Pournami - A high yielding black pepper selection tolerant to root-knot nematode (*Meloidogyne incognita*)

P N RAVINDRAN, K V RAMANA, M K NAIR, K NIRMAL BABU AND C MOHANDAS
National Research Centre for Spices
Calicut - 673 012, Kerala, India.

ABSTRACT

A high yielding selection (Coll. 812) from the germplasm, named Pournami, was tolerant to root-knot nematode *(Meloidogyne incognita)*, damaging roots of black pepper and causing yellowing of leaves and significant yield decline. This selection when tested for its comparative yield performance, was on par with Karimunda and Panniyur-I and was recommended for release.

Key words : black pepper, *Meloidogyne incognita, Piper nigrum*, tolerance.

Introduction

Black pepper from the perennial climbing vine *Piper nigrum* L. is the oldest and the most important spice of the world. India is one of the major producer and exporter of this spice. In India, productvity of black pepper is low due to cultivation of a large number of low yielding genotypes coupled with damage caused by pests and pathogens. The root-knot nematode (*Meloidogyne incognita*) is one of the major nematode pests of black pepper besides *Radopholus similis*. This nematode damages roots, causing yellowing of foliage which in turn leads to considerable yield reduction. At the National Research Centre for Spices, Calicut, experiments are in progress to evolve high yielding varieties resistant to major pests and pathogens. Initial studies led to the identification of a line tolerant to this nematode. The details of this cultivar are presented here.

Materials and methods

Rooted cuttings of black pepper cultivars were raised in methybromide fumigated soil mixture (sand, forest soil and cowdung at 1:2:1 ratio) contained in polythene bags (15 x 10 cm). At 4 to 5 leaf stage, 5 plants of each accession were inoculated with 1000 freshly hatched second stage juveniles of *M. incognita* per plant and maintained in the greenhouse. Four months after inoculation, the plants were carefully removed from polythene bags and the roots were washed free of soil particles. Root infection was assessed using root-knot index on 0-5 scale (Taylor & Sasser 1978) where 0 is immune and 5 is highly

susceptible. Roots of each plant were cut into small bits, mixed thoroughly and 1g of this sample was used for estimating nematode populations (all stages of nematode).

One cultivar (Coll. 812) (Pournami) that was tolerant, was evaluated for its comparative yield performance along with Karimunda and Panniyur-I. In the comparative yield evaluation trial, the vines were trailed on *Erythrina indica* standards planted at 2.5 x 2.5 m spacing, in a Randomised Block Design with five replications. Yield data for four years were used for comparison. Recommended plant protection and agronomic practices were adopted.

Characters contributing to quality of black pepper viz., oleoresin, essential oil content and dry recovery of the varieties were determined using standard ASTA methods (ASTA 1968). Piperine was determined using the spectrophotometric method suggested by Sowbhagya *et al.* (1968).

Data on root-knot index and nematode population in soil and roots of the experimental plants were also recorded. Root and soil samples were collected during November 1989 and 1990 and assessed for nematode infestation. Root-knot index was scored on visual observation on 1-5 scale (1 = no galls; 2 = mild galling; 3 = medium galling; 4 = high galling and 5 = very high galling and root rotting). Nematode population in roots was estimated by staining 1 g of root in acid fuchsin lactophenol and blending.

Results and discussion

The comparative indices of resistant reaction in a few accessions of germplam to *M. incognita* inoculation are given in Table 1. Coll. 812 (Pournami) gave a rating of 2.0 indicating its tolerance to *M. incognita* infestation (Ramana & Mohandas 1986).

Table 1. Reaction of black pepper cultivars to root-knot nematode *Meloidogyne incognita (mean of 5 replicates)**

Mean root-knot index	Cultivar
2.0 - 2.9	Coll. 812 (175)
3.0 - 3.9	Neyyatinkarimundi - 816 (5840), Jeeragamundi - 135 (3550), Kudirungunda - 872 (6150), Aimpirian - 983 (3625), Arakulammunda - 977 (8980)
4.0 - 4.9	Vellanamban - 814 (3181), Kaniyakadan - 901 (4800), Balankotta - 955 (7980), Kottanadan - 959 (6230), Mundi - 993 (12,500), Kalluvally - 880 (3000), Malamundi - 902 (3237), Cheriyakaniyakadan - 924 (6425)

* Ramana & Mohandas 1986

Numbers after cultivars denote germplasm accession numbers

Figures in parentheses are nematode population per gram of root

Root infection was assessed using a root-knot index on 0-5 scale (Taylor & Sasser 1978) where 0 is immune and 5 is highly susceptible

Though the vines started yielding in the first year after planting, it was negligble and hence was not used for comparison. The yield data for the next four years showed no significant

Table 2. Yield of Pournami in comparison with Karimunda and Panniyur-1

Cultivar	Mean yield (green) / vine (kg)					
	1987-88	1988-89	1989-90	1990-91	Total	Mean
Pournami	0.442	0.508	4.667	4.704	10.321	2.580
Karimunda	0.647	1.873	5.117	2.000	9.637	2.409
Panniyur-1	0.554	1.083	4.925	3.470	10.032	2.508
Mean	0.547	1.154	4.903	3.391		
CD 5%	0.410	0.620	1.930	2.020		

Table 3. Estimated average yield and yield potential of Pournami in comparison with Karimunda and Panniyur-1

Cultivar	Mean yield per vine (kg)	Highest recorded yield per vine (kg)	Average yield per ha (kg)*		Yield potential per ha (kg)**	
			Green	Dry	Green	Dry
Pournami	4.7	10.8	7526	2333	17,280	5356
Karimunda	2.0	8.1	3200	1120	12,960	4536
Panniyur-1	3.5	9.0	5552	1915	14,400	4968

* Based on yield at 5th year at the rate of 1600 vines/ha at 2.5 x 2.5 m spacing
** Based on highest yield recorded for each of the selections

differences between the cultivars except in 1988-89. During this year both Panniyur-1 and Karimunda gave better yields than Pournami. During the fifth year of evaluation (1990-91) Pournami yielded higher than others though the difference was not statistically significant. Thus yield performance of Pournami was consistent and comparable to that of Karimunda and Panniyur-1 (Table 2). Pournami recorded an average yield of 7526 kg/ha (green) and had an yield potential of 17,280 kg/ha, based on the highest recorded yield per vine (Table 3).

Pournami had highest oleoresin (13.8%) while Karimunda had highest piperine (5.2%). Pournami had low dry recovery as compared to that of Karimunda and Panniyur-1 (Table 4).

Pournami had good yield attributing characters like long spikes (12 cm), high percentage of bisexual flowers in the spike (84%), high spiking intensity (70%), high fruit set (68%) and bold fruits. Pournami was a medium maturity type with fruits available for harvest 6-7 months after flowering. Pournami was susceptible to other major pests like

Table 4. Quality attributes of Pournami, Karimunda and Panniyur-1

Cultivar	Piperine (%)	Oleoresin (%)	Essential oil* (%)	Dry recovery (%)
Pournami	4.1	13.8	3.35	31.0
Karimunda	5.2	12.6	3.60	35.0
Panniyur-1	3.6	9.5	3.50	34.5

* Based on analysis by R R L, Trivandrum

Table 5. Morphological features of Pournami

Character	Attribute
Habit	Vigorously growing vine
Shoot tip colour	Purple
Leaf shape	Ovate-lanceolate
Mean leaf length (cm)	15.6
Mean leaf breadth (cm)	8.5
Spike length (cm)	12.0
Spiking intensity (No. of spikes/ 100 nodes)	70
No. of flowers per spike	94
Spike composition	
Bisexual flowers	84%
Female flowers	15%
Male flowers	1%
Fruit set	68%
Fruit size (Volume of 1000 fruits)	130 cc
Weight of 1000 fruits	128 g
Yield per vine at 5th year	
Mean	4.7 kg (green)
Maximum	10.8 kg (green)
Average yield per hectare at 5th year	7526 kg (green)
Yield potential at 5th year	17,280 kg (green)
Crop duration (from flowering to maturity)	7 months
Quality attributes	
Piperine	4.1%
Oleoresin	13.8%
Essential oil	3.35%
Dry recovery	31%
Reaction to pests and diseases	
'Pollu' beetle (*Longitarsus nigripennis*)	Susceptible
Root-knot nematode (*Meloidogyne incognita*)	Tolerant
Burrowing nematode (*Radopholus similis*)	Susceptible
Phytophthora capsici	Susceptible

Table 6. Root-knot nematode (*Meloidogyne incognita*) infestation of black pepper cultivars in field

Cultivar	1989*			1990**		
	Root galling	Nematode population		Root galling	Nematode population	
		Soil (100 cc)	Root (1 g)		Soil (100 cc)	Root (1 g)
Panniyur-1	+	32	180	++	210	920
Karimunda	+	18	120	++	180	840
Pournami	+	17	70	+	86	530

Visual scoring of galling : + = Mild galling
++ = Medium galling

* 4th year after planting
** 5th year after planting

R. similis and 'pollu' beetle as well as disease like *Phytophthora* foot rot (Fig. 1 & Table 5).

The population of nematodes both in roots and soil around the experimental vines and the root galling index of three cultivars were estimated at 4th and 5th year after planting (Table 6). The data indicated that Pournami supported low populations of nematodes both in roots and in soil around the vine. The root galling index was also lower for this cultivar.

Fig. 1. Pournami, a high yielding black pepper selection tolerant to root-knot nematode

Because of its yield potential which was on par with Karimunda and Panniyur-1, high oleoresin and more importantly its tolerance to root-knot nematode, Pournami was recommended for release at the Group Meeting of All India Coordinated Research Project on Spices (Anonymous 1991).

Acknowledgements

The authors gratefully acknowledge the help rendered by Dr. T. John Zachariah and Mr. Jose Abraham, Scientists of NRCS for quality and statistical analysis, respectively. The authors are also thankful to Regional Research Laboratory, Trivandrum for the data on quality analysis presented in the paper.

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