

VARIETAL RESPONSE OF PEPPER TO INFESTATION BY THE BURROWING NEMATODE, *RADOPHOLUS SIMILIS*

Nalini C. Gnanapragasam

(Tea Research Institute of Sri Lanka, Talawakele, Sri Lanka)

In order to assess appropriate varieties of pepper that are resistant to the burrowing nematode, *Radopholus similis* that could be intercropped with tea, 15 varieties of pepper were screened against this species of nematode. Amongst these, the variety PW 14 was totally immune to infestation and hence the most suited for intercropping with tea. Six additional varieties including GK 49, KW 31, KW 33, MW 21, Panniyur and TG 7 showed promise for intercropping in tea areas, as these supported only low populations of *R. similis*. On the other hand the varieties KW 30, DM 7, H 8, IWS, Kuching, MB 12, MN 1 and M W 18 were very susceptible and hence not suitable to be grown in tea areas.

INTRODUCTION

The burrowing nematode, *Radopholus similis* is known to attack a wide range of hosts in the tropical and sub-tropical countries. It is also known to be a very destructive pathogen of black Pepper (*Piper nigrum*) (Christie, 1957; Sher, Chunram and Pholcharoen 1969; Venkitesan and Setty, 1977). In the island of Banka in Indonesia, which was at one time one of the world's principal sources of pepper, this species of nematode caused a disease commonly referred to as the 'pepper yellows', which wiped off almost the whole plantation (20 out of 22 million trees) during the period 1930-1950 (Van der Vecht, 1950; Christie 1957, 1959; Thorne, 1961; Ichinohe, 1976). In the states of Kerala and Karnataka in India *R. similis* is known to cause a disease called a slow wilt of pepper, the symptoms of which are similar to that of 'pepper yellows' (Venkitesan and Setty, 1977; Koshy, 1986). The yellow disease appears at localised points affecting a few trees and thereafter spreads slowly throughout the plantation. The leaves of the infested plants initially turn yellow followed by dieback and defoliation. Large numbers of lesions occur on the roots which subsequently cause discolouration of the root system (Christie, 1959; MacGowan, 1982).

Tea is known to be a good host for this pest (Zimmerman, 1899; Steiner and Buhrer, 1933; Sivapalan, 1968). Since pepper is intercropped with tea in the mid-elevation small holder tea areas, it became essential to screen the various available pepper varieties against this pest, in order to recommend appropriate resistant varieties that could be intercropped with selected, tolerant tea clones to this nematode species.

MATERIALS AND METHODS

Three replicates each of 15 varieties of pepper plants (obtained through the courtesy of the Department of Minor Export Crops), were transplanted into small plastic pots (18.5 cm in diameter x 16.5 cm height) containing fumigated soil (fumigated with Methyl bromide at the rate of 0.5 kg/2.83 cm³). The potted pepper plants were then arranged in a randomised block design and maintained in the Glasshouse at the Tea Research Institute sub-station at Hantane, Kandy. Two months after establishment in the pots, each pepper plant was inoculated with *Radopholus similis*, at the rate of 2000 nemas/plant and exposed to nematode infestation for a period of 7 months. The nematode inoculum was obtained from mass-reared cultures maintained on carrot discs.

At the end of the period of exposure, each plant was carefully removed from its pot and after noting the condition of the entire root system, the roots were gently washed to remove all soil particles and processed for nematode recovery by the same technique adopted for tea roots (Hutchinson, 1962). The soil from the respective pot was mixed thoroughly and duplicate samples of 100 g each were processed for nematode recovery by the method described by Sivapalan (1967).

RESULTS AND DISCUSSION

Estimation of both soil and root population of *R. similis* was used for rating the performance of the individual varieties of pepper (Table I).

As seen from the Table, the variety PW 14 was found to be totally immune to *R. similis* infestation. Except for this variety, all others showed varying degrees of susceptibility. Amongst these GK 49, KW 31, KW 33, MW 21, Panniyur and TG 7 showed some degree of resistance, as the rate of population buildup (Pf/Pi) in these was slow, compared to the buildup in the other tested varieties. The variety Panniyur was, however, reported to be susceptible to *R. similis* in Kerala, India (Venkitesan and Setty, 1978; Sundararaju, Koshy and Sosamma, 1979).

TABLE I — Mean number of nematode per gram root of pepper as well as mean number of nematodes per 100 g soil

Variety of pepper	Nematodes/g root $\sqrt{n+1}$	Nematodes/100 g soil $\sqrt{n+1}$	Pf/Pi **
DM 7	11.61 b *	7.98 ab	1.80
GK 49	5.84 ab	2.49 a	0.27
H 8	10.47 b	6.10 ab	2.02
IW 5	9.76 ab	9.77 b	2.40
KW 30	25.48 c	17.06 c	3.17
KW 31	6.62 ab	4.52 ab	0.51
KW 33	5.92 ab	3.16 ab	0.44
Kuching	8.86 ab	9.92 bc	2.50
MB 12	10.95 b	6.83 ab	1.27
MN 1	10.74 b	5.22 ab	1.11
MW 18	11.85 b	6.11 ab	2.66
MW 21	7.98 ab	5.56 ab	0.85
Panniyur	3.77 ab	1.82 a	0.10
PW 14	1.00 a	1.82 a	0.05
TG 7	8.87 ab	5.70 ab	0.65

* Mean followed by the same letter not significantly different from each other - Duncan's multiple range test.

** Rate of buildup = ratio of final population (Pf) to initial population (Pi).

The variety KW 30 was the most favoured one for the buildup of *R. similis*, as this supported the largest population in both soil as well as in the roots, which population levels were significantly higher than in any of the tested varieties. This particular variety could henceforth serve as a standard check for any further screening trials and should thus be completely avoided in tea areas meant to be intercropped with pepper.

The varieties DM 7, H 8, IW 5, Kuching, MB 12, MN 1, MW 18 were also found to be very susceptible and it is best to avoid using these as well, when intercropped with tea.

All susceptible varieties (irrespective of the level of infestation) had pale leaves and discoloured roots, the colour of which ranged from brown to black.

Amongst the tested varieties, PW 14 is the best suited for intercropping with tea, in so far as nematode susceptibility is concerned. The other varieties including GK 49, Panniyur, KW 31, KW 33, MW 21 and TG 7, which supported low populations and consequently rated as mild hosts may be intercropped with tea, provided they are propagated in fumigated nematode free soil.

Prior to intercropping a tea area with pepper, it is desirable to sample the tea field, to ascertain the possible presence of nematode infestation. If infested, it is useful to treat planting hole of the pepper vines with an appropriate nematicide.

ACKNOWLEDGEMENTS

I wish to thank the Director of the Department of Minor Export, Crops for granting permission to supply the different varieties of pepper plants and Dr. P de A. Gurusinghe of the same Department for arranging to supply the plants.

My thanks are also due to Messrs A. S. K. Karunaratne, I. Abeysinghe and A. Prematunge for providing technical assistance.

REFERENCES

- CHRISTIE, J. R. (1957). The yellow disease of pepper (*Piper*) and spreading decline in citrus *Plant Dis. Repr.* 41 (4), 267-268.
- CHRISTIE, J. R. (1959). Plant nematodes, their bionomics and control. 1st Ed. United States of America H & W Drew Co. Jacksonville, Florida.
- HUTCHINSON, M. T. (1962). Rehabilitating tea soils I. Susceptibility of plants now in use to the root-lesion nematode, *Pratylenchus loosi*, *Tea Q.* 33, 138-140.
- ICHINOHE, M. (1976). Nematode problems of Black Peppers in Bangka Island, Indonesia, *Nematology Newsletter*, 22 (3), 2.
- KOSHY, P. K. (1986). The burrowing nematode, *Radopholus similis* (Cobb, 1893) Thorne, 1949. p 223-248 In: *Plant Parasitic Nematodes of India, Problems and Progress* Ed by Gopal Swarup and D. R. Dasgupta, Indian Agricultural Research Institute, New Delhi pp 497.
- MACGOWEN (1982). The burrowing nematode infesting black pepper. *Nematology circular* No. 93 Fla Dept. Agric. and Consumer Services, Division of Plant Industry, Gainesville, Florida.
- SHER, S. A., CHUNRAM, C. and PHOLCHAROEN, S. (1969). Pepper yellows disease and nematodes in Thailand, *FAO Plant Pro. Bull.* 17 (2), 33.
- SIVAPALAN, P. (1967). Recovery of *Pratylenchus loosi* from soil samples. *Tea Q.* 38, 29-35.
- SIVAPALAN, P. (1968). Association of *Radopholus similis* with decline in young tea fields. *Plant Dis. Repr.* 52, 528.
- STEINER, G. and BUHRER, M. (1933). The nematode *Tylenchus similis* Cobb, as a parasite of the tea plant (*Thea sinensis* L) its sexual dimorphism and its nemic associates in the same host. *Zeitschr Parasitenk* 5 (2), 412-420.
- SUNDARARAJU, P. KOSHY, P. K. and SOSAMMA, V. K. (1979). Plant parasitic nematodes associated with spices. *J. Plant Crops* 7 (1), 17-26.
- THORNE G. (1961). *Principles of Nematology*. McGraw-Hill Book Co. Inc., New York 553 pp.
- VEICHT, J. van der (1950). Op plant parasiterende aaltjes (Tylenchidae). *Plagen van de cultuurgewassen in Indonesia* p 16-42.
- VENKITESAN, T. S. and SETTY, K. G. H. (1977). Pathogenicity of *Radopholus similis* to black pepper (*Piper nigrum*). *Indian J. Nematol.* 7 (1), 17-26.
- VENKITESAN, T. S. and SETTY, K. G. H. (1978). Reaction of 27 black pepper cultivars and wild forms to the burrowing nematode, *Radopholus similis* Cobb. Thorne, *J. Plant Crops* 6, 81-83.
- ZIMMERMANN, A. (1899). *Teysmannia* 10, 523-531.