

Resistance to Phoma leaf spot in cultivars and wild accessions of Arabica coffee characterized using REML/BLUP methodology

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Introduction

- Phoma leaf spot (PLS) is a significant fungal disease affecting coffee crops, primarily caused by *Boeremia exigua* pv. *coffea*, previously known as *Phoma tarda*.
- The objective of this study was to estimate genetic parameters and predict genotypic values for the evaluation of resistance to PLS in Ethiopian wild accessions and cultivars of *Coffea arabica*, using the REML/BLUP methodology.

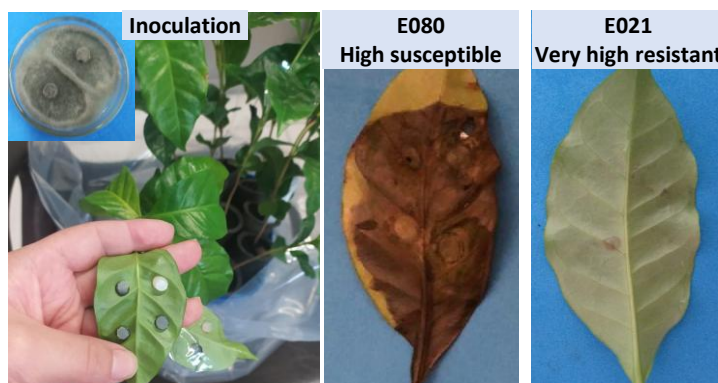


Figure 1. Artificial inoculation on the left. On the right, leaf area with lesions in accession E080 and in E021.

Table 1. Genotypic values ($\mu + g$), lower confidence interval limit (LCIL), upper confidence interval limit (UCIL), resistance levels (RL) for the variable percentage of leaf area affected of 21 accessions and four cultivars, ranked from the most susceptible to the most resistant coffee genotypes, out of a total of 76 genotypes evaluated for resistance to Phoma leaf spot.

Rank	Genotypes	u+g	LCIL	UCIL	RL ⁽¹⁾
1	E080/IDR.584	74.95	67.45	82.45	HS
2	E088/IDR.3435	73.67	66.17	81.17	HS
8	E148/IDR.254	63.53	56.03	71.03	HS
9	E071/IDR.557	62.74	55.24	70.24	S
15	Catucaí A. 2SL	53.40	43.74	63.06	S
18	E201/IDR.134	49.97	42.47	57.47	S
19	E152/IDR.167	48.09	40.58	55.59	L
25	IPR 103	42.32	32.66	51.98	L
29	Catucaí V. IAC 99	40.02	30.36	49.68	L
33	IPR 102	36.34	26.68	46.00	M
39	E151/IDR.575	34.22	26.72	41.72	M
56	E326/IDR.251	23.14	15.64	30.64	M
57	E331/IDR.280	22.57	15.06	30.07	MH
65	E233/IDR.398	20.83	13.33	28.33	MH
66	E298/IDR.382	19.55	12.05	27.05	MH
67	E061/IDR.126	19.13	11.63	26.63	H
68	E333/IDR.104	19.10	11.60	26.61	H
69	E025/IDR.308	18.97	11.70	26.23	H
70	E228/IDR.534	16.25	8.75	23.75	H
71	E270/IDR.044	14.91	7.41	22.41	H
72	M7846/IDR.256	13.96	6.46	21.46	H
73	E037/IDR.676	7.94	0.44	15.44	VH
74	E018/IDR.494	6.09	-1.41	13.59	VH
75	E016/IDR.298	4.48	-3.02	11.98	VH
76	E021/IDR.011	4.08	-3.69	11.86	VH

⁽¹⁾ HS = highly susceptible; S = susceptible; L = slight; M = moderate; MH = moderate-high; H = high; VH = very high.

Materials/Methods

- **Plant material:** 72 wild accessions from Ethiopia and 4 *C. arabica* cultivars.
- Seedlings with six pairs of fully expanded leaves.
- **Artificial inoculation:** *Boeremia exigua* var. *coffea* (IBLF 1199 isolate from the Instituto Biológico) (Figure 1).
- The last two pairs of fully expanded leaves were inoculated with four mycelial discs on each.
- Plants were placed in a moist chamber and then transferred to a B.O.D. incubator, with a 12-hour photoperiod and a temperature of 20 °C ± 0.2, for **7 days**.
- The experimental design used was completely randomized, with ten replications of one plant per plot.
- Variable: percentage of leaf area affected (%LAA).
- The data were analyzed using the **Selegen REML/BLUP software**.
- Statistical differences among genotypes were analyzed based on the overlap of the lower (LCIL) and upper (UCIL) confidence interval limits of the predicted genotypic values ($\mu + g$).

Results/Discussion

- The individual broad-sense heritability (h^2g) was 0.74, considered high, indicating the presence of substantial genetic variability for resistance to PLS among coffee plants. This also suggests that the trait is mainly controlled by genetic factors, with minimal environmental influence.
- Coffee plants exhibited resistance levels ranging from highly susceptible (HS), susceptible (S), slight (L), moderate (M), moderately high (MH), high (H), to very high (VH) (Table 1).
- Twenty accessions showed higher resistance levels than IPR 102 and were classified as MH, H, or VH (Table 1).
- Four accessions (E037, E018, E016, and E021) stood out with a VH level (Table 1 and Figure 1).

Conclusion/Perspectives

- Resistance to PLS appears to be controlled by a few genes and was minimally influenced by the environment, suggesting that it can be more easily transferred through breeding methods such as pedigree selection and backcrossing.
- Farmers can use the IPR 102 cultivar as one of the strategies to mitigate losses caused by PLS, as it showed moderate resistance and also presents high productivity along with resistance to bacterial halo blight and leaf rust.
- The Ethiopian wild accessions with higher resistance levels should be used by breeding programs aiming to develop new cultivars resistant to PLS.