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Selection of coffee progenies with multiple resistance to biotic agents

Caixeta Larissa B. (caixetalb@iac.sp.gov.br), Rodrigues Lucas M. R., Destéfano Suzete A. L., Braghini Masako T., Guerreiro Filho Oliveiro

IAC CAFÉ Centro de Café Alcides Carvalho · CAPES · Consórcio Pesquisa Café

Introduction

Among the pathogens that affect coffee growing, the root knot nematodes (*Meloidogyne spp*.), the coffee rust (*Hemileia vastatrix*) and the bacterial halo blight (*Pseudomonas syringae* pv. *garcae*) pose a great threat to coffee production. The pyramiding of biotic stress resistance genes in highly productive cultivars has been one of the main objectives of *Coffea arabica* breeding programs. In this sense, the objective of this work was to select coffee trees with multiple resistance to root-knot nematodes, coffee rust and bacterial halo blight, through the identification of plants with multiple resistance to biotic agents in early generations of the breeding program conducted by the Agronomic Institute of Campinas.

Results/Discussion

Of 597 F_2 coffee plants inoculated with *P. syringae* pv. *garcae*, 372 proved to be resistant to the pathogen. As for the coffee rust, only 18 plants out of 355 tested were susceptible to *H. vastatrix* race II. Plants with resistance to coffe rust and bacterial halo blight were further evaluated for resistance to root knot nematodes. At the end of the experimental period it was possible to select 35 plants with high levels of root knot resistance and, consequently, with simultaneous resistance to all biotic agents studied (Table 1).

Table 1. Phenotyping of F_2 coffee populations in relation to the response to infection by the *P. syringae* pv. *garcae*, *Hemileia vastatrix* and *Meloidogyne* spp.

	Pseudomonas syringae pv. *garcae*			*Hemileia vastatrix*			*Meloidogyne* spp.		
		Scale of points			LD/TR			Damage index (DI)	
Population		R	S		R	S		R	S
	n=	(0-1)	(2-5)	n=	(0-2/-0-2)	(3-9 / 2-4)	n=	(1-2)	(3-5)
H 20393-1	122	78	44	79	75	4	73	0	73
H 20393-2	125	76	49	73	73	0	71	9	62
H 20393-3	118	74	44	70	69	1	71	3	68
H 20393-11	109	52	57	46	38	8	36	4	32
H 20393-13	123	92	31	87	82	5	82	19	63

Materials/Methods

Plant materials

- F_2 seeds originating from oppen pollination of five hibrids H 20393
- Parental of the hibrids H 20393:

Accession from Ethiopia (IAC 2036-6) (Font of resistance to bacterial halo blight and *Meloidogyne* spp.) ✘ Cultivar (Sarchimor IAC 4933) (Font of resistance to coffee rust)

- Susceptibility standard: Cutivar IAC Mundo Novo 515-20

Multiple resistance evaluation

P. syringae* pv. *garcae

Experimental conditions

(IBSBF 1197) 3x108 CFU.ml^{-1}. Inoculation by sandpaper abrasion method (Rodrigues et al. 2017). The plants were kept in a damp chamber (humidity above 80%).

Evaluation methods

Evaluation 30 days after inoculation (Fig. 1A).
- Scale from 0 to 5 points
- Classification of resistant plants (0 and 1 points)
- Chi-square test data analysis

H. vastatrix

Experimental conditions

Uredospore suspension of *H. vastatrix* race II (0.025ml). Inoculation followed by incubation in the dark for 24h.(Eskes & toma-Braghini, 1981). (Fig. 1B).

Evaluation methods

- Lesion density (LD): scale from 0 to 9 points
- Type of reaction (TR): scale from 0 to 4 points
- Selection of resistant plants: LD and TR = 0 and 1

***Meloidogyne* spp.**

Experimental conditions

Plants inoculated with a mixture of *M. incognita*, *M. paranaensis* and *M. exigua* totaling 3000 eggs + J2/plant. Plants were kept in the green house contitions.

Evaluation methods

- Evaluation 180 days after inoculation (Fig. 1C).
- Damage index (DI): scale from 0 to 5 points (Hussey & Jansen, 2002)
- Classification of resistant plants: DI ≤ 2.

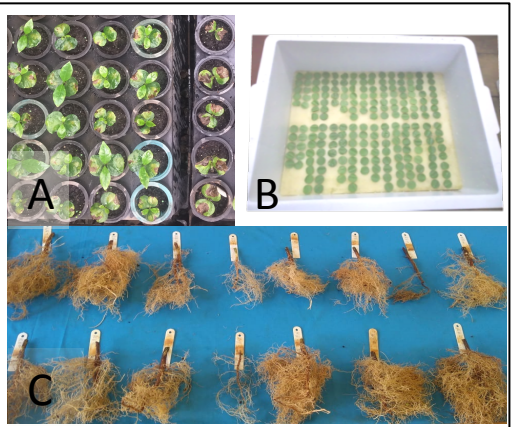

Figure 1. Part of the tests carried out for screening coffee trees with multiple resistance.
A: Response of coffee trees to halo blight 30 days after inoculations with the IBSBF 1197 strain of *Pseudomonas syringae* pv. *garcae*.
B: Detached disc test to evaluate resistance to race II of *Hemileia vastatrix*, the causal agent of coffee rust;
C: Roots of coffee trees 180 days after inoculation of *Meloidogyne* spp. in mixture.

Conclusion/Perspectives

- 35 F_2 coffee trees were select with multiple resistance;
- Resistance to halo blight is probably qualitative in character, governed by few genes, as well as for individual races of *H. vastatrix*.

References

- Eskes, A. B. & Toma-Braghini, M. FAO Plant Protection Bulletin, 1981, p. 56-66.
- Fatobene et al. Euphytica, 2017, p. 1-9.
- Rodrigues et al. Journal of Phytopathology, 2017, p. 105-114.