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Observations of Black Dead Arm symptoms in Bordeaux vineyards: evolution of foliar symptoms, localisation of longitudinal necroses, questions, hypotheses

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Black Dead Arm (BDA) is described as a grapevine decline showing foliar symptoms, similar to those associated with esca, and a brown streaking under the bark (Larignon *et al.*, 2001). In the vineyard, because symptoms of both declines can be observed on the same vine, the confusion is frequent. A survey was done in the Bordeaux area in 2004 and 2005 in order to understand better the development of BDA symptoms: weekly observations were made in 5 vineyards (black cultivars: Cabernet Sauvignon and Cabernet Franc, "Guyot" training system, 17-24 years old) mainly located in the Medoc and Entre-Deux-Mers vine-growing regions. Symptoms were recorded from June to mid-July in 2004, from mid-June to September in 2005.

Apoplectic forms on entire vines were rare. On leaves, symptoms of BDA appeared earlier than those of esca proper and were the most frequent. Foliar symptoms of BDA were variable and showed different levels of damage according to the importance of interveinal drying and/or the red wine pigmentation on the lamina. They developed on one or more shoots, on one or both arms. Symptoms were distributed into three groups. The most damaged leaves showed large drying zones and little or no wine red pigmentation. Most of them drop down rapidly. The less damaged leaves showed more limited drying spots and generally more wine red pigmentation. Surprisingly, these leaves showed, after about two weeks, typical tiger-striped foliar symptoms of esca with sometimes some red bright zones that appeared instead of the red wine coloration. And some leaves showed intermediate symptoms with large interveinal drying zones of the lamina but did not fall. In this latter case, the evolution in a symptom of esca was less important. The three kinds of symptom were sometimes identified on the same cane. Along the weekly observations, the vines showing such symptoms were first classified as "BDA" (all exhibited the longitudinal streaking) and then "BDA/esca" and finally "esca" when most of leaves showed a characteristic tiger-striped pattern. Curves of cumulated % of vines showing either "BDA" or "esca" symptoms were almost parallels during summer and met at the end of September. These results lead to the following questions: i) Is it a regular pattern to observe such an expression of the two declines on the same leaves? ii) Is there a natural and physiological evolution from one symptom toward another (both symptoms forming part of the same phenomenon?

Some vines showing recent and relatively severe BDA expression were collected and examined in the laboratory. After peeling off the bark, a description of the external longitudinal necroses was achieved. At its early development (1-6 days old), the altered wood

was yellowish-orange and very similar to those of oxidized tissues and necroses formed in the xylem were sometimes discontinuous. There was no wound (entry) and no necrotic tissue occluding the vessels. On the trunk, the external necroses always formed on the side (and generally on the arm) corresponding to the foliar symptoms. However, they did not always extend either down to the graft union or up to the base of affected shoots. In severe forms, the necroses were often large (2-4 cm) and extended to the base and along the affected canes. Other observations, done along the season 2005 in vineyards in the South-West of France on vines i.e. identified as either "BDA" or "esca", showed the presence of this longitudinal necrosis. A few isolations along the lesion revealed different zones sterile or contaminated by various saprophytic fungi that were detected alone or co-habiting (*Botryosphaeria*, *Aspergillus*, *Alternaria*, *Rhizopus*, *Penicillium*, ...). Longitudinal wood sections of arms and trunks revealed important decayed zones and necroses of esca (mostly central with white rot) limiting the sap routes and the functional wood. Moreover, the localisation of the streaking necroses indicated that they, apparently, did not formed randomly and could be influenced by vine architecture (training and pruning systems). For instance, in 2005, 78 % of the streakings formed in vessels located here and there or along pruning zones (Figure 1).

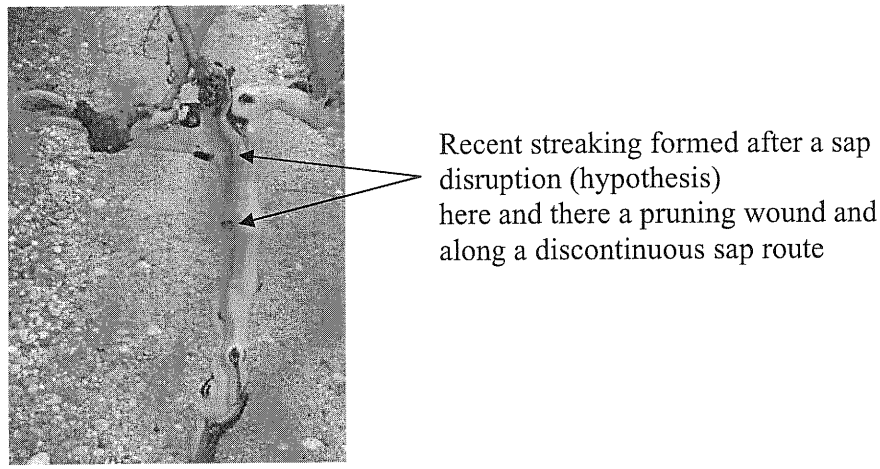

Fig. 1. Example of streaking located here and there pruning wounds

However, did the necroses result from fungal invasion or did they form after a disruption (embolism) linked with water stress along a sap route (which in turn could facilitate wood invasion by parasitic fungal species)? This study should encourage further surveys to clarify the symptomatology and the etiology of these declines (mainly described separately) and to identify predisposing factors that can favour their expression. Their integrated control in the future might be based on a combination of agronomical decisions and sanitary measures. Part of these results were presented elsewhere (Lecomte *et al.*, 2005 a,b).

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