



Emerging Nematode problem in protected vegetable cultivation in Jammu

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ABSTRACT

The commercial polyhouse erected near village Shama Chak was surveyed for the incidence of root-knot nematodes in the standing crop of cucumber which was at its final stage of harvest during the first week of June 2021. Soil and root samples were collected from the polyhouse to identify the nematode species and to estimate nematode population. The study confirmed that the species of root-knot nematode that infected the cucumber plants was *Meloidogyne incognita* on the basis of perineal pattern characteristics furthermore, its population density in sampled soils were in the range of 680-1024 J2s /200cc soil (out of 5 samples collected). This is the first report of *M.incognita* infection, leafminer and root-knot nematode-wilt disease complex under the polyhouses in Jammu.

1. Introduction

Jammu is situated on the foothills of Shivaliks in the Indian union territory of Kashmir. The altitude of Jammu varies between 320 to 720 meters above mean sea level. Protected cultivation is an emerging technology for raising vegetables round about the year across the country. The J&K government is encouraging farmers to adopt cultivation in protected structures through various schemes to improve the income levels of farmers in the state, particularly during the winter-spring seasons. The technology is yet to be popularized among the farming community since only six commercial units of polyhouse has been established in Jammu so far. The polyhouse erected near village Shama Chak is located at 32°49'30"N latitude to 74°44'39"E longitude and is largest among all the six structures in Jammu with the dimension of 2000sq. meters. The polyhouse is medium-cost, partially climate controlled, quonset-shaped one and framed with GI pipe and has a single layer covering of UV stabilized polythene of 200 microns.

Round the year cultivation in an unfavorable environment has been made possible with the help of protected cultivation and it has also shown some favourable changes like high yield per unit area, better quality produce, early maturity and use of microclimate to fulfill the individual

requirement of plant (Singh *et al.*, 2017). Owing to controlled environmental condition and continuous growing of same crops, the root-knot nematode (*Meloidogyne* spp.) has emerged as a major problem, especially in vegetable crops like cucumber (*Cucumis sativus*), tomato (*Lycopersicon esculentum*), chilli and bell-peppers (*Capsicum annum*). High day time temperature and relative humidity within the greenhouses with general poor plant hygienic conditions inside and outside the greenhouses provide ideal conditions for the introduction and rapid multiplication of insects, fungal, viral bacterial and diseases caused by plant parasitic nematodes (Hanafi & Pappasolomontos, 1999; Greco & Esmenjaud, 2004). The plant parasitic nematodes associated with these crops in India are *Meloidogyne* spp., *Rotylenchulus reniformis*, *Heterodera* spp., *Pratylenchus* spp., *Helicotylenchus* spp. and *Hoplolaimus* spp. Root-knot nematodes (*Meloidogyne* spp.) represent one of the most polyphagous genera of plant-parasitic nematodes. *M. incognita* spreads from 12 to 65% of the area across all the greenhouse vegetable producing areas because of the monoculturing causing enormous yield loss estimated to about 19 to 99% (Bhati, & Baheti, 2020). The yields in the polyhouse can be increases multiple times if the polyhouse growers learn to manage the root knot nematode infections.

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Keeping this in view, the present investigation was carried out in the commercial polyhouse that was erected near village Shama Chak located at 32°49'30''N latitude to 74°44'39''E longitude to estimate the occurrence of root-knot nematodes in soil and to identify the nematode species. The present study also aims at throwing light upon the other associated problems like disease complexes in cucumber under protected cultivation.

2. Materials and Methods

A detailed survey has been conducted in the commercial polyhouse erected near village Shama Chak to confirm the incidence of root-knot nematode in the standing crop of cucumber which was at its final stage of harvest during the first week of June 2021. The plants in poly-house were uprooted and inspected during the survey for the presence of any kind of knots in the root system that suggests nematode infestation. The plants were also visually examined for symptoms of secondary infection by other soil borne pathogens (fig. 1).



Figure 1. Cucumber plants showing symptoms of leaf miner and root-knot nematode-wilt disease complex under the protected structures in Shama Chak, Jammu.



Figure 2. Typical symptoms of root-knot nematode and wilt disease complex on cucumber roots.

Collection and processing of samples

The infested root samples and soil samples taken from the rhizosphere of plants were labelled properly and processed separately in laboratory. To find out the population status of plant parasitic nematodes, 200 cc of soil from each of the collected soil samples were processed by using Cobb's Sieving and Decanting Technique (Cobb NA., 1914) followed by Baermann's Funnel Assembly (Christie and Perry 1951). Roots were stained in 0.1% acid fuchsin--lactophenol solution at 80°C for 2-3 minutes (McBeth, 1941). Identification of the nematode species from the roots was done by preapring the perineal patterns (Eisenback *et al.*, 1981). In this method, the mature females were dissected out from the large galls formed on the roots of cucumber plants. Perineal patterns from each sample or locality were prepared and examined under the compound microscope for species identification the basis of their characteristic morphology involving the vagina, anus, plasmids, tail terminals, lateral lines and annulations. (Eisenback *et al.*, 1981).

3. Results and Discussion

The thorough examination of cucumber roots, uprooted from the polyhouse showed severe galling with innumerable knots in the root systems indicating high population densities of root-knot nematodes and severe damage to the cucumber crop. The population density of *M. incognita* in sampled soils of the polyhouse were in the range of 1024 J2s /200cc soil to 680 J2s /200cc soil. The similar survey conducted by Bhati and Baheti (2020) too reported very high population of juveniles ranging from 705 to 1460 J2s/100cc soil in polyhouses surveyed from different villages in Rajasthan during 2016 and 2017.

The cucumber plants in polyhouse that were examined during the survey/visit were also severely infected by the leafminer insect. The plants exhibited the typical symptoms like young leaves showed symptoms of zig-zag mines on leaf lamina whereas the lamina was completely distorted and dried in the older leaves (Fig. 2). Furthermore,

stunted growth, yellowing and drooping of the main stem, cross section showing browning in vascular bundles and completely wilted plants indicated an infection by the soil-borne pathogen.

Identification of the species

On the basis of perineal pattern characteristics, it was confirmed that the species of root-knot nematode that infected the cucumber plants was *M. incognita*. The results are in accordance with the findings of Uysal *et al.*, (2107) and Elling, (2013). It can also be noted that *M. incognita* was the only species that infected cucumber plants in the polyhouse from where the samples were drawn. This is the first report of *M. incognita* infection under the protected structures in Jammu.

Though there were insignificant differences between some isolates, all perineal patterns of the populations showed typical *M. incognita* features. The perineal region is characterized by an angularly oval structure with a high dorsal arch. The striae are smooth to wavy, sometimes zig-zagged. Distinct lateral lines are absent but lateral field may be marked by breaks and forks in the striae (Fig. 3). All perineal pattern features for *M. incognita* isolates were similar to those described as Jepson (1987).

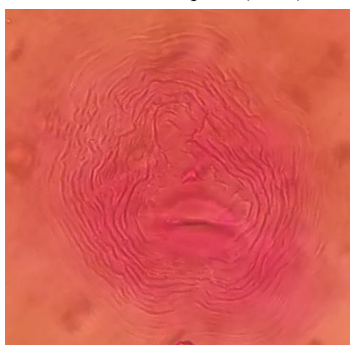


Figure 3. Perineal patterns of *Meloidogyne incognita* collected from protected structure in Shama Chak, Jammu.

4. Conclusion

From the results obtained it can be predicted that, root-knot nematode (*M. incognita*) infection may pose a future threat for expansion of the polyhouse cultivation in Jammu. The presence of stunted growth, wilting, chlorosis & drying of leaves and formation of galls on roots of cucumber plants conclude the probable outbreak of leafminer and root-knot nematode-wilt disease complex. This disease complex is resulted from the interactions of serpentine leafminer (*Liriomyza* spp.), root-knot nematode (*M. incognita*) and the wilt causing fungus, *Fusarium* spp. on common host cucumber. The identification of species of nematode and leafminer and root-knot nematode-wilt disease complex from this study also helps in developing effective control and management strategies for the protected cultivation in the Jammu region. As protected cultivation in Jammu is at its

infancy/budding stage with humongous scope and benefits ahead of it, it's important to safeguard the ventures against emerging problems with adaptation of suitable technological advancements to sustain the protected cultivation as the profitable and relatively risk free crop production technology.

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