

Original Research Article

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Survey for the Incidence of Root-knot Nematode (*Meloidogyne incognita*) in FCV Tobacco Growing Soils of Karnataka

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An intensive roving survey was undertaken in major tobacco growing districts of Karnataka viz., Mysuru, Hassan, Shivamogga and Davanagere to know the extent of root-knot nematode infestation. Results revealed that the disease was widespread in all the tobacco growing regions of Karnataka with an average root-knot index of 2.90. Maximum root-knot incidence was noticed in Harave village of Hunsur taluk, Mysuru district with nematode population of 756.00 J<sub>2</sub>/200 cc soil and 356.00 J<sub>2</sub>/5 g of root. Whereas, least incidence of root-knot infestation was observed in Kattige village of Davanagere district, with nematode population of 120.00 J<sub>2</sub>/200 cc soil and 105.00 J<sub>2</sub>/5 g of root.

**Introduction**

Tobacco (*Nicotiana tabacum* L.) is one of the most economically significant crop in the world. It is said to have been introduced into India in the beginning of 17<sup>th</sup> century. The plant belongs to the genus *Nicotiana* and to solanaceae (nightshade) family (Gopalachari, 1984). Unlike in other crops, in tobacco, the ultimate product is the leaf that is consumed and leaf contains the principle alkaloid called Nicotine. The oil obtained from tobacco is gaining more importance as it is edible and known to be good for heart patients and it is also used as a pain killer and also in soap

industries (Ravindra, 2007).

Tobacco is grown in an area of 0.45 million ha (0.27% of the net cultivated area) producing 800 million kgs of tobacco leaf. India stands second in production and export of tobacco in the world after China and Brazil respectively. Southern transition zone (STZ) of Karnataka is ideally suited for growing export quality of FCV tobacco. It is grown mainly in parts of Shivamogga, Chikmagalur, Davanagere, Hassan, Kodagu and Mysuru districts. Karnataka produces FCV tobacco to the tune of 98.72 million kgs from an area of 76,089 ha with an average yield ranging

between 1200-1300 kg/ha (Anon., 2017).

In Karnataka, tobacco crop grown in light soil provides ideal conditions for development and perpetuation of pathogens. There are many diseases caused by fungi, bacteria, viruses, nematodes and root parasite, orobanche affecting yield and quality of tobacco both in the nurseries and main field (Ravindra, 2007). Root-knot, a disease caused by root-knot nematodes *M. incognita* and *M. javanica* is a primary production constraint in tobacco. In India, root-knot nematode, *M. incognita*, have been estimated to cause yield loss upto 22 per cent from field infestation and 50 per cent if the infestation started in the seedbed (Shepherd and Barker, 1990).

Root-Knot nematode continues to be the major production threat both in the nursery and main field since tobacco is cultivated as monocrop in some parts of STZ. The genus, *Meloidogyne* has several species and information regarding different species is very meager. Therefore, survey was conducted in major tobacco-growing areas with varied soils of Karnataka to identify and to determine the intensity of root-knot nematode infestation.

### Materials and Methods

An intensive roving survey was undertaken during *Khari* 2017 in major tobacco growing districts of Karnataka viz., Mysuru, Hassan, Shivamogga and Davanagere. From each district, selected taluks, from each taluk four villages and in each village three farmer fields were surveyed.

Soil and root samples were collected from the rhizosphere of the infected tobacco plants. Samples from 6-7 spots were collected randomly representing the whole field. From this, composite samples, 200 cc of soil and 5 g of roots were used as working samples for further studies. Each sample collected was filled in a polythene bag and tied with a

rubber band and labeled immediately. Information about the locality, crop history, etc., was also obtained along with the samples. Samples of soil and roots were placed in the refrigerator and analyzed on the next day of collection. The nematode populations from soil and root samples were estimated.

The galled root system was scored by using 0 to 5 disease rating scale given by Taylor and Sasser (1978).

| Grade | Description              | Disease reaction       |
|-------|--------------------------|------------------------|
| 0     | No galls                 | Immune                 |
| 1     | 1-2 galls/root system    | Resistance             |
| 2     | 3-10 galls/root system   | Moderately resistance  |
| 3     | 11- 30 galls/root system | Moderately susceptible |
| 4     | 31-100 galls/root system | Susceptible            |
| 5     | >100 galls/root system   | Highly susceptible     |

### Nematode population assessment

#### Extraction of nematodes from soil

From the collected samples, nematodes were extracted by following Cobb's sieving and decanting technique (Cobb's, 1918) followed by Modified Baermann's funnel method (Whitehead and Hemming, 1965). Dilution method was followed for counting of root-knot nematodes.

After incubation of 24 hrs, the extracted J<sub>2</sub> nematode population was made up to a known volume (usually 100 ml) and the suspension was bubbled through a pipette, out of which 5 ml was transferred to a Perspex counting dish. The nematode numbers were counted by using Tally counter under a stereo binocular microscope. Nematode populations from this were finally estimated for 200 cc soil.

### **Estimation of nematode population from root samples**

Nematode populations in 5 g of roots were estimated by root incubation method (Ayoub, 1977). Roots were gently washed with tap water to get free of soil particles. Washed roots were cut into small bits of 2.5 to 3.0 cm and these were placed over tissue paper spread on a wire gauge and mounted on a Petri plate. Level of water was maintained in Petri plate and left undisturbed for 24 hrs. After 24hrs, the content of Petri plate was emptied into a beaker, diluted to a suitable volume and population counts were made with the help of Fenwicks multi-chamber counting slide and observed for nematodes by using a stereo binocular microscope. Based on requirement the suspension was diluted with sterile water. Five aliquots were examined from each sample and the average population was calculated.

### **Results and Discussion**

An intensive roving survey was undertaken in major tobacco growing districts of Karnataka viz., Mysuru, Hassan, Shivamogga and Davanagere to know the extent of root-knot nematode infestation. Results presented in Table 1 revealed that the disease was widespread in all the tobacco growing regions of Karnataka with an average root-knot index of 2.90. Maximum root-knot incidence was noticed in Harave village of Hunsur taluk, Mysuru district with nematode population of 756.00 J<sub>2</sub>/200 cc soil and 356.00 J<sub>2</sub>/5 g of root. Whereas, least incidence of root-knot infestation was observed in Kattige village of Davanagere district, with nematode population of 120.00 J<sub>2</sub>/200 cc soil and 105.00 J<sub>2</sub>/5 g of root.

In Mysuru district, FCV tobacco was grown in different villages of Hunsur and Periyapatna taluks. Among these two taluks,

Hunsur showed highest root-knot nematode incidence with RKI of 4.30, whereas, it was 2.00 in Periyapatna. Nematode population from the soil of different villages of Hunsur taluk was compared, Harave village ranked first (756.00 J<sub>2</sub>/200 cc soil), followed by Hunsur (560.00 J<sub>2</sub>/200 cc soil), H. Ramenahalli (540.00 J<sub>2</sub>/200 cc soil) and Chilkunda (480.00 J<sub>2</sub>/200 cc soil). Whereas, root nematode population was highest in Harave (356.00 J<sub>2</sub>/5g of root) followed by H. Ramenahalli (277.00 J<sub>2</sub>/5g of root), Hunsur (232.00 J<sub>2</sub>/5g of root) and Chilkunda (137.00 J<sub>2</sub>/5g of root).

Among four villages of Periyapatna taluk, Haptur showed the highest soil and root nematode population (420.00 J<sub>2</sub>/200 cc soil and 240.00 J<sub>2</sub>/5g of root) followed by Hunse koppa (350.00 J<sub>2</sub>/200 cc soil and 188.00 J<sub>2</sub>/5g of root), Hitne hebbagilu (260.00 J<sub>2</sub>/200 cc soil and 180.00 J<sub>2</sub>/5g of root) and Billalahalli (180.00 J<sub>2</sub>/200 cc soil and 120.00 J<sub>2</sub>/5g of root).

Ramanathpura, Keragodu, Lakkuru and Lakki kuppe are the villages that were surveyed in Arkalgud taluk of Hassan district. Among these villages, Lakki kuppe showed the highest soil nematode population (650.00 J<sub>2</sub>/200 cc soil) and Lakkuru showed highest root nematode population (320.00 J<sub>2</sub>/5 g of root), whereas, least soil and root nematode population was noticed in Ramanathpura (360.00 J<sub>2</sub>/200 cc soil and 103.00 J<sub>2</sub>/5g of root) respectively.

An average nematode population of 240.00 J<sub>2</sub>/200 cc soil and 153.75 J<sub>2</sub>/5 g of root was recorded in Davanagere district. In this district, FCV tobacco was majorly grown in Honnali taluk. Among different villages of Honnali taluk, Kenchikoppa had nematode population of 320.00 J<sub>2</sub>/200 cc soil and 210.00 J<sub>2</sub>/5g of root with highest root-knot nematode infestation which was followed by

Soraturu (270.00 J<sub>2</sub>/200 cc soil and 110.00 J<sub>2</sub>/5 g of root), Jeenahalli (250.00 J<sub>2</sub>/200 cc soil and 190.00 J<sub>2</sub>/5g of root) and Kattige (120.00 J<sub>2</sub>/200 cc soil and 105.00 J<sub>2</sub>/5g of root) respectively.

Similarly, in Shivamogga district, Navile showed the highest soil and root nematode population (590.00 J<sub>2</sub>/200 cc soil and 298.00 J<sub>2</sub>/5g of root), followed by Kunchenahalli (488.00 J<sub>2</sub>/200 cc soil and 187.00 J<sub>2</sub>/5g of root), Mallapura (470.00 J<sub>2</sub>/200 cc soil and 223.00 J<sub>2</sub>/5g of root) and Hunasodu (444.00 J<sub>2</sub>/200 cc soil and 202.00 J<sub>2</sub>/5g of root). The

average root-knot index of Shivamogga taluk was 3.54.

Taluk wise comparison of root-knot incidence showed that Hunsur had the highest incidence with root-knot index of 4.30, followed by Arkalgud (3.66), Shivamogga (3.54), Periyapatna (2.00) and least root-knot index was recorded in Honnali (1.96). However, comparison of district mean of root-knot index revealed that root-knot incidence was maximum in Hassan followed by Shivamogga, Mysuru and Davanagere respectively (Fig. 1).

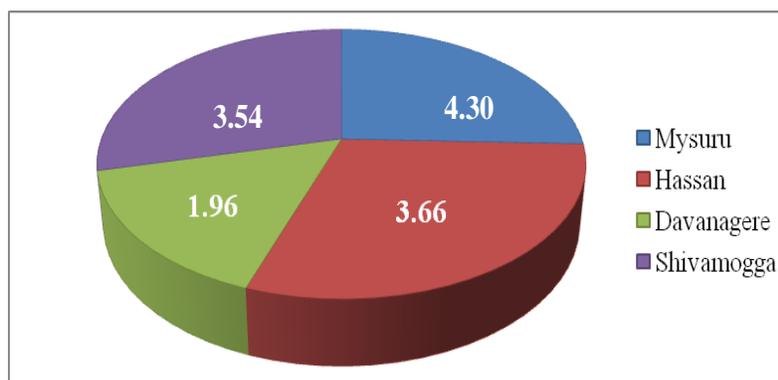
**Table.1** Survey for the incidence of root-knot nematode in FCV tobacco growing soils of Karnataka during 2017-18

| District             | Taluk       | Village        | Nematode population/ 200 cc soil | Nematode population/ 5 g root | RKI (0-5)   |
|----------------------|-------------|----------------|----------------------------------|-------------------------------|-------------|
| Mysuru               | Hunsur      | Hunsur         | 560.00                           | 232.00                        | <b>4.30</b> |
|                      |             | Harave         | 756.00                           | 356.00                        |             |
|                      |             | Chilkunda      | 480.00                           | 137.00                        |             |
|                      |             | H. Ramenahalli | 540.00                           | 277.00                        |             |
|                      | Periyapatna | Hitnehebbagilu | 260.00                           | 180.00                        | <b>2.00</b> |
|                      |             | Billalahalli   | 180.00                           | 120.00                        |             |
|                      |             | Haptur         | 420.00                           | 240.00                        |             |
|                      |             | Hunse koppa    | 350.00                           | 188.00                        |             |
| <b>District mean</b> |             |                | <b>443.25</b>                    | <b>216.25</b>                 | <b>3.15</b> |
| Hassan               | Arkalgud    | Ramanathpura   | 360.00                           | 108.00                        | <b>3.66</b> |
|                      |             | Keragodu       | 470.00                           | 224.00                        |             |
|                      |             | Lakkuru        | 585.00                           | 320.00                        |             |
|                      |             | Lakki kuppe    | 650.00                           | 295.00                        |             |
| <b>District mean</b> |             |                | <b>516.25</b>                    | <b>236.70</b>                 | <b>3.66</b> |
| Davanagere           | Honnali     | Kattige        | 120.00                           | 105.00                        | <b>1.96</b> |
|                      |             | Jeenahalli     | 250.00                           | 190.00                        |             |
|                      |             | Kenchikoppa    | 320.00                           | 210.00                        |             |
|                      |             | Soraturu       | 270.00                           | 110.00                        |             |
| <b>District mean</b> |             |                | <b>240.00</b>                    | <b>153.75</b>                 | <b>1.96</b> |
| Shivamogga           | Shivamogga  | Hunasodu       | 444.00                           | 202.00                        | <b>3.54</b> |
|                      |             | Kunchenahalli  | 488.00                           | 187.00                        |             |
|                      |             | Mallapura      | 470.00                           | 223.00                        |             |
|                      |             | Navile         | 590.00                           | 298.00                        |             |
| <b>District mean</b> |             |                | <b>498.00</b>                    | <b>227.5</b>                  | <b>3.54</b> |

**Plate.1** Root-knot nematode infected FCV tobacco plant and roots



**Fig.1** District mean of root-knot index



The present investigations are in conformity with the findings of a survey conducted by Hussaini and Krishnamurthy (2002) who observed that there was no healthy tobacco crop found in Hunsur, Periyapatna and Ramanathpura areas. They also noticed that the root-knot nematode disease was widespread in tobacco growing areas of Karnataka with an average incidence of 81.9 per cent. Further, these results are also in line with survey conducted by Ravindra (2007a) under AINRP (T) in Karnataka, they noticed average RKI of 1.00 to 5.00 in different clusters of Honnali, Shivamogga and Tarikere and found that in all clusters of Hassan and Mysuru districts root-knot incidences were high and average RKI ranged from 2.00 to 5.00. Further, similar results were observed by Ravindra, 2012.

In conclusion, the survey showed that the disease varied from region to region with soil type, cultivar used and cropping pattern practiced. Monocropping has favoured the build up of nematode population in soil leading to heavy infestation and lose to the crop yield. Due to resistance breaking ability of nematodes it is very much needed to go for cultivation different cultivars during every growing season to avoid severity of root-knot nematode damage.

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## References

Anonymous. 2017. Annual report for 2016-17, Tobacco board, India.

Cobb, N.A. 1918. Estimating the nema population of the soil. Agricultural Technology Circular-1, pp. 48. Bureau of plant industry, U.S.D.A. California, USA.

Gopalachari, N.C. 1984. Tobacco published by Indian Council of Agricultural Research, New Delhi.

Hussaini, S.S. and Krishnamurthy, G.V.G. 2002. Occurrence and distribution of root-knot species of FCV tobacco in Karnataka. *Indian J. Nematol.*, 32(1): 20-22.

Ravindra, H. 2007. Ecofriendly approaches for the integrated management of root-

knot nematode of tobacco. *Ph.D. Thesis*, Kuvempu University, Shivamogga.

Ravindra, H. 2012. Survey for the occurrence of root-knot nematode in Karnataka light soils (KLS). Quinquennial review report (2008-13), AINRP (T).

Shepherd, J.A. and Barker, A.K. 1990. Nematode parasites of tobacco. pp. 493-517 *In: Plant-parasitic nematodes in subtropical and tropical agriculture*. M. Luc, R. A. Sikora, and J. Bridge, (eds.) Wallingford: CAB International.

Taylor, A. L. and Sasser, J. N., 1978, Biology, identification and control of root-knot nematodes (*Meloidogyne* species). IMP. North Carolina States Univ., Graphics, pp. 111.

Whitehead, A. G. and Hemming, J. R., 1965, A comparison of some quantitative methods of extracting small vermiform nematodes from soil. *Ann. Appl. Biol.*, 55: 25-38.

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