# Complete and Partial Resistance to *M. exigua* in *C. arabica* Modified Pre-existing Field Nematode Populations

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### SUMMARY

Nematodes represent a major threat in all major coffee-growing (Coffea arabica L.) areas throughout the world. Chemical control by nematicides is only effective in the short term, expensive to use and hazardous to the environment and human health. Growing nematoderesistant coffee trees constitutes so far the most promising option to control the pest. In most coffee regions of Costa Rica, commercial cultivars are infested by two damaging nematode species, Meloidogyne exigua and Pratylenchus sp. In this study we evaluated if the introduction of new genotypes with complete or partial resistance to M. exigua, could modify the competition pre-existing in the roots between the two nematode populations. M. exigua and *Pratylenchus* sp. populations were recorded every month during one year on roots of susceptible, partial and complete resistant C. arabica genotypes to M. exigua. High number of both eggs and juveniles of *M. exigua* with few *Pratylenchus* sp. were present in roots of the susceptible genotype. In contrast, a high number of *Pratylenchus* sp. with none *M. exigua* was observed in complete resistant genotype. Interestingly, a low density of both nematode populations was recorded within intermediate resistant genotype. The results obtained confirm that the introduction of partial or complete resistance to M. exigua modified the preexisting competition between the two populations in field conditions. Since mixed populations nematodes are highly frequent in most coffee fields in Latin America, it seem necessary to make previous studies before doing massive commercial diffusion of nematode resistant genotypes.

### INTRODUCTION

The nematode *Meloidogyne exigua* is a very common parasite in the roots of the coffee trees in Latin America. Yield losses caused by this root-knot nematode infection are estimated between 10 to 15% (Bertrand et al., 1997). Nematicide treatments are expensive, hazardous for environment and human health (Campos et al., 1990). Genetic resistance seem the best way to fight against root-knot nematode (Luc and Reversat, 1985). In a first work (Bertrand et al., 2001), observed several Arabica lines derived from the interspecific Timor hybrid (wild *C. arabica* x *C. canephora*), that exhibited resistance to the nematode and we had confirmed that *M. exigua* resistance came from *C. canephora*.

Noir et al. (2003) had identified molecular markers associated with the *M. exigua* resistance. Segregation data analysis of F2 progeny derived from the cross between the resistant introgression line T-5296 and the susceptible accession ET-6 had showed that the resistance (R) to *M. exigua* is controlled by a simply inherited major gene, designated as *Mex-1* locus. However this major gene could have an incomplete dominant expression because most of the resistant showed a gall index higher than the mean value of the resistant parent T-5296.

# **MATERIAL AND METHODS**

## Plant material

Three cultivars were employed in the study, one susceptible (cv. CR-95); one resistant (cv. IAPAR-59) and one F1 hybrid clone derived from the cross between the M. exigua resistant T-5296 and the susceptible accession ET-6.

The cv. IAPAR-59 and cv. T-5296 are derived from the same F3 accession named C1669 (from Instituto Agronomico de Campinas, Brazil) that originated from the cross between 'Timor Hybrid CIFC  $832/2 \times cv$ . Villa-Sarchi'. The cv. IAPAR-59 is highly homozygous with progenies that were all resistant, while the cv. T-5296 presented some level of heterozygous and presented resistant and susceptible plants (Bertrand et al., 2001).

The propagation of the clone was made using the somatic embryogenesis method described by Etienne and Bertrand (2003).

### **Resistance evaluation in field conditions**

At the Research Station of Costa Rica Coffee Institute (CICAFE), population (eggs + juveniles) of nematodes *M. exigua* and *Pratylenchus* sp. were recorded every month from August 2001 to August 2002 from roots of coffee trees following the protocol of Taylor y Loegeing (1953). The population of *Meloidogyne exigua* was previously characterized by electrophoresis patterns (Hernandez et al., 1996)

Seven year old trees of susceptible (cv. CR-95), partial (F1 hybrid T-5296 x ET-6) and complete resistant (cv. IAPAR-59) *C. arabica* cultivars to *M. exigua* were compared. For each cultivar 10 plants were randomly chosen with three replicates. Mean values were compared by Duncan test at (P = 0.05).

# **RESULTS AND DISCUSSION**

High number of *M. exigua* individuals with low levels of *Pratylenchus* sp. was present in roots of the susceptible cultivar cv. CR-95, (Figure 1). In contrast, a high number of *Pratylenchus* sp. with none *M. exigua* was observed in the complete resistant cultivar cv. IAPAR-59. A low density of both nematode populations was recorded in the partially resistant F1 hybrid (T-5296 x ET-6).

Noir et al. (2003) mentioned that an intermediated resistance to *Meloidogyne exigua* probably exists in *C. arabica*. In this study, we demonstrated clearly the existence of such phenomena. The F1 hybrid studied, cultivated in conditions of strong infestations, and expressed an intermediate level of resistance to the root-knot nematode as compared with well known susceptible and resistant cultivars.

The susceptible cultivar 'CR-95' exhibited great amount of large galls while the resistant cultivar only exhibited a few small galls (results not shown). The hybrid T-5296 x ET-6 showed only small galls, but in higher proportion than in the resistant cv. IAPAR-59.

The results showed that the introduction of partially or completely resistant coffee cultivars to M. exigua can modify the pre-existing competition between two nematode populations previously established in a field. Since mixed nematode populations are highly frequent in

most coffee fields in Latin America, it seems necessary to make similar studies before doing massive commercial diffusion of nematode resistant cultivars.



Figure 1. Average number of individuals of *Meloidogyne exigua* and *Pratylenchus* sp. for three coffee cultivars (I-59, CR-95 and clone F1) Heredia (CR). (August 2001- August 2002).

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