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Article *in* Nematropica · December 2012

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RESEARCH NOTE/NOTA INVESTIGATIVA

RESISTANCE OF COMMON BEAN TO *PRATYLENCHUS JAEHNI*

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ABSTRACT

Bonfim Junior, M. F. and M. M. Inomoto. 2012. Resistance of common bean to *Pratylenchus jaehni*. Nematropica 42:320-323.

A population of *Pratylenchus jaehni*, named K_5 or race coffee, is found in coffee plantations of São Paulo state, Brazil, usually causing extensive damages in plants of *Coffea arabica*. Taking into account that common bean (*Phaseolus vulgaris*) cv. Safira is resistant to this population, two experiments were conducted to verify if other eight cultivars of common bean can be used for the management of *P. jaehni* in coffee plantations. The experiments were carried out in a greenhouse with an initial population of 200 specimens per plot (three plants in a 700 ml plastic pot). Evaluation were performed at 64 and 60 days after inoculation in experiments 1 and 2, respectively, using the variables reproduction factor [RF = final population/initial population] and nematodes/g roots. The nematode did not build up in any of the bean cultivars used in the experiments. The RF ranged from 0.17 (IAPAR 81) to 0.33 (IPR Siriri) in experiment 1 and 0.10 (IPR Juriti) to 0.57 (IPR Siriri) in experiment 2. These results show that the common bean has potential for the management of *P. jaehni* in coffee plantations, as intercropping or crop rotation.

Keywords: common bean, reproduction factor, resistance.

RESUMEN

Bonfim Junior, M. F. and M. M. Inomoto. 2012. Resistance of common bean to *Pratylenchus jaehni*. Nematropica 42:320-323.

La población de *Pratylenchus jaehni*, llamada K_5 o raza café, se distribuye en las plantaciones de café de São Paulo, Brasil, causando grandes daños en plantas de *Coffea arabica*. Teniendo en cuenta que el frijol común (*Phaseolus vulgaris*) cv. Safira es resistente a esta población, se realizaron dos experimentos para verificar si otros ocho cultivares de frijol común se pueden utilizar para el manejo de *P. jaehni* en plantaciones de café. Los experimentos se llevaron a cabo en un invernadero con una población inicial de 200 especímenes por parcela (tres plantas en una maceta de plástico 700 ml). El evaluación se fue realizada a los 64 y 60 días después de la inoculación en los experimentos 1 y 2, respectivamente, utilizando el factor de reproducción [FR = población final/población inicial] y nematodos/g raíces. El nematodo no se reprodujo en ninguno de los cultivares de frijol común utilizados en los experimentos. El FR fue de 0,17 (IAPAR 81) a 0,33 (IPR Siriri) en el experimento 1 y 0,10 (IPR Juriti) a 0,57 (IPR Siriri) en el experimento 2. Estos resultados muestran que el frijol común tiene potencial para el manejo de *P. jaehni* en plantaciones de café, como en los cultivos intercalados o rotación de cultivos.

Palavras-chave: frijol común, factor de reproducción, resistencia.

The citrus root-lesion nematode, *P. jaehni*, was described based in a population from roots of Rangpur lime (*Citrus limonia*), used as rootstock for *Citrus sinensis* in the municipality of Itápolis, state of São Paulo, Brazil (Inserra *et al*., 2001). Currently, *P. jaehni* distribution is restricted in Brazil, where the nematode has been reported in citrus orchards of São Paulo, Minas Gerais and Paraná state (Campos & Santos, 2005). A population of root lesion nematode called K_5 (Duncan *et al*., 1999), formerly identified as *P. coffeae*, is co-specific to *P. jaehni*, as both have high genetic identity each other (Oliveira *et al*., 2011).

Evidence exists that *P. jaehni* has at least two races: the race citrus, composed by the populations C1 and C2 (Duncan *et al*., 1999) that reproduce in *C. limonia*, but not in Arabic coffee (*Coffea arabica* L.), and the race coffee, composed by K_5 that reproduces on both citrus and coffee (Wilcken *et al.*, 2008; Bonfim Junior *et al*., 2011). The race coffee has been reported causing reduction in the growth of coffee shoots and roots due to negative effect in carbon fixation and distribution of photoassimilates in susceptible coffees (Mazzafera *et al*., 2004). Kubo *et al*. (2004) showed that the nematode had frequency of 5.1% in coffee plantations of the state of São Paulo.

Coffee rootstocks resistant to *P. jaehni* have already been identified and are potentially good tools for the nematode management (Tomazini *et al*., 2005). The intercropping of non-host plants can be a valuable complementary method, improving the effect of resistant coffees. Common bean is usually cultivated intercropped in coffee plantations, but little is known about the host reaction of common bean cultivars to nematodes of coffee. An exception is the cv. Safira, which was rated as resistant to *P. jaehni* by Silva & Inomoto (2002.)

The aim of the present study was to evaluate the host status of eight cultivars of common bean (*Phaseolus vulgaris* L.) to the race coffee of *P. jaehni,* to verify if the resistance to *P. jaehni* is extensive to others genotypes beyond of cv. Safira, the only that was tested by Silva & Inomoto (2002). The cultivars were chosen among the most adapted to the conditions of Minas Gerais, São Paulo e Paraná, which are the main Brazilian coffee producing states.

The population of *P. jaehni* was obtained from Arabic coffee roots collected in the municipality of Marília, São Paulo State, and maintained on grain sorghum (*Sorghum bicolor* (L.) Moench) plants, in greenhouse. The inoculum was extracted from sorghum roots by Baermann funnel modified to shallow containers (Hooper, 1986). After 48 h in B.O.D. incubator at 28°C, adults and juveniles were collected and the suspension calibrated with Peters' slides to the concentration of 100 nematodes/ml.

In the first experiment, seeds of eight common bean cultivars (Table 1) were sowed in plastic pots of 700 ml of capacity, containing 650 ml of steam-heat de-infested soil (62% sand, 8% silt, 30% clay). Seven days after sowing, the plants were thinned to three per plastic pot. The experiment was a completely randomized design with nine treatments (eight common bean cultivars and the susceptible host grain sorghum hybrid Sara) and six replicates. The experimental plot was one plastic pot with three plants. The inoculation was done nine days after sowing, when common bean was in V2 stage (pair of primary leaves expanded). Two holes (2 and 4 cm depth) were made in the soil plot, and 1 ml of the nematode suspension was poured in each one, and the holes were covered with vermiculite; therefore, the initial population was 200 nematodes (P_i=200).

The plants were maintained during the experimental period (64 days after inoculation) in greenhouse. The soil temperature was registered daily, ranging from 15.1°C (mean of the daily minimum soil temperature at that period) to 34.7°C (mean of the daily maximum soil temperature at that same period). In the evaluation, nematodes were extracted from the roots by the Coolen & D´Herde (1972) method. The final population (P_f), constituted of adults and juveniles, was estimated by counting nematodes using the Peters' slide, thereafter the variables reproduction factor ($RF= P_f/P_i$) and nematodes/g of fresh roots (Nem./g) were calculated for each replicate. The variables RF and Nem./g were transformed in log (x+1), to normalize the data (Noe, 1985), and analyzed with the support of the software SANEST ("Sistema de Análise Estatística" – developed by Departamento de Matemática e Estatística da ESALQ-USP, Piracicaba, SP, Brazil). The means were compared by Tukey's test (P=0.05).

The second experiment was carried out to confirm the results of the first one. The inoculation was at 21 days after sowing in desinfested soil (62% sand, 8% silt, 30% clay), when the cultivars were in V3 stage (first trifoliolate leaf expanded). Evaluation was made at 60 days after the inoculation and the mean of the daily soil temperature was 17.5°C (minimum) and 34.3°C (maximum).

Grain sorghum hybrid Sara was used for comparison in both experiments because it is a good host for *P. jaehni*, according to Bonfim Junior *et al.* (2011), which tested this sorghum in two experiments. These authors found that in the first experiment the density of *P. jaehni* folded 106.2 times after 120 days and 1,329.9 times after 245 days; and in the second experiment the density folded 1.4 times after 60 days and 394.6 times after 240 days.

Adults and juveniles of *P. jaehni* were detected in most replicates of common bean, but at low densities (Table 2). All the cultivars had RF<1.0 and significantly lower than grain sorghum (RF=1.62 and RF=1.47); therefore all the cultivars were rated as resistant to the race coffee of *P. jaehni*.

The intercropping with common bean is used in many Brazilian coffee plantations (Carvalho *et al.*, 2008), due to the advantages such as: reduction of weeds; improvement of physical, chemical and biological properties of the soil; control the erosion; reduction of the costs of installation of coffee plantations (Carvalho *et al.,* 2007). Beyond these advantages, the results of this work showed that common bean can be used to reduce the population of the race coffee of *P. jaehni*, which cause extensive damage in Arabic coffee in infested areas. Tomazini *et al.* (2005) reported that the race coffee of *P. jaehni* reproduces very well and causes severe reduction in dry top weight (DTW) and root fresh weight (RFW) of *C. arabica* cv. Mundo Novo IAC 388-17. Reduction in height, DTW and in RFW caused by race coffee of *P. jaehni* was also observed by Inomoto *et al.* (2004) in *C. arabica* cv. Catuaí

Table 1. Characteristics of the common bean cultivars studied in the experiments 1 and 2.

	Characteristics			
Cultivars	Growth Habit	Average Cycle	Comercial Group	Growing States
IPR Juriti	Erect	89	Carioca	RS, SC, PR, SP, GO, MT
IAPAR 81	Erect	92	Carioca	RS, SC, PR, SP, MG, GO, MT
Pérola	-	-	Carioca	-
Saracura	Semi - erect	88	Carioca	PR, MT
IPR Siriri	Semi - erect	85	Carioca	RS, SC, PR, SP, GO, MT
IAPAR 31	Erect	93	Carioca	PR
Carioca	-	-	Carioca	-
IPR Tangará	Erect	87	Carioca	PR

Source: IAPAR 2009
States: GO (Goiás); MG (Minas Gerais); MT (Mato Grosso); PR (Paraná); RS (Rio Grande do Sul); SC (Santa Catarina) e SP (São Paulo).

Table 2. Reproduction factor (RF) of *Pratylenchus jaehni* (K_5) in common bean cultivars and sorghum 'Sara', and number of nematodes per gram of fresh roots (Nem./g).

	Experiment 1		Experiment 2	
Treatments	RF	Nem./g	RF	Nem./g
'IAPAR 81'	0.17 b[z]	3 b	0.42 bc	9 ab
'IPR Tangará'	0.19 b	2 b	0.25 bc	5 abc
'IPR Juriti'	0.2 b	3 b	0.10 c	6 bc
'Carioca'	0.24 b	4 b	0.13 c	2 c
'IAPAR 31'	0.24 b	4 b	0.36 bc	5 abc
'Saracura'	0.25 b	3 b	0.32 bc	5 abc
'Pérola'	0.29 b	4 b	0.14 c	3 bc
'IPR Siriri'	0.33 b	5 b	0.57 b	7 abc
Sorghum 'Sara'	1.62 a	18 a	1.47 a	20 a

[z]Means followed by different letters in column differs significantly by Tukey's test (P = 0,05); P_i= 200 (adults +juveniles)

Vermelho. That nematode can be managed by the use of resistant rootstocks, e.g., *C. canephora* cv. IAC 4764 and IAC 4765 (Tomazini *et al.*, 2005), associated with intercropping or crop rotation with resistant hosts.

The resistance reaction observed in common bean cv. Safira, by Silva & Inomoto (2002), is extensive to the eight cultivars tested in the present work. Thereafter those cultivars can be recommended for intercropping or crop rotation with coffee in plantations infested by *P. jaehni*.

AKNOWLEDGEMENTS

The first author thanks the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the master's scholarship.

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Received: *Accepted for publication:*
22/III/2012 16/X/2012
Recibido: *Aceptado para publicación:*