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Reaction of Cultivar Coffee 'Vitória INCAPER 8142' of Cornillon to Parasitism of *Meloidogyne exigua*

Reacción del Cultivar de café 'Vitória INCAPER 8142' de Cornillon al parasitismo de Meloidogyne exigua

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ABSTRACT

Among factors limiting to the yield of the coffee crop are the diseases, deserving prominence the nematode *Meloidogyne exigua*. The objective of this work was to assess the level of resistance of 13 clones (1V, 2V, 3V, 4V, 5V, 6V, 7V, 8V, 9V, 10V, 11V, 12V and 13V) wich composes the clonal variety 'Vitória INCAPER 8142' of conilon coffee (*Coffea canephora* Pierre), to *M. exigua*. The 13 clones and more one control (*C. arabica*, cv. Catuaí IAC-44) were inoculated with 7,000 individuals of *M. exigua*. After 180 days of inoculation, the final population of nematodes per root system was determined. For determination of the resistance levels, both the reproduction factor and the reduction of the reproduction factor were considered. The variety 'Vitória INCAPER 8142' presented clones with different levels of resistance. Clones 1V, 4V, 7V, 9V and 12V behaved as susceptible or efficient host and the other clones were resistant or non-efficient host.

Key words: *Coffea canephora,* clones, robust coffee, resistance, root-knot nematode.

RESUMEN

Entre los factores que limitan la productividad de los cultivos de café en Brasil son las enfermedades, especialmente el nematodo Meloidogyne exigua *presenta relevancia. El objetivo de este estudio fue evaluar la resistencia de 13 clones (1V, 2V, 3V, 4V, 5V, 6V, 7V, 8V, 9V, 10V, 11V, 12V y 13V) que comprenden la variedad clonal de café Conillón "Vitoria INCAPER 8142" (*Coffea canephora *Pierre), a* M. exigua. *Clones y un testigo (*C. arabica *cv. Catuai IAC-44) se inocularon con 7.000 individuos (huevos + juveniles) de* M. exigua. *Después de 180 días de la inoculación se determinó la población final de nematodos por planta. Para determinar los niveles de resistencia se consideró el factor de la reproducción y el Indice de reproducción. El cultivar "Victoria INCAPER 8142" mostró clones con diferentes niveles de resistencia. Los clones 1V, 4V, 7V, 9V e 12V se comportaron como huésped susceptible y eficiente, y los otros clones fueron anfitriones menos resistentes o ineficientes.*

Palabras clave: Coffea canephora*, clones, café robusta, resistencia, nematodo de las agallas.*

Introduction

The coffee is affected by many diseases such as rust, brown eye spot, phoma leaf spot, etc., which have been the subject of many studies, however, the nematodes have received little attention, although they may limit the exploitation of this important crop (Gonçalves and Silvarolla, 2001).

The phytonematodes, usually present in soil, feed on the roots of plants causing direct damage by destroying cells and tissues and indirect damages for opening gateways to other pathogens (Ventura *et al.*, 2007). Among the species that affect the coffee (*Coffea canephora* Pierre and *Coffea arabica* L.), *Meloidogyne exigua* Goeldi, 1887, is the most widespread in the Americas and is present in the main coffee regions, causing yield losses (Carneiro and Almeida, 2000).

In infested areas with *M. exigua*, one of the most desirable management is the use of resistant cultivars.

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Some genotypes have the ability to reduce the rate of reproduction of *M. exigua*, leading to continued declines in the pathogen population (Roberts, 2002). This resistance has been identified in the cultivar IAC 2258 Apoatã of *C. canephora* (Salgado *et al.*, 2005). In a few years the clonal cultivar of konillon coffee-trees 'Victoria INCAPER 8142' was developed, formed by a group of thirteen superior clones. This variety stands out from others because it has high productivity, yield stability, tolerance to drought and rust, uniformity of maturity and large grains size (Ferrão *et al.*, 2007). However, it's unknown the level of resistance of this cultivar to *M. exigua*, which restricts its cultivation in contaminated areas with this *Meloidogyne* species.

For conilon coffee, the Instituto Capixaba de Pesquisa, Assistência Técnica e Extensão Rural (INCAPER) developed and recommended six varieties of coffee conilon, five of clonal propagation (EMCAPA 8111, EMCAPA 8121, EMCAPA 8131, EMCAPA 8141 - Robustão capixaba and Victoria - INCAPER 8142) and one of seed propagation (EMCAPA 8151 - Robusta Tropical) (Ferrão *et al.*, 2007). These varieties have genetic variability for resistance to diseases, the clonal varieties especially and the most productive clones (Ventura *et al.*, 2007). However is need for studies to evaluate the performance of these varieties and clones against *M. exigua*.

Although there's tendency of *C. canephora* to show greater resistance to *M. exigua*, compared to *C. arabica* species (Curi *et al.*, 1970), this resistance is very dependent on the genotype, being necessary a genetic evaluation for further conclusions. If the reproductive rate of *M. exigua* in each clone is quantified, it is possible to identify those clones that can inhibit the pathogen.

This study aimed to evaluate the level of resistance of the thirteen clones that make up the clonal cultivar of coffee-trees konillon Vitoria 8142 INCAPER against *M. exigua* and identify those with greatest effect on the reproductive rate of the pathogen.

Material and Methods

The experiment was carried out from 7 august to 8 march in a greenhouse at the Centro de Ciências Agrárias da Universidade Federal do Espírito Santo (CCA-UFES), Alegre (ES), 20º 45' S and 41º 29' W and 270 m altitude. It was evaluated the 13 clones that make up the cultivar of coffee conilon (*C. canephora* Pierre) Vitoria INCAPER 8142. The cultivar Catuaí-IAC 44 (*C. Arabica* L.) was used as susceptibility standard (control). The treatments were arranged in a completely randomized design with seven replicates.

Coffee seedlings were produced in the INCAPER and sent to the CCA-UFES in aseptic conditions. When the plants reach the 3rd pair of leaves, they were transferred to a plastic bag containing 12 dm^3 of a mixture of soil and sand at a ratio of 2:1 (V:V) previously treated in autoclave (140º C/1 hour on three consecutive days). Thirty days later each plant was inoculated with 7,000 nematodes (75% eggs + 25% second-stage juveniles).

To obtain the inoculum, a pure population of *M. exigua* was multiplied and was maintained on roots of *C. arabica* cv. IAC-44 b cultivated in 5-liter pots containing a mixture of soil and sand (1:1 V:V) previously autoclaved, as described before, and maintained in a greenhouse. Employing the technique of Hussey & Barker (1973), modified by Boneti & Ferraz (1981), the inoculum was extracted from the roots of plants and was quantified in Peters chamber under stereoscope. Subsequently, an aliquot of a aqueous suspension of nematodes in three holes made in the soil around the plants was deposited. The fertilizations were based on soil analysis. To have an adequate nutrition of plants, two foliar spray applications of calda viçosa were made. The plants were cultivated with only one orthotropic branch and irrigation was carried out when was necessary. With a automatic weather station the air temperature during during the experimental period was recorded.

180 days after inoculation, the plants were removed from the pots, the roots carefully washing to remove the substrate and determined the final nematode population (FP) at each root system (Bonetti and Ferraz, 1981).Subsequently, we calculated the reproduction factor of the nematodes (RF) by dividing the value of the population final (FP) by the value of the initial population (IP) of each treatment (RF = FP/IP).

Levels cultivar resistance to nematodes were classified using two criteria.The first, adopted by Seinhorst (1967), in which plants with RF > 1 are considered efficient host (EH), RF < 1 non-efficient host (NEH), and RF = 0 non host (NH). In the second criteria, the reproduction factor (RF) was calculated dividing final population of each genotype by initial population (RF=Fp/Ip). The resistance selection was based on criterion proposed by Moura & Regis (1987) (Table 1).

Table 1. Criterion to evaluate percentage of the reproduction rate (%RR) adopted from Moura & Regis (1987).

%RR	Host reaction
0-25	Highly susceptible (HS)
26-50	Susceptible (SU)
51-75	Low resistant (LR)
76-95	Moderately resistant (MR)
96-99	Resistant (RE)
100	Highly resistant (HR) or immune (IM)

Results and Discussion

Based on the criterion used by Moura and Regis (1987), clones 3V, 5V, 8V and 13V showed higher %RR (71.87; 72.32; 74.55 and 75, respectively), behaving as LR. The clones 2V, 6V, 10V and 11V also were LR. The other clones were classified as SU to *M. exigua* (Table 2). All clones that behaved as SU and PR by the criterion of Moura and Regis (1987) were EH and NEH, respectively, according Seinhorst (1967), demonstrating consistency between the two methods.

None of the clones behaved as MR, RE, HR or IM, demonstrating that exist a few resistance genes to these materials, and if these clones are grown in an area with root-knot nematode may be subject to damages and losses yield caused by these plant parasitic nematodes (Potter and Olthof , 1974; Chen *et al.*, 1999; Chen *et al.*, 2000; Castillo *et al.*, 2006).

Some authors have reported that there is resistance in the species *C. canephora*, *C. congensis*, *C. dewevrei*, *C. liberica*. *C. racemosa* and *C. salvatrix* against *M. exigua* (Fazuoli and Lordello, 1977, 1978), but there are few works that allude to the resistance in *C. canephora* (Fazuoli *et al.* 2005; Matiello *et al.*, 2005) although plants resulting from crosses between different species of *Coffea* show resistance to *M. exigua* (Sakiyama *et al.*, 1999). Fazuoli *et al*, (1977), tried to find out sources of resistance to *M. exigua* in populations derived from interspecific crosses (*Coffea arabica* x *C. canephora* and *C. arabica* x *C. dewevrei*). According to this study, of 1,692 seedlings analyzed, only 106 were selected for not presenting nematode galls.

In another work, Fazuoli and Lordello (1978) evaluated several plant species and cultivars of coffee for resistance to *M. exigua* and reported nematode reproduction was affected due to the resistance of C. canephora.Silva *et al.* (2007) also studied the effect of populations of *M. exigua* in 25 genotypes from the Timor Hybrid, natural crossing between *C. arabica*

Table 2. Final population (FP), reproduction factor (RF), percentage of the reproduction rate (%RR) and reaction (RE) of clones of the variety Vitória INCAPER 8142 for resistance to *M. exigua* in an experiment carried out in Alegre-ES, 2007.

Clones	FP	RF[1]	% RR[2]	RMR[3]	RSE[4]
Clone 1V	9,142.86	1.3	41.96	SU	EH
Clone 2V	6,187.71	0.88	60.71	LR	NEH
Clone 3V	4,387.29	0.63	71.87	LR	NEH
Clone 4V	10,928.57	1.56	30.36	SU	EH
Clone 5V	4,333.29	0.62	72.32	LR	NEH
Clone 6V	5,642.86	0.81	63.84	LR	NEH
Clone 7V	13,125.71	1.87	16.52	SU	EH
Clone 8V	4,000	0.57	74.55	LR	NEH
Clone 9V	11,581.57	1.65	26.34	SU	EH
Clone 10V	6,901.43	0.99	55.80	LR	NEH
Clone 11V	6,071.43	0.87	61.16	LR	NEH
Clone 12V	7,833.29	1.12	50	SU	EH
Clone 13V	3,928.57	0.56	75	LR	NEH
Control	15,681.43	2.24	-	SU	EH
Average	7,235.74	1.03	54.02	-	-

[1]RF = final population/initial population.

[2] %RR = (RF control - RF clone) / RF control x 100.

[3] Reaction of the clones according to the criterion of Moura and Regis (1987). Highly susceptible (HS); susceptible (SU); low Resistant (LR); moderately resistant (MR); Resistant (RE); highly resistant (HR) or immune (IM).

[4] Reaction of the clones based on the criterion of Seinhorst (1967). RF<1 - non-efficient host (NEH), RF>1 - efficient host (EH) and RF = 0 – non host (NH).

and *C. canephora*, and their derivatives: Catimor (Caturra X Híbrido de Timor) Cavimor (Catuaí X Catimor) Sarchimor (Villa Sarchi X Hibrido de Timor) and Icatu (artificial crossing between *C. Arabica* X *C. canephora*). Among these materials 56% were susceptible to the nematode.

It is important to note that the reaction of the coffee plants may be different to isolates of *M. exigua* coming from different regions. Ribeiro *et al.* (2005), for example, evaluated the reaction of progenies in *C. canephora* interspecific hybrids timor UFV 1680 408 28 Cad, UFV 1804 428-3, UFV 1285 382-09 Cad, UFV 1805 428-5, UFV 1825 433-11 Cad and progenies of Catimor UFV 6617 1246 Col. Am., UFV 6572 698 Col., UFV 6569 575 Col., UFV 6619 1322 Col am. to a *M. exigua* population come from Mirai, MG that were SU. However, Gonçalves and Pereira (1998), assessing the reaction of these selections to a population of *M. exigua*, from São Sebastião do Paraíso, MG, obtained reaction of resistance. According to Silva *et al.* (2007) there is evidence of the existence of intraspecific variability in *M. exigua* in relation to virulence in coffee plants. In fact, in addition to the wide distribution and damage in coffee, another aggravating of *M. exigua* is the genetic variability, demonstrated by different results in coffee plants inoculated with different populations of this nematode (Ribeiro *et al.*, 2005, Barbosa *et al.*, 2007). Muniz *et al.* (2007), for example, found virulence in resistant coffee plants carrying the gene Mex-1 inoculated with a fluminense population of *M. exigua*.

Considering the importance of clonal variety Vitória INCAPER 8142 in the scenario of coffee culture, further research should be performed to confirm the results, since the resistance to nematodes is dependent on many factors (Ventura *et al.*, 2007). These studies must be carried out under controlled environment and, after confirmation of the resistant clones, they should be evaluated under field conditions at different levels of infestation and populations of *M. exigua*, once the characterization of variability in *M. exigua* is essential to direct the work of coffee breeding.

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