

ROOTSTOCK IMPACT ON FOLIAR SYMPTOM EXPRESSION OF ESCA ON VITIS VINIFERA CV. CABERNET SAUVIGNON

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Abstract

Trunk diseases and esca in particular, represent a major threat to the sustainability of the vineyards. The percentages of unproductive vines in a plot could vary from 4% to over 20 % depending on local conditions and vintages.

This syndrome is characterized both by foliar symptoms of variable intensity and internal symptoms in the grapevine wood. These necroses induce vascular disorders on vine trunk. Most survey networks or other monitorings of plot generally show that the levels of leaf symptom expression of esca may depend on the cultivar and the soil x climate under which this crop is grown. It has been also shown that soil has a major effect on water status of grapevine. And the interface between ground and vine is provided by the rootstock. The study presents the results of an experiment carried out in a plot of Cabernet Sauvignon in the Bordeaux region with twelve repeats of four different rootstocks over four vintages. Data suggest that one of the four rootstocks tested significantly led to less foliar symptoms of esca under these conditions. Among the three other rootstocks, there were some differences that could be reversed depending on weather conditions of the year.

This breakthrough could be considered as an extra-element to add to all the criteria required for choosing a rootstock.

Keywords: *esca, rootstock, soil effect, weather effect*

1 INTRODUCTION

Trunk diseases, esca and Eutypa dieback, represent in France and around the world a main concern for vine growers. In particular esca represent a major threat to the sustainability of the vineyards. The percentages of unproductive vines in a plot could vary from 4% to over 20 % depending on local conditions and vintages (Doublet, 2013). Esca disease of grapevine is described for a long time but finally very few elements are known yet on the infectious process and the factors influencing the development of the disease. Esca is a complex disease that comprises an array of symptoms, some are internal wood symptoms and others are external symptoms on leaves (Pearson, 1988). Among the leaf expressions, there are a sudden wilting in summer which named apoplexy and a slow form of esca which is the result of disorders on vine trunk induced by necroses. While Eutypa dieback is caused by a well-defined pathogen (*Eutypa lata*) that was identified long ago, the causes of esca appearance and development still remain controversial today (Mugnai, 1999). Furthermore, means to manage disease are lacking against esca. A survey leads by French national observatory shows an impact of the age of vines and of varieties on foliar expression symptoms (Fussler, 2008). Some studies also attest of the

importance of soil (Destrac 2007) and climate under which the vines are grown on the expression of esca. The expression of symptoms is variable depending on the ecophysiological context including a plot effect and even a year effect (Goutouly, 2010). According to the author, years of favorable growth conditions (eg in Bordeaux vineyard in 2007) would lead to a reduction in capacity of resistance of vine to dieback disease, and reciprocally for unfavorable years. The effect of rootstock on necrosis has been shown (Liminana, 2009). In a 16 years old plot of rootstocks mother plants, nine trunks per variety were cross-sectioned at the point of greatest diameter. All sections revealed typical esca necrosis, central and/or sector-shaped, indicating that such necrosis is very common (Liminana, 2009). This study confirms that necrosis in grapevine wood is not always associated with foliar symptoms, but that it is related positively with grapevine mortality. 101-14 MGt rootstock seems to be the most sensitive of the series with 71 % of necrotic area.

On field trials very few studies show a rootstock effect on symptom of esca of the scion. In Cognac area, 333EM and Rupestris du Lot would show less symptom of esca than 110 R, 1103 P or 161-49C. In other trials of the region, observations relativize these trends (Dumot, 2010).

2 MATERIALS AND METHODS

The experimental plot is located in a first growth of Médoc, in Pauillac appellation. Geologically, it is on the fourth terrace of the Garone river, and the soil is gravelly brunisol on clayey gravels in depth. The variety cultivated is *Vitis vinifera* cv Cabernet Sauvignon. Four different rootstocks have been planted on this plot, Riparia Gloire de Montpellier, 101-14 MGt, 3309 C and Gravesac. The density of plantation is 10 000 plants per hectare, spacing is one meter by one meter. A total of 12480 vine stocks have been planted in 1998. Vines were treated as conventional plants by the Château, pruned in double Guyot, with an average of three buds per cane. Twelve replications of five rows per rootstock were arranged in a randomized design. 3120 vine stocks per rootstock have been observed during four years, from 2010 to 2013. The observations collected in the stocks concerned presence of esca symptoms and apoplexy. In 2013, unproductive vines (dead plants, absent, young plants under two years old) were also set down.

The data were analysed with the statistical software R (<http://www.r-project.org>). The climatic data have been collected by the local weather station of the Château.

3 RESULTS AND DISCUSSION

During the time of observation (four years) the weather was contrasted from a vintage to another as shown figure 1. The average data for the past 30 years in Bordeaux vineyard are: minimal temperature 9.1°C, maximal temperature 18.5°C, rainfall 944 mm (410 mm from April to September), sunshine 2035h.

In 2010, temperatures during vegetative period were in the average of past thirty years. On the other side, 2010 can be considered as a rainfall deficit year, especially during the growing season except a month of June quite rainy with 84 mm. A total of 205 mm have been recorded from April to September.

In 2011, spring was relatively warm and the rest of the year was poorly differentiated compared to the last decade. It is considered as the warmest year of the series. After a very dry winter and spring, few summer rains

have allowed vine not to stress too much despite of an early water deficit. 2011 is very dry year with 226 mm from April to September.

2012 is an average year concerning temperature for Médoc climate, a little cooler than normal early in the season but with no real feature. Concerning rainfall 2012 is also an average year overall (388 mm from April to September) but with strong irregularities: very dry from January to March, very wet in April and dry in the summer, until the beginning of September.

2013 is afresh year early in the season and very cool in late spring and early summer wish has provided effects on flowering (bad fruit set), with warmer temperature at the end of the growing season. 2013 is a year quite rainy (392 mm from April to September) with July and August quite dry (30 mm each). The harvesting period occurred late in October during a wet period.

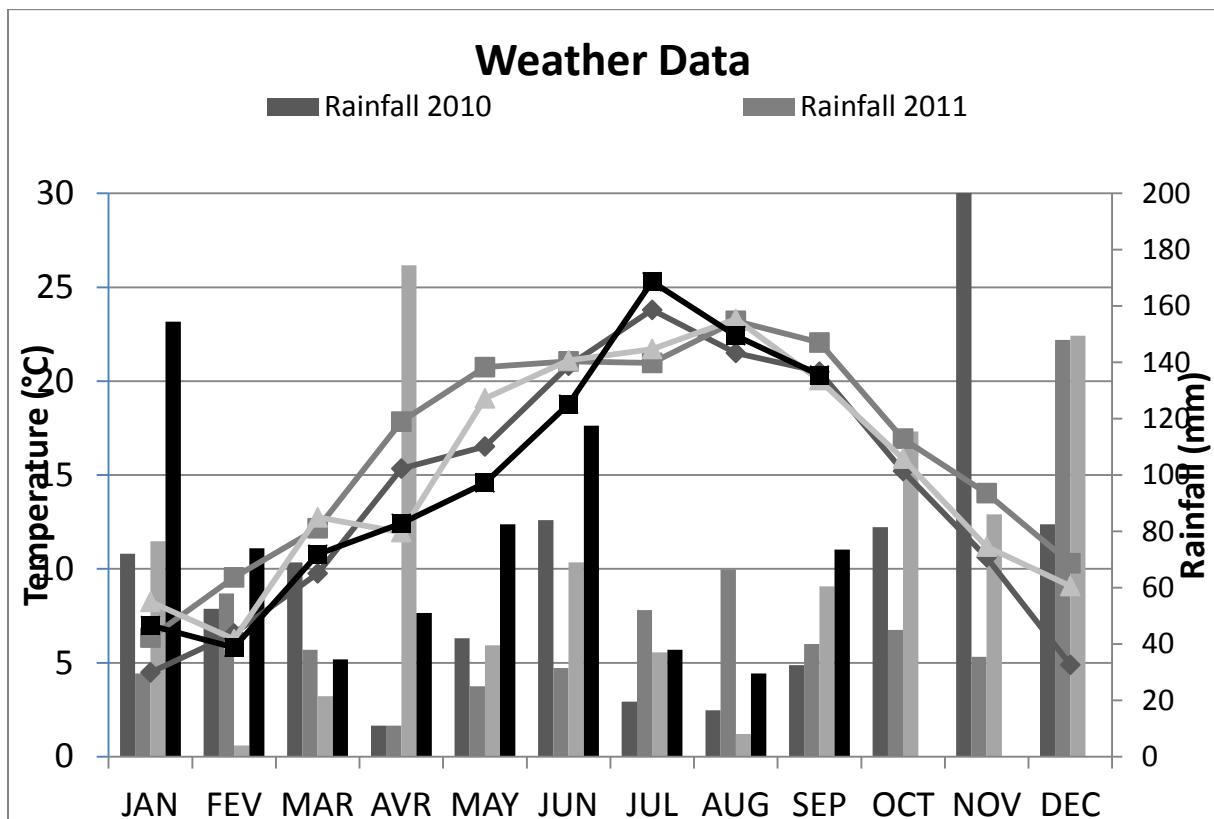


Figure 1: Weather data of Pauillac for the period 2010-2013

Concerning the effect of the weather, the results are in accordance with the bibliography as shown in figure 2. The year of highest symptomatic expression is 2012 with 12.5% of stocks exhibiting symptoms of esca. This level is considered as high knowing that it is reached 14 years only after plantation. This vintage was favorable to growth with normal temperature (without excess), and very low water deficit.

Conversely the year for which the highest water deficit is observed (2010) is the year which shows the lower symptomatic expression of vine stocks (3.1 %).

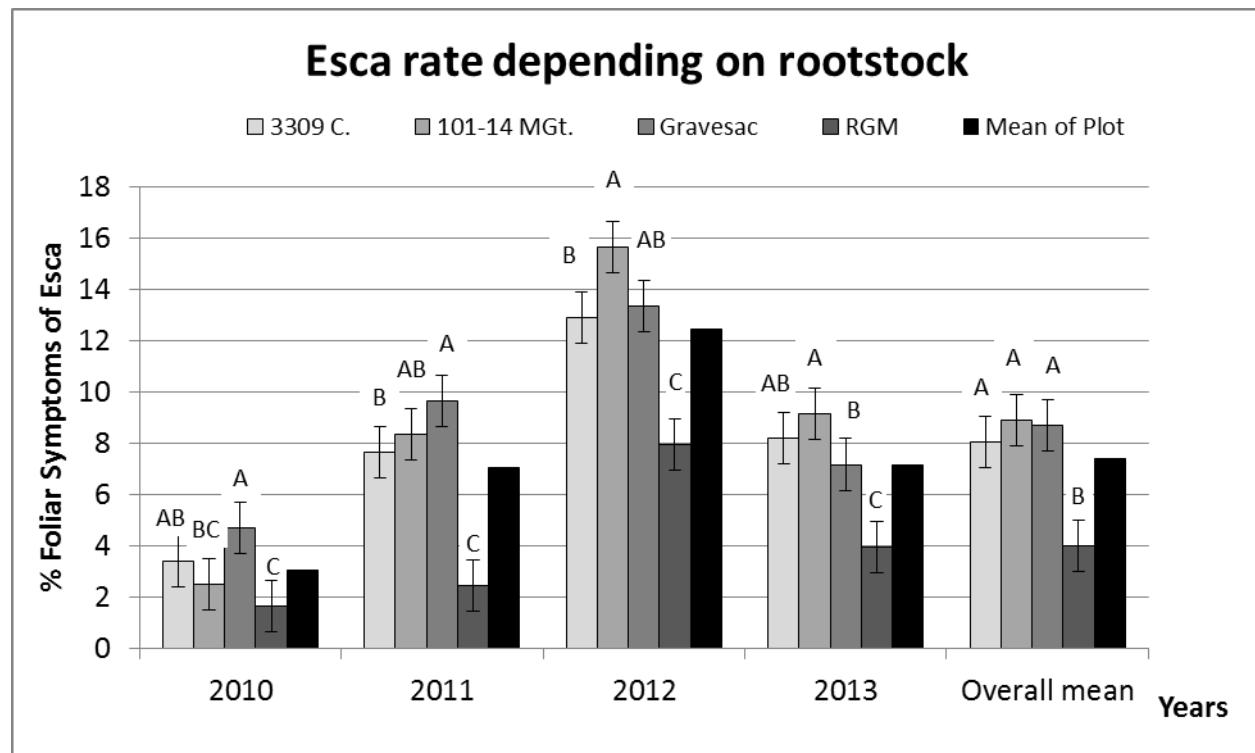


Figure 2: Rate of esca depending on rootstock for four different vintages

Concerning rootstocks behavior and expression of symptoms of esca by the Cabernet Sauvignon they are grafted on, the results are shown in the Figure 2. One appears always significantly different, Riparia Gloire de Montpellier, which express esca only on 4% of the vine stocks during the four years of observation. The difference observed on the three other rootstocks are mainly not significant during this period. Their average rate of expression of symptoms varies from 8% to 8.9% during the considered period. 101-14 MGt appears as the most sensitive of the series, especially in years with a favorable meteorology on esca foliar symptoms expression. Thereby, we observed 15.6% of the vine stocks grafted on this rootstock express esca symptoms in 2012, which is the worse year of the series. In other hand, years when the weather is less favorable to expression of esca foliar symptoms as 2010 and 2011, the Gravesac rootstock seems to develop the most symptoms. Finally, 3309 C seems to be a good compromise in term of behavior which can be classified as intermediate concerning expression of esca symptoms on Cabernet Sauvignon. It seems to have a similar behavior with Gravesac when the year is favorable with high expression of foliar symptoms of esca and with 101-14MGt during dry year such as 2010 and otherwise. However the rate of expression of vines grafted on 3309C remains much higher than those on RGM. But among the rootstocks of this trial, 3309C is the second after RGM to limit the expression of foliar symptoms of esca. These results concern only the variety Cabernet Sauvignon which is considered as a very sensitive variety for esca syndrome. The effect of the rootstocks should be observed on different main varieties, in different environmental conditions, soils and weather in particular. Considering the high rate of expression on a young plot (16 years old), this proposal seems to be relevant for wine region cultivating sensitive varieties.

4 CONCLUSION

These observations confirm that rootstock have an impact on the expression of symptoms of esca by grape variety. It confirms also that the weather have a main influence on the rate of expression of the esca syndrome. Indeed, the year which offers the best conditions for vine growth, average temperature, and no severe water deficit, 2012 in this case, is also the year of higher rate of expressions of esca symptoms for all tested rootstocks. The low amount of rainfall of August 2012 (8 mm), following a high foliar development at spring, should have increased the esca expression.

In Médoc area, Cabernet Sauvignon variety is very frequently grafted on 101-14 MGt rootstock, especially on gravelly brunisol, which are the majority in Médoc area. Riparia Gloire de Montpellier, which is less and less planted today due to its lack of vigor, is under these environmental conditions, the less sensitive to foliar expression of symptoms of esca. These results should be taken in consideration henceforward for the choice of rootstock on a plot. However, the same trials should be implemented on different type of soils of a same wine region, for each grape vine variety.

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5 LITERATURE CITED

- Destrac-Irvine A., Goutouly J.P., Laveau C., Guerin-Dubrana L., 2007. L'écophysiologie de la vigne. Mieux comprendre les maladies de dépérissement. L'Union Girondine 1035, 28-32.
- Doublet B., 2013. Etat des lieux issu des dispositifs d'observation au vignoble. Compte-rendu du groupe de travail des Maladie du Bois de la Vigne, 19-20 mars 2013-Angers.
- Dumot V., 2010. Effet de quelques facteurs agronomiques sur les maladies du bois. *Compte rendu de la journée Les maladies du bois de la vigne, du 16-17 novembre 2010, p47-48.* IFV. Villefranche/Saône
- Fussler L., Kobes N., Maumy M., Bertrand F., Grosman J., Savary S., 2008 - A characterization of grapevine trunk diseases in France from data generated by the National Grapevine Wood Disease Survey. *Phytopathology* 98, 571-579.
- Goutouly J.P. Influence de la physiologie de la plante sur le développement de l'Esca. *Compte rendu de la journée Les maladies du bois de la vigne, du 16-17 novembre 2010, p20.* IFV. Villefranche/Saône.
- Liminana J.-M., Pacreau G., Boureau J., Menard E. David S., Himonnet C., Fermaud M., Goutouly J.-P., Lecomte P. et Dumot V., 2009. Inner necrosis in grapevine rootstock mother plants in the Cognac area (Charentes, France). *Phytopathol. Mediterr.* (2009) 48, 92–100.
- Mugnai L, Graniti A, Surico G (1999) Esca (Black Measles) and brown wood-streaking: two old and elusive diseases of grapevines. *Plant Dis* 83:404–418
- Pearson R. and Goheen, A. 1988. Compendium of Grape Diseases. APS Press, St. Paul, MN. 93 pages.