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INTERACTION OF *MELOIDOGYNE INCOGNITA* AND *PHYTOPHTHORA PALMIVORA* ON BETELVINE

by

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Summary. Experiments were conducted for two years to study the interaction between *Meloidogyne incognita* and the wilt fungus *Phytophthora palmivora* on *Piper betle*. Synergistic interaction occurred between nematode and fungal pathogens on the crop, both in concomitant and sequential inoculations. Wilt disease incidence in terms of root rot index was significantly high in concomitant and sequential inoculations of the nematode and fungus. Increase in vine mortality was observed when the nematode inoculation preceded the fungus.

Betelvine (*Piper betle* L.) is one of the important commercial crops grown in India. *Phytophthora palmivora* Butler causes wilt of betelvine and is often associated with plant parasitic nematodes. Among them, root-knot nematode *Meloidogyne incognita* (Kofoid *et* White) Chitw. commonly attacks this crop and causes yield reduction (Sivakumar and Marimuthu 1984). Synergistic interactions between *M. incognita* and *P. parasitica* var. *nicotianae* have been recorded in tobacco (Powell and Nusbaum, 1960). We investigated the interaction of *M. incognita* and *P. palmivora* in betelvine with reference to time of infection of the two pathogens.

Materials and methods

Uniformly sized, three-noded cuttings of betelvine cv. Karpoori were planted in pots containing 5 kg sterilized soil and kept in a mist chamber. Thirty days later, the plants were inoculated with the fungus and/or the nematodes as

indicated in Tables I and II. There were five replications in each treatment.

The nematode inoculum was obtained from a pure culture of *M. incognita* maintained on tomato. Freshly hatched-out juveniles were inoculated at 5000/pot. The fungus was isolated from a diseased betelvine plant and multiplied on potato-dextrose agar (PDA) (Ricker and Ricker, 1936). One week old cultures maintained in Petri plates were flooded with sterile tap water and the fungal growth disturbed with a sterile needle. The plates were incubated at 25 °C for 24 hrs. The sporangia produced were harvested and a suspension (50 sporangia/ml water) was prepared. The sporangial suspension was inoculated at the rate of 50 ml/pot. Inoculations were made by carefully removing the soil at the root zone of the plants and adding the homogenous suspension of *M. incognita* J2 and/or sporangial suspension.

Plants were uprooted 90 days after the treatments. Measurements on shoot and root length and weight were made. The number of leaves

per vine and per cent mortality of vines were recorded. The root-knot and root rot indices were estimated on a 0-5 scale.

Results and discussion

M. incognita and *P. palmivora* individually caused significant reductions in shoot length, shoot weight, root length and root weight. They also reduced the number of leaves per vine when compared with uninoculated control (Tables I and II). Inoculation of the nematode alone resulted in the highest gall index of 5. Significant reduction in the gall index was ob-

served in concomitant and sequential inoculation of the two pathogens. With the fungus alone the root system was free from galls but had a root rot index of 1.9 and 2.5, respectively, during 1993 and 1994.

When both the pathogens were inoculated concomitantly or sequentially, the decline in plant growth parameters, viz. shoot length and weight and root length and weight, was greater than with either pathogen alone. The pathogens together also significantly reduced the number of leaves per vine.

The root rot index was significantly higher with concomitant and sequential inoculations than with the fungus alone. This clearly indicat-

TABLE I - *Interaction of Meloidogyne incognita and Phytophthora palmivora in betelvine (1993).*

Treatment	Shoot		Root		No. of leaves/vine	Root-knot index (0-5 scale)	Root rot index (0-5 scale)	Mortality of vine (%)
	length (cm)	weight (g)	length (cm)	weight (g)				
Nematode alone (N)	154.3	91.3	35.3	14.6	195.3	5.0 (2.4)	0.0 (0.7)	0.0 (4.1)
Fungus alone (F)	155.5	93.5	34.5	13.5	193.2	0.0 (0.7)	1.9 (1.6)	9.5 (18.4)
Concomitant inoculation of N+F	145.2	85.3	30.3	12.8	185.6	2.5 (1.8)	2.6 (1.7)	25.2 (30.4)
N 20 days before F inoculation	144.5	84.5	29.3	12.6	184.1	3.5 (2.0)	2.8 (1.8)	29.3 (33.1)
F 20 days before N inoculation	146.3	87.2	30.6	11.9	186.3	3.0 (1.9)	2.4 (1.7)	22.5 (28.5)
Uninoculated control	190.5	108.5	39.2	19.2	205.3	0.0 (0.7)	0.0 (0.7)	0.0 (4.1)
SEM	2.5	1.7	1.3	1.1	2.3	0.1	0.05	0.4
CD at 5%	7.4	5.9	3.7	3.2	6.5	0.3	0.2	1.1

Figures in parentheses are $\sqrt{X+0.5}$ transformed values and figures in parentheses for mortality of vine are $X+0.5$ Arcsin transformed values; root-knot index 0=0 galls, 1=1-2 galls, 2=3-10 galls, 3=11-30 galls, 4=31-100 galls, 5=100 galls or more per root system; root rot index 0 = free from rotting, 1=1-15% rotting, 2=16-30% rotting, 3=31-45% rotting, 4=46-60% rotting, 5 = above 60% rotting.

TABLE II - Interaction of *M. incognita* and *P. palmivora* in betelvine (1994).

Treatment	Shoot		Root		No. of leaves/vine	Root-knot index (0-5 scale)	Root rot index (0-5 scale)	Mortality of vine (%)
	length (cm)	weight (g)	length (cm)	weight (g)				
Nematode alone (N)	152.5	89.1	34.2	13.5	185.2	5.0 (2.4)	0.0 (0.7)	0.0 (4.1)
Fungus alone (F)	153.3	90.3	32.5	12.8	182.5	0.0 (0.7)	2.5 (1.7)	11.2 (20.0)
Concomitant inoculation of N+F	143.5	83.5	29.5	10.2	175.2	2.8 (1.8)	3.5 (2.0)	27.3 (31.8)
N 20 days before F inoculation	142.3	81.3	28.4	9.5	172.6	3.5 (2.0)	4.0 (2.1)	30.2 (33.7)
F 20 days before N inoculation	145.2	84.6	30.3	10.4	178.5	2.9 (1.8)	3.0 (1.9)	23.5 (29.3)
Uninoculated control	188.5	105.8	37.8	18.5	199.6	0.0 (0.7)	0.0 (0.7)	0.0 (4.1)
SEM	2.2	1.5	1.2	0.9	2.1	0.8	0.07	0.6
CD at 5%	6.5	4.3	3.5	2.6	6.2	2.3	0.2	1.5

Figures in parentheses are $\sqrt{X+0.5}$ transformed values and figures in parentheses for mortality of vine are $X+0.5$ Arcsin transformed values; root-knot index 0=0 galls, 1=1-2 galls, 2=3-10 galls, 3=11-30 galls, 4=31-100 galls, 5=100 galls or more per root system; root rot index 0 = free from rotting, 1=1-15% rotting, 2=16-30% rotting, 3=31-45% rotting, 4=46-60% rotting, 5 = above 60% rotting.

ed a synergistic interaction between *M. incognita* and *P. palmivora* in betelvine.

Vine mortality was evident with the fungus alone, concomitant inoculation and with sequential inoculations of the two pathogens. However, a significant increase in vine mortality also was observed when the fungal pathogen was inoculated 20 days after the nematode inoculation. This suggests that the root-knot nematode *M. incognita* can predispose the betelvine plants to *P. palmivora* and enhance the severity of wilt disease.

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