

STUDIES ON WILT DISEASE EXPRESSION IN THE PRESENCE OF *MELOIDOGYNE INCOGNITA* AND *FUSARIUM MONILIFORME* IN GRAPEVINE

T. Senthilkumar and G. Rajendran

Department of Nematology, Tamil Nadu Agricultural University,
Coimbatore - 3, Tamil Nadu, India

Summary. A study on wilt disease expression in the presence of *Meloidogyne incognita* and *Fusarium moniliforme* on grapevine cv. Muscat Hamburg was carried out under glasshouse conditions. Growth parameters, viz., shoot length, shoot weight, root length and root weight of vines, were found to be significantly affected by the inoculation of *M. incognita* and *F. moniliforme* alone and in combination. Simultaneous inoculation of nematode and fungus resulted in the greatest reduction of shoot length (40.6%) and shoot weight (63.9%). Wilt disease was observed when both *M. incognita* and *F. moniliforme* were inoculated or when the fungus was inoculated alone. The per cent wilt disease incidence (35%) was higher in vines inoculated with nematodes a week prior to fungal inoculation.

Grapevine is an important fruit crop, grown throughout India. In terms of area (286 ha) and production (6140 t), Coimbatore district is the second most important production area among all the districts of Tamil Nadu in India. Fruits are used for fresh consumption (90%), preparation of raisins (5%) and wine making (5%). Grapevine cultivation has become one of the most remunerative farming enterprises in Tamil Nadu. In recent years, a decline in growth of vines has been observed in vineyards of Coimbatore district. Preliminary observation of the soil and root samples from affected vines revealed the presence of a root-knot nematode, *Meloidogyne incognita*, and a fungus, *Fusarium moniliforme*. *F. moniliforme* was encountered in all the affected vineyards of Coimbatore district, and may be one of the reasons for vine decline. *M. incognita*, which causes 25 to 50 per cent yield loss in grapevine cv. Muscat Hamburg in Tamil Nadu, is one of the major constraints to grape production (Tirumalarao and Seshadri, 1981).

The work described here was undertaken to study the nematode disease complex involving *M. incognita* and *F. moniliforme* in grapevine under glasshouse conditions.

MATERIALS AND METHODS

Uniform size cuttings of *Vitis vinifera* L. were raised in microplots filled with sterilized soil. After 30 days, rooted cuttings were planted, one per five kg capacity pot filled with steam sterilized potting mixture. The pots were maintained under glasshouse conditions. Watering of pots was done regularly. The rooted cuttings were allowed to grow for a period of 30 days for better establishment.

The nematode, *M. incognita* (Kofoid et White) Chitw.

inoculum required for the experiment was obtained from *Coleus* sp. raised in the glasshouse. The egg masses were collected from the pure culture and incubated for hatching at room temperature for two to three days. The hatched juveniles were used for inoculation.

The fungal inoculum of *F. moniliforme* Sheldon was isolated from wilted plants collected from Madampatti village, Coimbatore district, Tamil Nadu State, by a tissue transplant isolation method (Richer and Richer, 1936). The infected root tissues were placed on potato dextrose agar (PDA) medium after surface sterilization with 0.1% HgCl₂ and incubated at room temperature (29±1°C) for ten days. The fungal hyphae developing from the tissue were subcultured on PDA. Mycelial discs were taken from the advancing zone of the colony and were transferred to potato dextrose broth for mass multiplication (Richer and Richer, 1936). This broth was used for inoculation purpose.

Nematodes were inoculated at the rate of 1 J₂/g of soil and the fungus at the rate of 1x10⁵ spores/ml, as indicated in Table I. Each treatment was replicated four times.

The experiment was terminated 90 days after the last inoculation of nematode and fungus. At this time, shoot length (cm), shoot weight (g), root length (cm), root weight (g), root gall index, final nematode population in soil (250 g) and per cent wilt disease incidence were recorded.

RESULTS

The data from the study of wilt disease expression in the presence of *M. incognita* and *F. moniliforme* on grapevine are presented in Table I.

Shoot length was significantly reduced when *M. incognita* and *F. moniliforme* were inoculated indepen-

Table I. Interaction of *Meloidogyne incognita* and *Fusarium moniliforme* on grapevine cv. Muscat Hamburg.

Treatment	Shoot length (cm)	Shoot weight (g)	Root length (cm)	Root weight (g)	Root gall index*	Final soil nematode population (250 g)*	% wilt disease incidence
Fungus alone	85.3 ^d (-24.7)	54.8 ^d (-32.4)	45.5 ^c (-32.8)	35.5 ^e (-39.6)	- (-0.3) ^a	- (-0.3) ^a	16.0
Inoculation of fungus one week prior to nematode	82.5 ^c (-27.2)	49.3 ^c (-39.2)	56.3 ^d (-17.0)	31.8 ^d (-46.0)	2.3 (0.4) ^b	2898.8 (3.5) ^b	25.5
Inoculation of nematode one week prior to fungus	75.3 ^b (-33.6)	35.8 ^b (-55.9)	39.3 ^b (-42.1)	21.8 ^a (-63.0)	3.8 (0.6) ^{cd}	3353.8 (3.6) ^c	35.0
Simultaneous inoculation of nematode and fungus	67.3 ^a (-40.6)	29.3 ^a (-63.9)	47.5 ^c (-29.9)	24.5 ^b (-58.3)	3.3 (0.6) ^c	3583.8 (3.6) ^d	30.0
Nematode alone	92.5 ^e (-18.3)	62.5 ^e (-22.8)	35.5 ^a (-47.6)	27.3 ^c (-53.6)	4.3 (0.7) ^d	3872.5 (3.6) ^e	-
Uninoculated control	113.3 ^f	81.0 ^f	67.8 ^e	58.8 ^f	- (-0.3) ^a	- (-0.3) ^a	-
CD (p=0.05)	2.27	1.99	2.65	1.95	0.06	0.00	

Figures in parentheses are per cent decrease over control; * figures in parentheses are log (x+0.5) transformed value.

dently and in combination. When both the pathogens were inoculated simultaneously, the reduction of shoot length (40.6%) was greater than when fungus was inoculated prior to nematodes or nematodes prior to fungus.

Inoculation of vines with pathogens alone or in combination resulted in a significant reduction in shoot weight of vines compared to the uninoculated control. However, the maximum reduction of shoot weight was recorded in vines inoculated with nematodes and fungus simultaneously (64%), followed by those inoculated with nematodes prior to fungus (56%).

When nematodes and fungus were inoculated individually or in combination, root length and root weight were also found to be significantly reduced compared to the uninoculated control. The smallest root length was observed in vines inoculated with nematodes alone. The least root weight was recorded in vines inoculated with nematodes prior to the fungus when compared to the uninoculated control.

The smallest root gall index (2.3) was recorded in vines inoculated with fungus prior to nematodes and the highest in vines inoculated with nematodes alone (4.3). The lowest final soil nematode population was recorded when fungus was inoculated prior to nematodes followed by inoculation of nematodes prior to fungus.

The greatest wilt disease incidence (35%) was recorded in vines inoculated with nematodes prior to fungus, followed by simultaneous inoculation of nematodes and fungus (30%).

DISCUSSION

Simultaneous inoculation of *M. incognita* and *F. moniliforme* caused the maximum suppression of shoot length and shoot weight in grapevine. This is in agreement with work by Arya and Saxena (1988), where the interaction between *M. incognita* and *F. oxysporum* f.sp. *lycopersici* resulted in reduction of tomato plant growth. Sheela and Venkitesan (1990) observed that interaction between *M. incognita* and *Fusarium* sp. resulted in suppression of growth of pepper and simultaneous inoculation of *M. incognita* and *F. oxysporum* f.sp. *udum* suppressed the growth of pigeon pea (Dwivedi *et al.*, 1992). Anwar and Verma (1993) reported that greatest reduction in shoot height, root length and fresh and dry weight of shoot and root occurred with simultaneous inoculation of *M. javanica* and *Rhizoctonia solani* on chickpea.

Root gall index and final nematode population differed significantly between the inoculation of *M. incognita* alone or in combination with *F. moniliforme*. The highest gall index was recorded when nematodes were

inoculated alone followed by inoculation of nematodes prior to the fungus. Siddiqui and Husain (1992) reported that inoculation of *M. incognita* and *Macrophomina phaseolina* together caused more damage to chickpea.

Nematodes cause histopathological disturbances and physical and biochemical changes in roots and these facilitate fungal colonization. The present findings were similar to La Mondia (1992) who reported that tobacco plants infected by *M. hapla* prior to fungus suffered greater *Fusarium* wilt incidence and severity. The disease incidence was greater with combined inoculation of *M. incognita* and *F. oxysporum* than with either of the pathogens alone. A report of *M. incognita* increasing the wilt incidence of watermelon caused by *Fusarium* wilt (Yen *et al.*, 1998) also supports the present findings.

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