

Survey Report on Incidence and Intensity of Root Knot Nematode (*Meloidogyne incognita*) on Spinach (*Spinacea oleracea*) in U.P. and Bihar

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Abstract: A survey conducted to assess the incidence and intensity of root knot nematode disease in twenty seven district of Uttar Pradesh and Bihar showed that spinach (*Spinacea oleracea*) grown in all twenty seven districts were infected with root knot nematode disease. A total 3375 spinach root samples were uprooted, 1891 samples were found to be root knot nematode as visible galls. The frequency of root knot nematode disease in spinach infested with varied a great deal and it was observed that *Meloidogyne incognita* was most widely distributed species as it was found in the entire twenty seven districts. The incidence ranged from 32.8 to 81.6% and the average intensity in terms of root knot index was 3.2.

Key words: Survey · Spinach · Root knot nematode · Incidence and intensity

INTRODUCTION

Spinach (*Spinacea oleracea*) is an economically important leafy vegetables crop grown in our country. Fungal and viral diseases are generally recognized as the most economically important constraints in spinach production [1]. However several plant parasitic nematodes have been reported to damage the crop. Nematode species associated with spinach include cyst (*Heterodera schachtii*), root lesion (*Pratylenchus penetrans*) and root knot nematodes (*Meloidogyne hapla*, *M. arenaria*, *M. incognita*, *M. javanica*) [2-6]. Root knot nematodes are considered among top five of major plant pathogens and rank first among ten most important genera of plant parasitic nematodes of the world [7]. Besides causing direct yield losses they interact with other organisms to produce disease complexes, breakdown resistance against other pathogen and reduce plant tolerance to environmental stress [8]. In spinach the plant parasitic nematodes particularly root knot nematodes, *Meloidogyne incognita* had proved itself as an important limiting factor for successful cultivation and productivity of this crop. Reports pertaining to the association of root knot nematodes in spinach roots are very meager. The *Meloidogyne* species are the most common and damaging nematodes of spinach in several countries [9]. Although attacks by *Meloidogyne* species are probably an important constraint for spinach cultivation, little information exists regarding the host parasite relationships

between these nematodes and spinach [10]. A systematic survey on cultivation of spinach crop was conducted. It has been observed that root knot nematode cause serious losses to spinach crop. Plant growth parameters shows reduction in leaves size. Nematode induced mature galls were large and usually contained one or more females and egg masses with eggs. Feeding sites were characterized by the development of giant cells. Extent of crop growth impairment by the nematode is influenced by nematode population density at planting and that a minimum population density is required before measurable yield loss occurs (tolerance limit) [11]. Root knot nematode damage plants by devitalizing root tips and causing formation of swelling of the roots. These effects cause reduction of tender leaves and reduce the market value. When susceptible plants are infected at the initial stage, losses are heavy and may result in complete destruction of the crop. During survey work root knot nematodes disease were usually detected first in localized areas within a field. The above ground symptoms are reduced growth, patchy growth, chlorotic appearance, yellowing, reduced leaf size that tends to wilt in warm weather. The presence of root knot nematodes cannot be diagnosed by above ground symptom, as below ground symptoms are the galls of various sizes present on the root. In the present study attempts have been made on systematic survey of root knot nematodes disease of spinach in twenty seven district of Uttar Pradesh and Bihar by assessing incidence and intensity of the disease.

MATERIALS AND METHODS

Survey of root knot disease (*M. incognita*) in spinach (*Spinacea oleracea*) was conducted in twenty seven district (Bhagalpur, Mungeer, Katihar, Purnia, Patna, Gaya, Darbhanga, Vailshali, Madhepura, Khagaria, Baxor, Allahabad, Raebareli, Bareilly, Sahajahanpur, Hardoi, Lucknow, Deoria, Aligarh, Chitrakoot, Rampur, Sultanpur, Sitapur, Kaushambi, Chandauli, Jaunpur and Kushinagar) of Uttar Pradesh and Bihar. Five fields were selected in each district for observation of root knot incidence. Twenty five spinach root samples were uprooted randomly from each field (10 sq. m area) and collected in the polythene bags, properly labeled and brought to the laboratory. Root samples were thoroughly washed under tap water and were examined by using hand lens and stereoscopic binocular and disease incidence were calculated. The disease incidence in each district was calculated in following way and observations were recorded.

$$\text{Disease incidence} = \frac{\text{Number of sample with root knot nematodes infection}}{\text{Total number of sample surveyed}} \times 100$$

Roots were washed clean and were then immersed in aqueous solution of phloxin B (0.15gm/lit) for 15-20 minutes and then washed with tap water to stain egg masses [12]. Numbers of galls per roots system if present were counted. Intensity of root knot disease was measured by Gall index (GI) and egg mass index (EMI) which were determined on the following scale [8] 0=0 (highly resistance), 1=1-2 (resistance), 2=3-10 (moderate resistance), 3=11-30 (tolerance), 4=31-100 (susceptible) and 5=greater than 100 galls or egg masses per root system (highly susceptible).

The number of larvae from each root sample was determined by using a counting disc. For quantitative assessment of second stage juveniles, the infested roots were cleaned, stained and were immersed in sufficient amount of water and macerated by laboratory homogenizer for 15-30 seconds. Water was added to this suspension and 2ml aliquot was taken by pipette for counting. The number of juveniles per gm root system was determined from counts of three replicates. Identification of *Meloidogyne* species were done by studying perineal pattern of mature female, head shape and stylet used method by Eisenback *et al.* [13].

RESULTS AND DISCUSSION

Of the 3375 samples, 1891 were found infested with root knot nematode (*M. incognita*) infection in spinach (*Spinacea oleracea*) in all twenty seven districts (Table 1) which reveals that spinach is a good host for root knot nematodes. Potter *et al.* [9] also reported that spinach is good host for all *Meloidogyne* species (*M. incognita*, *M. javanica* and *M. arenaria*) and *M. incognita* can reduce yields and economic return. District wise incidence and intensity of root knot disease in spinach is given in Table 1. This disease was found to be wide spread with an average incidence as 56%. The maximum incidence (81.6%) was observed in Bhagalpur district (Bihar) and minimum (32.8%) in Kaushambi district (U.P.). It was 79.2, 68, 66.4, 65.6 and 62.4% in Mungeer, Sultanpur, Purnia, Sahajahanpur, Patna, Allahabad, Katihar, Raebareli and Bareilly respectively. The incidence varied from 52.0-58.4% in Aligarh, Lucknow, Kushinagar, Khagaria, Darbhanga, Sitapur, Hardoi, Jaunpur, Madhepura, Vailshali, Baxor and Chitrakoot. It ranges from 39.2-48% in Chandauli, Deoria, Gaya and Rampur respectively.

Table 1: Status of root knot disease incidence, intensity and root knot index in Spinach (*Spinacea oleracea*) Uttar Pradesh and Bihar

District	Sample Analyzed	Infected sample	Disease Incidence (%)	Average No. of larvae/gm root system.	GI/EMI
Bhagalpur	125	102	81.6	193.6	5/5
Mungeer	125	99	79.2	182.6	4/4
Sultanpur	125	99	79.2	181.0	4/4
Sahajahanpur	125	83	66.4	173.7	4/4
Patna	125	82	65.6	172.0	4/4
Allahabad	125	82	65.6	166.7	4/4
Katihar	125	82	65.6	164.0	4/4
Raebareli	125	78	62.4	160.7	4/4
Bareilly	125	78	62.4	153.0	4/4
Aligarh	125	73	58.4	144.3	3/3
Lucknow	125	73	58.4	135.7	3/3
Kushinagar	125	73	58.4	132.0	3/3
Khagaria	125	73	58.4	123.7	3/3
Darbhanga	125	71	56.8	123.3	3/3
Sitapur	125	70	56.0	123.0	3/3
Hardoi	125	70	56.0	114.7	3/3
Jaunpur	125	70	56.0	106.3	3/3
Madhepura	125	68	54.4	96.3	3/3
Vailshali	125	68	54.4	94.6	3/3
Baxor	125	68	54.4	92.6	3/3
Chitrakoot	125	65	52.0	82.3	3/3
Chandauli	125	60	48.0	82.0	2/2
Deoria	125	53	42.4	78.0	2/2
Gaya	125	49	39.2	73.3	2/2
Rampur	125	49	39.2	71.0	2/2
Kaushambi	125	41	32.8	68.0	2/2
Total	3375	1891	56.0	118.2	3.2/3.2

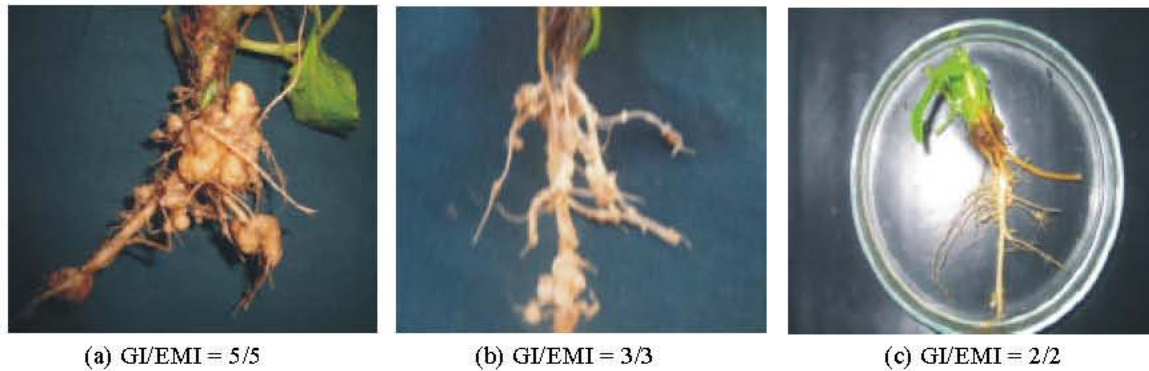


Fig. 1: Root knot disease in Spinach crop (*Spinacea oleracea*) caused by *Meloidogyne incognita*.

The intensity of the disease on spinach in above mentioned district based on average gall and egg mass indicate was high in general. District wise variations were, however, noticed. Both gall index and egg mass index (average) ranged between 2-5 through 3 and 4. The maximum intensity (5/5) was found in Bhagalpur (the area in which the incidence was also maximum) shown in Fig. 1(a) And minimum intensity (2/2) was seen in Chandauli, Deoria, Gaya and Rampur respectively in Fig. 1(c). The disease intensity in Mungeer, Sultanpur, Purina, Sahajahanpur, Patna, Allahabad, Katihar, Raebareli and Bareilly was 4/4 respectively. In Aligarh, Lucknow, Kushinagar, Khagaria, Darbhanga, Sitapur, Hardoi, Jaunpur, Madhepura, Vailshali, Baxor and Chitrakoot the intensity (3/3) was comparatively low (Table 1.) shown in Fig. 1(b) And the average intensity in terms of root knot index was 3.2.

Reduced and patchy growth, chlorotic appearance, yellowing and reduced leaf size was the above ground symptom and severe stunting and extensive root galling were underground symptom. On the basis of perineal pattern characteristics, *M. incognita* was identified to infect spinach which is the most important constraints in spinach production. [1] though other *Meloidogyne* species along with plant parasitic nematode were also associated. Similar findings confirm the result of Potter *et al.* [9] that *Meloidogyne* species are the most common and damaging nematode of spinach. The increasing occurrence and damage of this nematode to spinach was standard and efficient control measure to be adapted in order to save the crop from huge loss.

Thus the frequency of root knot nematode disease in spinach (*Spinacea oleracea*) infested varied a great deal and it was observed that *Meloidogyne incognita* was most widely distributed species. The above results reveal that spinach is a good host for root knot

nematodes. In order to save the crop from huge losses, standard and efficient control measure should be adapted.

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