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# Gradient of grapevine varietal susceptibility to esca

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To study varietal susceptibility to esca, we recently analyzed the annual incidence of leaf symptoms on an experimental plot (2017–2023)[1] and from a trunk-disease monitoring network in France (2003–2023)[2]. This work confirmed very high variability in the incidence of esca between grape varieties, both within French wine regions and within the same plot, opening the debate on the factors responsible for this variability.

## Can varietal diversity be used as a tool for sustainable management of esca?

Esca is one of the grapevine trunk diseases that has been the focus of French and international research for several decades and represents one of the major threats to the profitability and sustainability of vineyards worldwide[3 4]. Esca causes internal and external symptoms associated with hydraulic dysfunction[5].

Following the discontinuation in Europe of the only effective chemical treatment (sodium arsenite), sustainable esca management strategies have emerged, but without taking advantage of the wide varietal diversity of grapevine (*Vitis vinifera* L.). There is now renewed interest in the use of varietal diversity, particularly regarding current challenges of adapting viticulture to climate change. In France, several programs have been launched to monitor trunk diseases on a range of grape varieties, including (i) the VitAdapt[6] plot and (ii) a national observatory for monitoring grapevine trunk diseases, as part of the national vineyard dieback plan (*Plan National Dépérissement du Vignoble*)[2].

## Two complementary programs: the VitAdapt plot and the national monitoring observatory

The VitAdapt plot was planted in 2009–2010 at the Institut National de Recherche pour l'Agriculture, l'alimentation et l'Environnement (INRAE) Grande Ferrade in Villenave d'Ornon (Bordeaux region, 44°47'23.83"N 0°34'39.3"W) to study varietal adaptation to the Bordeaux wine production in the context of climate change. It has been used to monitor esca in 46 cultivars, with plants of the same age, grafted on the same SO4 clone, grown in a uniform soil-climate context and with uniform viticultural practices. The data presented in Gastou *et al.* (2024)[1] represents a seven-year monitoring (2017–2023) of the annual incidence of esca leaf symptoms (Figure 1) on 40 vines per cultivar.

The national trunk disease observatory, set up in 2003 by the Directions Régionales de l'Alimentation, de l'Agriculture et de la Forêt (DRAAF), consists of 2,119 plots in major French wine regions. It had two main goals: to monitor the evolution of trunk diseases following the discontinuation of sodium arsenite, and to identify plot-specific criteria affecting their incidence. Various regional observations from 2003 to 2023 have been brought together and standardized to form a national trunk disease monitoring database[2], following on from the first summary covering the years 2003–2008[7]. Within each plot, scores were given to 300 randomly distributed vines (10 small plots of 30 vines each). Each year, the proportion of vines showing esca symptoms was quantified on these plots between August and September. Data since 2003 on the annual incidence of trunk diseases (leaf symptoms of esca and eutypa dieback) for different grape varieties, age classes and major French wine regions is available in the form of graphs and dashboards in an open-access application: https://app-maladies-bois-vigne.sk8.inrae.fr/.

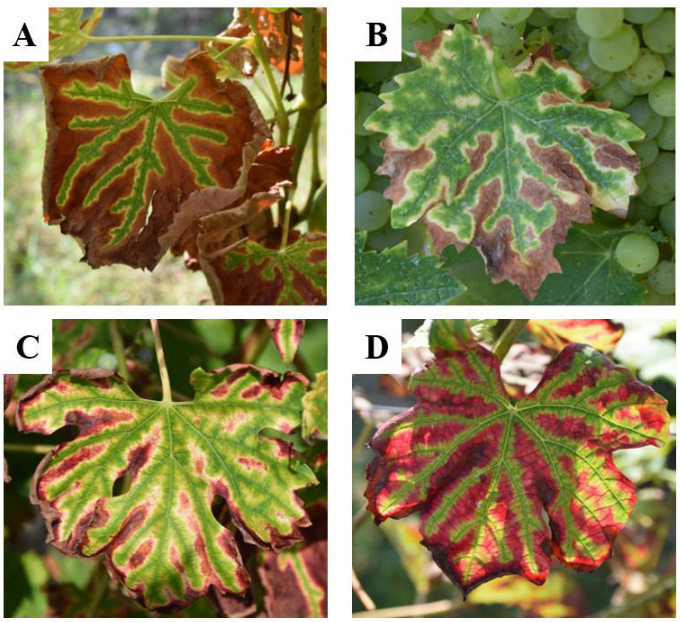



**FIGURE 1.** Esca leaf symptoms on the VitAdapt plot for four grape varieties: (A) Sémillon (B) Ugni Blanc (C) Cabernet Sauvignon (D) Castets.

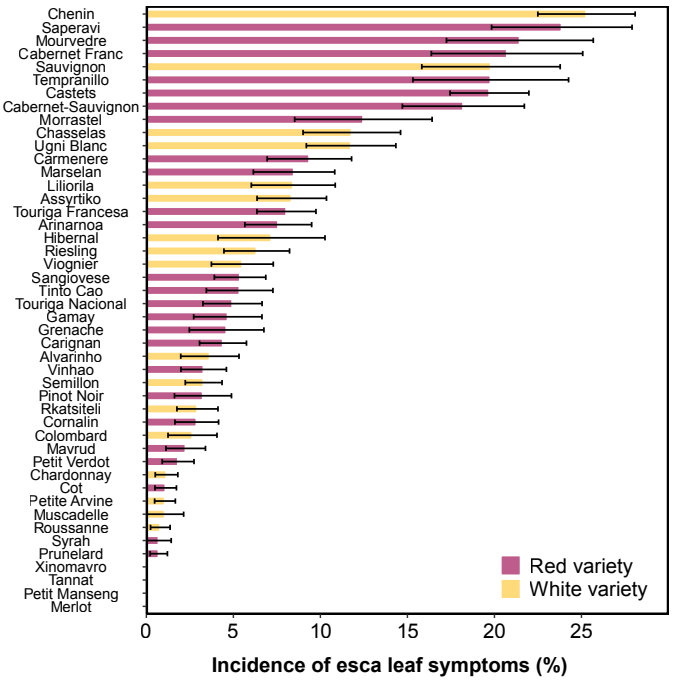



**FIGURE 2.** Mean annual incidence (± standard error) of esca leaf symptoms on the VitAdapt plot (2017–2023).



The translation of this article into English was offered to you by Moët Hennessy.

## A wide range of susceptibility to esca among grape varieties

Within VitAdapt, the mean annual incidence of esca leaf symptoms differs significantly between grape varieties (Figure 2). Four grape varieties never exhibited any symptom over the seven years of monitoring, while eight showed a mean incidence greater than 20%. The trend was broadly comparable when considering the incidence of plant dieback, while no clear varietal effect emerged for symptom severity[1]. Notably, the varietal susceptibility gradient remained comparable from one year to the next, irrespective of the increase in the mean annual incidence of esca as the plot aged: this is evidence for a strong genetic component to esca susceptibility.

Overall, at national level, a wide varietal gradient of susceptibility to esca leaf symptoms was observed. The mean annual incidence by grape variety ranged from 0.6 % to 10.6 % (Figure 3). Trousseau was the most susceptible grape variety, followed by Savagnin and Ugni Blanc. Pinot Noir was the least susceptible grape variety, followed by Meunier and Syrah. Statistical analysis was performed using a Bayesian approach, taking into account various factors such as year, grape variety, and a temporal effect on age using a first-order autoregressive model. It is presented in detail in Etienne *et al.* (2024)[2] and highlights the varietal effect, notably on the presence or absence of esca symptoms in the plots, the vintage effect, and the non-linear effect of plot age.

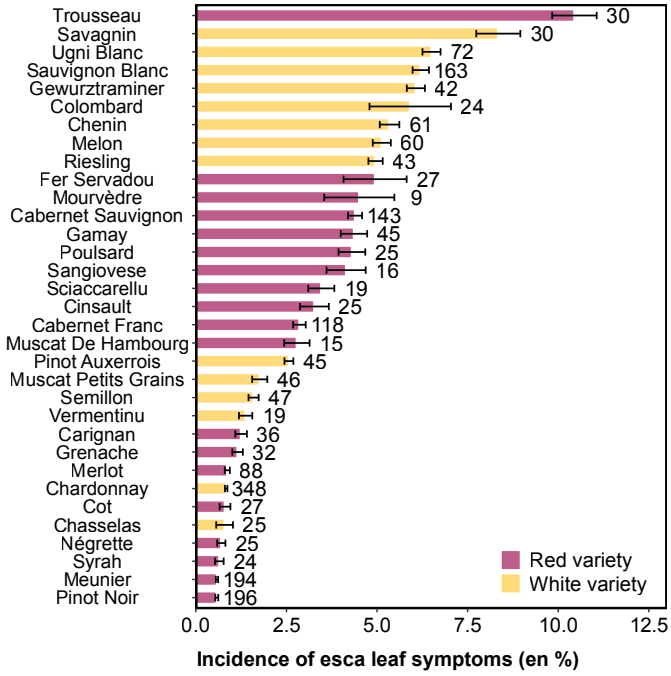



**FIGURE 3.** Mean annual incidence (± standard error) of esca leaf symptoms on all national observatory plots (2003–2023). The figures refer to the number of plots.

Comparing the 19 grape varieties common to the national observatory and VitAdapt reveals the impact of regional specificities. The varietal rankings in the susceptibility gradient are broadly similar for the national observatory and for VitAdapt (Figure 4). This result confirms the existence of a constitutive susceptibility level for each grape variety, partially independent of farming practices or soil-climate conditions. Nevertheless, Figure 4 highlights three grape varieties considered to be more susceptible in the national observatory (Colombard, Ugni Blanc, Sauvignon Blanc) and, conversely, three that were less susceptible (Chardonnay, Pinot Noir, Chasselas). In France, grape varieties are sometimes highly regionalized, with viticultural practices specific to each region, and in particular with different training systems. Colombard and Ugni Blanc are particularly common in the Charentes region, which may potentially be prone to high incidence of esca. Conversely, the Burgundy and Champagne regions seem less favorable to esca (the case of Chardonnay and Pinot Noir).

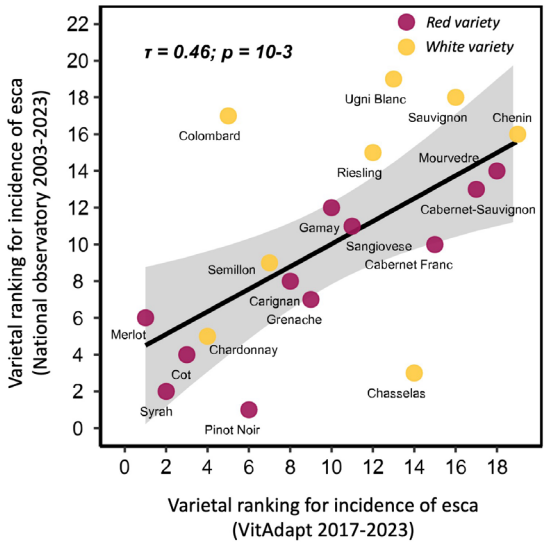



**FIGURE 4.** Comparison of varietal susceptibility to esca between the national observatory and the VitAdapt experimental plot.

## Towards the identification of esca susceptibility factors

Joint monitoring by two complementary programs reveals the great diversity of response to esca among a range of European grape varieties of major agronomic importance. Varietal susceptibility to esca appears weakly but significantly correlated with genetic similarity between grape varieties and with eco-physiological characteristics linked to water use by the vine ($\delta^{13}C$), which can have an impact on vine transpiration in particular[1]. Understanding factors that add to or interfere with the plant material is also essential. A high incidence of esca was observed in plots aged between 10 and 30 years, with variability between grape varieties[2]. Lastly, the differences in varietal susceptibility observed between the national observatory and the VitAdapt plot may in part be due to climatic or agronomic factors, as grape varieties are generally associated with specific regions and climates. ■

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**1** Gastou, P., Destrac-Irvine, A., Arcens, C., Courchinoux, E., This, P., van Leeuwen, C., & Delmas, C. E. L. (2024). Large gradient of susceptibility to esca disease revealed by long-term monitoring of 46 grapevine cultivars in a common garden vineyard. *OENO One*, 58(2). https://doi.org/10.20870/oeno-one.2024.58.2.8043

**2** Etienne, L., Fabre, F., Martinetti, D., Frank, E., Michel, L., Bonnardot, V., Guerin Dubrana, L., & Delmas, C. E. L. (2024). Exploring the role of cultivar, year, and plot age in the incidence of esca and Eutypa dieback: Insights from 20 years of regional surveys in France. *Plant Pathology*, 00, 1–15. https://doi.org/10.1111/ppa.13975

**3** Fontaine, F., Gramaje, D., Armengol, J., Smart, R., Nagy, Z. A., Borgo, M., Rego, C., & Corio-Costet, M.-F. (2016). Grapevine trunk diseases: A review (24 pp.). *OIV Publications*. https://hal.science/hal-01604038

**4** Gramaje, D., Úrbez-Torres, J. R., & Sosnowski, M. R. (2018). Managing grapevine trunk diseases with respect to etiology and epidemiology: Current strategies and future prospects. *Plant Disease*, 102(1), 12-39. https://doi.org/10.1094/PDIS-04-17-0512-FE

**5** Bortolami, G., Gambetta, G., & Delmas, C. E. L. (2023). L'un ou l'autre : En condition de sécheresse, la vigne n'exprime pas de symptômes foliaires d'esca. *IVES Technical Reviews*. https://doi.org/10.20870/IVES-TR.2023.7502

**6** Destrac-Irvine, A., & van Leeuwen, C. (2016). VitAdapt: An experimental program to study the behavior of a wide range of Vitis vinifera varieties in a context of climate change in the Bordeaux vineyards. In Climwine: Sustainable grape and wine production in the context of climate change (pp. 165-171). Bordeaux, France: 11-13 April 2016.

**7** Bruez, E., Lecomte, P., Grosman, J., Doublet, B., Bertsch, C., Fontaine, F., Ugaglia, A., Teissedre, P.-L., Costa, J.-P. D., Guerin-Dubrana, L., & Rey, P. (2013). Overview of grapevine trunk diseases in France in the 2000s. *Phytopathologia Mediterranea*, 52(2), Article 2. https://doi.org/10.14601/Phytopathol_Mediterr-11578


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