Indian J. Hill Farmg. 11(1 & 2) : 99 — x 1998

ROOT KNOT NEMATODE IN KIWI NURSERIES IN HIMACHAL PRADESH

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Kiwi fruit or Chinese gooseberry (Actinidia chinensis Planch) has tremendous commercial possibility in sub-Himalayan regions and other temperate fruit growing regions of India viz. hilly regions of Himachal Pradesh, Uttar Pradesh, Meghalaya, Arunachal Pradesh, Sikkim, West Bengal (Darjeeling hills) and Nilgiri hills of Tamil Nadu (Pandey and Joshi, 1997). The area under kiwi cultivation has been expanding rapidly during last five years in Himachal Pradesh and demand for planting material has also been increased. Multiplication of planting material is, therefore, underway in various research centres of the country. Most common vegetative methods of propagation are either by raising seedlings from true seed and then grafting scion wood/budding or by inducing rooting in semi-hard shoot cuttings in specially prepared rooting beds (Pramanick *et al*,. 1997).

Different nurseries were surveyed for surveillance of diseases. During survey, unthrifty growth of Kiwi seedlings, rooted shoot cuttings and wilting during sunny days were observed. Affected roots showed swellings and typical root knot galls. Several swellings along the same root exhibited rough and clubbed appearance (Fg.1). Measurements of galls were recorded and morphological characteristics of galls were observed under disecting microscope. Root knot galls intensity was calculated by 0-III rating scale viz. 0 = apparantly free; I = 0 to 5%; II = 5 - 10% and III = 10 to 25% roots showing galled appearance and severity values were calculated in different nurseries by the following formula.

$$\text{Severity} = \frac{\sum nv}{N \times V} \times 100, \text{ where}$$

$\sum nv$ = Sum of product of all the numerical rating
N = Total number of seedlings/rooted suckers observed
V = Maximum rating value.

Gall size varied from 1.0 to 2.85 mm. which were two to three times larger than the diameter of healthy roots. Observations under disecting microscope showed gelatinous egg mass on the surface of swollen regions.Gentle teasing just below the egg mass revealed the presence of typical pear shaped female nematode bodies inside the galls. Morphological characteristics of immature and mature stages of females revealed the presence of *Meloidogyne* sp in the infested Kiwi plant roots. The detailed studies concerning identification of the *Meloidogyne* upto species level are in progress and samples have also been submitted to Nematology Division, IARI, New Delhi.

The occurrence of different *Meloidogyne spp* viz. *M. hapla*, *M. incognita* and *M. arenaria* have been reported by various workers from NewZealand, USA, France, Italy, Chile, Spain, China, Iran and Brazil (Tacconi, 1997, Cayrol et al. 1991; Philippi et al. 1996; Pincochet et al. 1990; Fang. 1991; Maffi and Mahadevian, 1997. A detailed information of *Meloidogyne* on Kiwi fruit plant and its worldwide distribution during 1929-93 have been reported by Tacconi (1997). To our knowledge this constitutes the first report of root knot nematode parasitising Kiwi roots in India.

The distribution of root knot infestation varied from 4.2 to 93.2% with varying severity in different nurseries (Table 1). Rooted shoot cuttings of different cultivars differed in percent root knot infestation as well as severity values. Cv. Abbott exhibited the maximum (93.2%) followed by cvs. Monty, Hayward Allision and Tomuri (male cultivar) in decreasing order (Table 1). The differences in cultivars reaction to root knot susceptibility might have been also due to variable inoculum in the infested soil. This requires further confirmation by testing the cultivars under artificially infested soil with uniform egg mass inoculum.

Observation further revealed that nurseries location had marked effect on percent root knot infestation. Nurseries located in warmer areas like Darlaghat and Poanta Sahib have recorded 55.4 to 93.2% infestation as compared to 4.2 to 6.6 in Shimla (Table 1). Root knot infestation in Kiwi seedlings was higher in seedlings raised in polyethylene bags (69.4%) than open fields (55.4% at Darlaghat. The effect of high temperature on increasing incidence of *Meloidogyne hapla* on kiwi has been reported from Spain (Pinochet *et al.* 1990).

The wide spread occurrence of root knot infestation on Kiwi seedlings or rooted shoot cuttings in different nurseries in Himachal Pradesh warrants strict nursery certification and implementation of quarantine regulation to restrict the distribution of infested plant material to new areas within the State as well as other Kiwi growing regions of the country. Nursery sites should be selected in cooler areas where root knot infestation is low. Soil fumigation with dichloropropene before planting and periodical application of fenamiphos have been suggested for the Kiwi root knot nematode (Tacconi, 1997). Necessary treatments with nematicides to quality planting material should be given before distributing these to the growers. No work has been done in India in this regard. However, in NewZealand bare-root immersion for one hour in 0.1% aqueous solution of phenamiphos (fenamiphos) has been recommended to control *M. hapla* in Kiwi nursery stock (Grandison, 1983). Weed management in nursery might be helpful in keeping the nematode under check because common nursery weeds like *Chenopodium album, Lamium amplexicaule; Solanum nigrum* and *Trifolium repens* are the hosts of root knot nematodes besides other commercial crops (Ciancio *et al.* 1992). Integrated approach for the management of Kiwi root knot nematode includes selection of nursery sites in cooler areas, weed management and procurement of nematode free planting material from certified nurseries and implementation of quarantine regulation. These practices may help in securing the future of this new fruit crop in the country.

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Table 1. Distribution of root knot nematode in Kiwi roots in different nurseries

Nursery Location	Type of planting material	Cultivars	Population infested (%)	Severity (%)
Poanta Sahib	Rooted Suckers	Hayward	79.2	47.8
Distt. Sirmour		Allison	72.9	36.8
		Monty	82.0	47.7
		Abbott	93.2	59.2
		Tomuri	70.6	29.6
Shimla				
Distt. Shimla				
i. Dhanda	Rooted suckers	Allison	4.2	1.4
ii. Phagli	Rooted suckers	Hayward	6.6	2.2
Darlaghat				
Distt. Solan	i) Kiwi seedlings (Nursery beds)	-	55.4	25.6
	ii) Kiwi seedlings (Polyethylene bags)	-	69.4	32.2