

Survey for Different Plant Parasitic Nematodes Association with Pomegranate Wilt Complex

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Five plant parasitic nematodes were found association with pomegranate wilt complex along with fungus as they are *Meloidogyne incognita*, *Helicotylenchus dihystera*, *Xiphinema* sp., Dorylamid PPN, *Rotylenchulus reniformis*. In five nematodes predominant is *Meloidogyne incognita*. Community analysis of nematodes shows which one is more predominant. *M. incognita* was found with highest absolute frequency (85.71) and least was Dorylamid PPN (32.14). However, absolute density of *M. incognita* (14.50) was highest and least was Dorylamid PPN (1.86). In relative frequency, among five plant parasitic nematodes *Meloidogyne incognita* (139.54) was highest While least of Dorylamid PPN (52.32). Among five plant parasitic nematodes *M. incognita* (42.66) was highest and least in Dorylamid PPN (5.47) having relative density. The *M. incognita* (1.34) was highest least was Dorylamid PPN (0.10) were having prominence value.

Key words: *Meloidogyne incognita*, *Helicotylenchus dihystera*, *Xiphinema* sp., Dorylamid PPN, *Rotylenchulus reniformis* and Pomegranate.

Pomegranate (*Punica granatum* L.) is an ancient fruit, belonging to the smallest botanical family puniceae and pomegranate is a native of Iran. It is commercially an important fruit crop of both tropical and subtropical regions. In India, it is regarded as a "vital cash crop", grown in an area of 1, 16,000 ha with a production of 89,000 MT with an average productivity of 7.3 MT. Karnataka state has the distribution of cultivating pomegranate under tropical condition in an area of 12,042 ha with a production of 1, 29, 547 tones. Successful cultivation of pomegranate in recent years has met with different traumas such as pest and diseases. Among diseases wilt complex caused by *Ceratocystis fimbriata* Ell. and Halst. is a major threat. At present, the crop

is severely affected by wilt pathogen and day by day the wilting severity is increasing at faster rate. It was first noticed in two areas of the Bijapur district of India in 1990. Around 1993, rapid spread of this disease was observed in the entire Bijapur district. The cause was not identified until 1995, in 1996, the fungus *C. fimbriata* was isolated from discoloured stem, root, and branch tissues on wilted plants. Disease is characterised by the initial symptoms were yellowing and wilting of leaves on one to several branches leading to death of affected plants in a few weeks. Cross sections of diseased plants revealed brown discoloration in the outer xylem from roots to the main trunk. The disease is prevalent in parts of a Maharashtra, Karnataka, Andrapradesh, Gujarat and Tamil Nadu states. Despite many factors conducive for the high severity of disease, seedlings selection for planting, soil borne nature and also association with shot hole borer and plant parasitic nematodes. This might be the reason for

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the current rampant spread of the disease in south Indian states. There is no more information available on involvement of different plant parasitic nematodes, susceptible and resistant cultivars, mode of spread of disease, association with insect, soil type. Hence the survey work is conducted in northern Karnataka.

MATERIALS AND METHODS

To assess the extent of wilt complex disease severity, intensive roving survey was conducted during *Kharif*2009 in important pomegranate growing district of northern Karnataka. In each district important pomegranate growing talukas were selected, in each village fields are randomly selected on both sides of road. Samples of soil and roots were collected from sufficiently wet fields from the rhizosphere of pomegranate crop to the root depth.

Each soil samples was filled in polythene bag and tied with a rubber band and labelled immediately. Information pertaining to the locality, crop history, etc. was also labelled along with the samples. Samples of soil and roots were analysed on the day of collection or after keeping for a few days under refrigerated conditions. The nematode population from soil was estimated.

Galled root system was scored by using a disease rating (0 to 5 scale) given by Taylor and Sesser (1978). The disease severity (root-knot disease) was calculated for the village by using following formula

$$\text{Disease severity} = \frac{\text{Number of infected root samples from village}}{\text{Total number of root samples collected from a village}} \times 100$$

Estimation of nematode population in soil

Cobb's sieving and decanting technique was followed, for which 200 cc of the soil sample was taken in a container and mixed thoroughly with water. Hard particles and stones, if any, were removed by stirring the suspension, and were passed through a set of sieves of 250, 45 and 37 μm size. The sievates were collected on a tissue paper over a coarse mesh, which was then placed in a Petri dish containing enough water as to keep the tissue paper (placed on coarse mesh) always moist. This assembly was kept still for three days, care was taken to prevent drying of the tissue paper. The nematode suspension collected in the Petri dish was examined by means of a research

stereo binocular microscope. The different plant parasitic nematodes present in the suspension were identified to genus level. Their numbers present in the suspension were determined by taking the average number of nematodes present in three different one millilitres of nematode suspension.

The population densities of different nematodes species in the samples were calculated using the formulae (Norton, 1978).

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

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

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

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

$$\text{Prominence value} = \frac{\text{Absolute density} \times \sqrt{\text{absolute frequency}}}{100}$$

RESULT

Plant parasitic nematodes and their absolute density

Among (Table 1) five plant parasitic nematodes *M. incognita* was highest in Besigegere (25.76) in Bellary district, followed by Koppal (17.30). It was not observed at Mahalingpur. *Helicotylenchus dihystra* was observed highest in Chumnal (24.13) Gadag district, followed by Mahalingpur (21.21) in Bagalkot district. In Kalakbandi observed zero. *Xiphinema* spp. was having more absolute density in Basavanagudi (10.16) in Koppal district, followed by Kalakbandi (8.19) in Koppal district. In Tuntapur noticed as zero. More density of Dorylamid PPN was observed in Basavanagudi (8.47) in Koppal district, followed by Koppal (5.76) in Koppal district. However, observed zero in Jerkundi, Kalakbandi, Unchgera, Chumnal and Tuntapur. *Rotylenchus reniformis* was observed more in Babaleswar (10.00) Bijapur district, followed by Kalakabandi (8.19) and observed zero in Mahalingpur, Jumargudi, Vajrabandi, Koppal, Unchgera and Tuntapur.

Community analysis

Highest absolute frequency (85.71) of *M. incognita* followed by *H. dihystra* (78.57) was observed, while least was Dorylamid (32.14) (Plate 2 and Table 3). However, in absolute density *M. incognita* (14.50) was highest followed by *H. dihystra* (10.44). Least was Dorylamid (1.86). In relative frequency, among five plant parasitic nematodes *M. incognita* (139.54) was highest followed by *H. dihystra* (127.92). Least was Dorylamid (52.32). Among five plant parasitic nematodes *M. incognita* (42.66) was highest followed by *H. dihystra* (30.76). Least was

Dorylamid (5.47) were having relative density. The prominence value of *M. incognita* (1.34) was highest followed by *H. dihystra* (0.30). While the least was Dorylamid PPN (0.10).

Percentage of *M. incognita* in different location surveyed

Among all the (Table 3) locations surveyed, *M. incognita* was observed more 100 per cent in Besegegere in Bellary district, followed by Basavanagudi and Hebbal (71.42%) were on par with each other. Zero per cent was observed in Mahalingpur of Bagalkot district.

Table 1. Plant parasitic nematodes encountered in the locations surveyed and their absolute densities (per 200 CC of soil)

Location	<i>Meloidogyne incognita</i>	<i>Helicotylenchus dihystra</i>	<i>Xiphinema</i> sp.	Dorylamid PPN	<i>Rotylenchulus reniformis</i>
Bijapur District					
Babaleshwar	12.94	10.00	1.76	1.17	10.00
Bagalkot District					
Hebbal	15.20	12.80	7.60	1.20	4.80
Malingpur	-	21.21	4.04	-	-
Koppal district					
Basavanagudi	15.25	10.16	10.16	8.47	6.77
Jerkundi	14.28	10.71	3.57	-	5.35
Kalakbandi	14.75	-	8.19	-	8.19
Jumargudi	8.82	7.35	1.47	4.41	-
Vajrabandi	13.28	7.35	-	4.41	-
Koppal	17.30	9.61	-	5.76	-
Gadag District					
Unchgera	16.12	12.90	3.22	-	-
Chumnal	15.51	24.13	5.17	-	5.17
Raichur District					
Tuntapur	11.53	5.76	-	-	-
Appledinni	7.30	1.82	2.28	1.82	4.56
Bellary district					
Besigegere	25.76	10.38	3.46	1.92	2.69

Table 2. Community analysis of plant parasitic nematodes associated with Pomegranate

Nematode species	Absolute frequency	Absolute density	Relative frequency	Relative density	Prominence value
<i>Meloidogyne incognita</i>	85.71	14.50	139.54	42.66	1.34
<i>Helicotylenchus dihystra</i>	78.57	10.44	127.92	30.72	0.30
<i>Xiphinema</i> sp.	60.71	3.92	98.84	11.54	0.92
Dorylamid PPN	32.14	1.86	52.32	5.47	0.10
<i>Rotylenchulus reniformis</i>	50.00	3.26	81.40	9.58	0.23

*Helicotylenchus dihystra**Meloidogyne incognita***Fig. 1.** Major plant parasitic nematodes association with pomegranate wilt complex**Table 3.** Occurrence of root – knot disease of pomegranate in different locations

Locations	Per cent root-knot incidence
Bijapur District	
Babaleswar	60.00
Bagalkot District	
Hebbal	71.42
Mahalingpur	-
Koppal District	
Jerkundi	50.00
Kalakabandi	40.00
Jumargudi	33.37
Vajrabandi	60.00
Koppal	25.00
Basavangudi	71.42
Gadag District	
Unchgera	62.50
Chumnal	57.14
Raichur District	
Tuntapur	7.00
Appledinni	28.57
Bellary district	
Besigegere	100.00

DISCUSSION

Plant parasitic nematodes and their absolute density

M. incognita was highest in Besigegere (25.76) in Bellary district, followed by Koppal (17.30) in Koppal district. While no infestation was found at Mahalingpur. *H. dihystra* was

observed highest in Chumnal (24.13) Gadag district, followed by Mahalingpur (21.21) in Bagalkot district. While Kalakabandi recorded no occurrence. *Xiphinema* spp was having more absolute density in Basavanagudi (10.16) in Koppal district, followed by Kalakabandi (8.19) in Koppal district. Dorylamid ppn was observed with more density in Basavangudi (8.47) in Koppal district, followed by Koppal (5.76) in Koppal district. However, no occurrence in Jerkundi, Kalakabandi, Unchgera, Chumnal and Tuntapur. *R. reniformis* was observed more in Babaleswar (10.00) Bijapur district, followed by Kalakabandi (8.19) and no occurrence in Mahalingpur, Jumargudi, Vajrabandi, Koppal, Unchgera and Tuntapur (Darekaret *al.*, 1990).

Community analysis

M. incognita was found with highest absolute frequency (85.71), followed by *H. dihystra* (78.57). Least was Dorylamid PPN (32.14). However, absolute density of *M. incognita* (14.50) was highest followed by *H. dihystra* (10.44). Least was Dorylamid PPN (1.86). In relative frequency, among five plant parasitic nematodes *Meloidogyne incognita* (139.54) was highest followed by *H. dihystra* (127.92). While least of Dorylamid PPN (52.32). Among five plant parasitic nematodes *M. incognita* (42.66) was highest followed by *H. dihystra* (30.76), and least in Dorylamid PPN (5.47) having relative density. The *M. incognita* (1.34) was highest followed by *H. dihystra* (0.30). Least was Dorylamid PPN (0.10) were having

prominence value (Darekar *et al.*, 1990).

Percentage of *M. incognita* in different location surveyed

M. incognita was observed more (100%) in Besegegere in Bellary district, followed by Basavanagudi and Hebbal (71.42) were on par with each other. Zero per cent was observed in Mahalingpur, in Bagalkot district (Benagi *et al.*, 2009, Somasekhara, 2009)

Community analysis of plant parasitic nematode associated with pomegranate

Soil and root samples collected during the survey from different parts of the northern Karnataka revealed the presence of plant parasitic nematodes like *M. incognita*, *H. dihystra*, *Xiphinema* spp. *R. reniformis* and Dorylamid PPN. The root knot nematode and *H. dihystra* was found to be the most predominant species in the soil sample collected from different cultivars. This was followed by the *R. reniformis*, Dorylamid PPN and *Xiphinema* spp. The higher density of nematodes especially *M. incognita*, *H. dihystra* predispose the pomegranate roots for the entry of the *C. fimbriata* (Darekar *et al.*, 1990).

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