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 know about the consequences of Esca on vineyard productivity. In Portugal, in a 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, where 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 – gs; intercellular concentration of CO2 – ci; 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 - μmol.m-2.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 ± SD of 50 independent lectures. The analysis was done between the pairs FApB/FD and FB/FApB, to identify statistically different values (ns – not significant; * - significant; ** - very significant; *** - extremely significant).

**Figure 2** – Intercellular concentration of CO2 (ci - μmol.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 ± SD of 50 independent lectures. The analysis was done between the pairs FApB/FD and FB/FApB, to identify statistically different values (ns – not significant; * - significant; ** - very significant; *** - extremely significant).

**Figure 3** – Stomatal conductance (gs - mmol.m-2.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 ± SD of 50 independent lectures. The analysis was done between the pairs FApB/FD and FB/FApB, to identify statistically different values (ns – not significant; * - significant; ** - very significant; *** - extremely significant).

**Figure 4** – Transpiration (E - μmol.m-2.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 ± SD of 50 independent lectures. The analysis was done between the pairs FApB/FD and FB/FApB, 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), comparatively to asymptomatic bough leaves (FB).
- In the infected cordon leaves, E and gs were also severely affected for leaves from the symptomatic cordon (FApB, FD). These results suggest a decrease on the photosynthetic capacity of the stress 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 grapevines physiological conditions. These results may be used as a pattern to predict the damage magnitude of Esca disease in grapevines.

**REFERENCES**


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