

Effects of Esca disease on leaf gas exchange of cv. Alvarinho in a vineyard of the Portuguese Vinho Verde region

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INTRODUCTION

Esca is a very complex disease that is usually noticed when the grapevine show external symptoms. However, the grapevines can be infected for a long period of time and rarely manifest the typical leaf symptoms. Moreover, little is known about the consequences of Esca on vineyard productivity. In Portugal, in *Vinho Verde* region, Alvarinho sub-region, most vineyards are infected with Esca. In this work we evaluate the impact of Esca on some physiological parameters of grapevines cv. Alvarinho.

MATERIALS AND METHODS

Plant material - Several grapevine plants (cv. Alvarinho) were selected from one vineyard in the *Vinho Verde* region. From each plant, two types of cordons were selected: infected cordons containing leaves with (FD) and without (FApB) visible symptoms of Esca, and asymptomatic cordons (FB). Samples of 5 leaves, for each leaf condition, were chosen in every 10 different plants (in a total of 150 leaves).

Gas exchange measurements - Leaf gas exchange measurements were made, by a portable gas exchange system (LCA-4, Analytical Development Co. Ltd., Hoddesdon, U.K.), on three different leaf materials established. Parameters studied were: net photosynthesis - A ; transpiration - E ; stomatal conductance - g_s ; intercellular concentration of CO_2 - c_i , and were calculated according to the approach proposed by Flexas *et al.* (1998). All the results obtained underwent a *t*-test analysis.

RESULTS

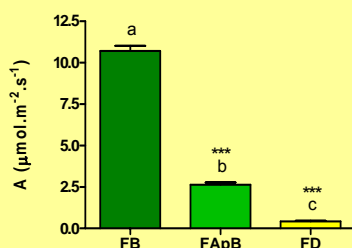


Figure 1 – Net photosynthesis (A - $\mu\text{mol.m}^{-2}.\text{s}^{-1}$) in cv. Alvarinho leaves of infected boughs containing leaves with (FD) and without (FAPB) visible symptoms of Esca, and asymptomatic boughs (FB). All the values are statistically different ($P < 0.05$), except those marked with the same letters. The results are mean \pm SD of 50 independent lectures. The *t*-analysis was done between the pairs FB/FAPB and FB/FD, to identify statistically different values (ns-not significant; *-significant; **-very significant; ***-extremely significant).

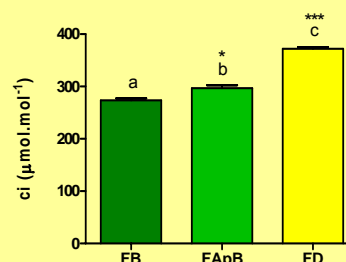


Figure 2 – Intercellular concentration of CO_2 (c_i - $\mu\text{mol.m}^{-1}$) in cv. Alvarinho leaves of infected boughs containing leaves with (FD) and without (FAPB) visible symptoms of Esca, and asymptomatic boughs (FB). All the values are statistically different ($P < 0.05$), except those marked with the same letters. The results are mean \pm SD of 50 independent lectures. The *t*-analysis was done between the pairs FB/FAPB and FB/FD, to identify statistically different values (ns - not significant; * - significant; ** - very significant; *** - extremely significant).

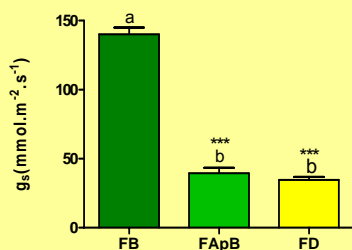


Figure 3 – Stomatal conductance (g_s - $\text{mmol.m}^{-2}.\text{s}^{-1}$) in cv. Alvarinho leaves of infected boughs containing leaves with (FD) and without (FAPB) visible symptoms of Esca, and asymptomatic boughs (FB). All the values are statically different ($P < 0.05$), except those marked with the same letters. The results are mean \pm SD of 50 independent lectures. The *t*-analysis was done between the pairs FB/FAPB and FB/FD to identify statistically different values (ns-not significant; *-significant; **-very significant; ***-extremely significant).

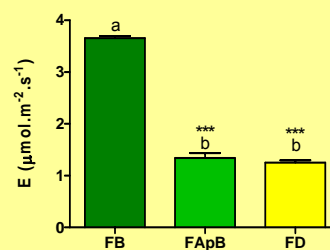


Figure 4 – Transpiration (E - $\text{mmol.m}^{-2}.\text{s}^{-1}$) in cv. Alvarinho leaves of infected boughs containing leaves with (FD) and without (FAPB) visible symptoms of Esca, and asymptomatic boughs (FB). All the values are statistically different ($P < 0.05$), except those marked with the same letters. The results are mean \pm SD of 50 independent lectures. The *t*-analysis was done between the pairs FB/FAPB and FB/FD to identify statistically different values (ns-not significant; *-significant; **-very significant; ***-extremely significant).

MAIN CONCLUSIONS

► The results show a significant decrease in the A values, in the symptomatic bough leaves (FAPB, FD), comparatively to asymptomatic bough leaves (FB). This was particularly noticed in the leaves with external symptoms (FD), where the A values were extremely low. C_i was also affected, showing significant increase in leaves from the symptomatic cordon (FAPB, FD). These results suggest a decrease on the photosynthetic capacity of the stress leaves (FAPB, FD).

► In the infected cordon leaves, E and g_s were also severely affected for leaves from the symptomatic cordon, but the values were not significantly different between FAPB and FD. These results suggest that there are not only photosynthetic changes, but also physiological ones, in the infected cordon leaves (FAPB, FD).

► The results indicate that Esca reduce both functional leaf area and assimilation rate of the grapevines. Moreover, the results suggest that leaves either with or without visual symptoms, belonging to the same infected cordon, are affected.

► This preliminary work reveal the importance that these kind of physiological measurements can have in the valuation of the infected Esca grapevine physiological conditions. These results may be used as a pattern to predict the damage magnitude of Esca disease in grapevines.

REFERENCES

FLEXAS, J.; ESCALONA, J. M.; MEDRANO, H. (1998) Down-regulation of photosynthesis by drought under field conditions in grapevine leaves. *Aust. J. Plant Physiol.* **25**: 893-900.

ACKNOWLEDGMENTS

Palácio da Brejoira to allow all the studies in their vineyards.

Eng. Tiago Alves de Sousa for all the help and support in the utilization of the portable gas exchange system (IRGA) and in the calculation of all the parameters studied.

