelenchoides* (5.65%), *Helicotylenchus* (5.10%), *Rotylenchus* (4.59%), *Tylenchorhynchus* (4.46%), *Paratylenchus* (4.29%), *Xiphinema* (3.65%) and *Scutellonema* (3.32%). With slight variations in the earlier observed trend for absolute and relative densities, the highest prominence value was observed for *Meloidogyne* followed by *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus*, *Aphelenchoides*, *Helicotylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Rotylenchus*, *Xiphinema* and *Scutellonema*. In the respective nematodes, the prominence value was observed as 1295.72, 165.34, 159.11, 121.73, 120.90, 106.16, 82.65, 76.02, 69.62, 59.26 and 56.44.

## Discussion

It is clearly evident from the results that the eleven genera of phyto-parasitic nematodes viz., *Aphelenchoides*, *Helicotylenchus*, *Hemicycliophora*, *Meloidogyne*, *Paratylenchus*, *Pratylenchus*, *Rotylenchulus*, *Rotylenchus*, *Scutellonema*, *Tylenchorhynchus*, and *Xiphinema* were found to be

associated with *S. melongena* growing in 20 localities of Banda district. The species *Meloidogyne* was present in most of the soil samples followed by the species *Aphelenchoides*, *Helicotylenchus*, *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Scutellonema*, *Xiphinema*, and *Rotylenchus*. The results of the present study are also in accordance with the findings of other researchers who reported the occurrence of these phyto-parasitic nematodes except *Hemicycliophora* in *S. melongena* growing in different countries<sup>2,13,14,21,23,25</sup>.

However, our observations are contradictory to the previous findings<sup>2,5,9,12,14,19,23,24</sup> which recorded the existence of different genera of plant parasitic nematodes viz., *Aphelenchoides*, *Belonolaimus*, *Boleodorus*, *Criconema*, *Cephalenchus*, *Criconemoides*, *Ditylenchus*, *Dorylaimus*, *Globodera*, *Hetrodera*, *Hirschmanniella*, *Hoplolaimus*, *Longidorus*, *Macroposthonia*, *Monochus*, *Nacobbus*, *Paurodontus*, *Seinura*, *Siddiquia*, *Telotylenchus*, *Tricodorus*, *Tylenchus* and *Zygotylenchus* associated with *S. melongena*. It was interesting to note that the association of three plant parasitic nematodes viz., *Hemicycliophora*, *Paratylenchus* and *Scutellonema* in brinjal has not yet been reported from India. Moreover, *Paratylenchus* and *Scutellonema* have been reported earlier<sup>1,6</sup> from Syria and Niamey (Niger). Hence, *Hemicycliophora* is recorded for the first time from India and abroad in brinjal crop.

The genus, *Meloidogyne* showed maximum absolute frequency and relative frequency in *S. melongena* followed by *Aphelenchoides*, *Helicotylenchus*, *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Scutellonema*, *Xiphinema*, and *Rotylenchus*. Our results are also in accordance with earlier ones<sup>1,9,13,14,17,25</sup> which recorded the highest frequency of occurrence of the genus *Meloidogyne* in vegetables including brinjal. Although, the other genera was not in order of decreasing frequency of occurrence as compared to our results. However, our observations are contrary to some others<sup>6,23,24</sup> which reported the highest frequency of occurrence of *Helicotylenchus*, *Pratylenchus* and *Rotylenchus* in brinjal field, respectively.

The value of absolute and relative densities were highest in *Meloidogyne* followed by the *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus*, *Aphelenchoides*, *Helicotylenchus*, *Rotylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Xiphinema* and *Scutellonema*. Moreover, the highest prominence value was observed for *Meloidogyne* followed by *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus*, *Aphelenchoides*, *Helicotylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Rotylenchus*, *Xiphinema* and *Scutellonema*. Among the plant parasitic

TABLE- 3.Community analysis of plant parasitic nematodes associated with *Solanum melongena* in Banda district (U.P.) India.

Plant Parasitic Nematode.	Average	Absolute Frequency	Relative Frequency	Absolute Density	Relative Density	Prominence Value
<i>Aphelenchoides</i>	38.10	40.28	10.63	19.05	5.65	120.90
<i>Helicotylenchus</i>	34.40	38.10	10.06	17.20	5.10	106.16
<i>Hemicycliophora</i>	54.00	37.50	9.90	27.00	8.01	165.34
<i>Meloidogyne</i>	315.05	67.66	17.86	157.53	46.73	1295.72
<i>Paratylenchus</i>	28.95	27.58	7.28	14.48	4.29	76.02
<i>Pratylenchus</i>	42.55	32.74	8.64	21.28	6.31	121.73
<i>Rotylenchulus</i>	53.10	35.91	9.48	26.55	7.88	159.11
<i>Rotylenchus</i>	30.95	20.24	5.34	15.48	4.59	69.62
<i>Scutellonema</i>	22.40	25.40	6.71	11.20	3.32	56.44
<i>Tylenchorhynchus</i>	30.10	30.16	7.96	15.05	4.46	82.65
<i>Xiphinema</i>	24.60	23.21	6.13	12.30	3.65	59.26

nematodes, the highest density and prominent value of *Meloidogyne* were also reported by different workers in vegetable crops including brinjal<sup>6,9,13,14,24</sup>. The variation in frequency of occurrence and population density of nematodes might be due to the difference in food abundance, variety of host plant, biotic interaction with other organisms and soil type having different physico-chemical characteristics<sup>26</sup>. It was reported that some other factors, like soil pH, total nitrogen, humus content and exchangeable bases, are also responsible for variations in the composition of nematode communities, but no single factor could be selected as being of overriding importance<sup>11</sup>.

On the basis of density and prominence value of plant parasitic nematodes, it can be concluded that the

*Meloidogyne*, *Hemicycliophora*, *Rotylenchulus*, *Pratylenchus* and *Aphelenchoides* were emerged as most important phytoparasitic nematode menace for brinjal crop grown in Banda district. Therefore, the agro communities of this area were advised to adopt suitable management measures against these noxious parasitic nematodes, which were known to cause huge economic loss to brinjal as well as other solanaceous crops. More extensive research works are needed to further identification of the genera up-to species level and also to determine the nematode- nematode interaction and nematode interaction with other soil pathogens present in brinjal growing fields.

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