ADVID Technical Notes

GRAPEVINE WOOD DISEASES
EUTYPA DIEBACK and ESCA
Contents

Introduction and Objectives

Eutypa Dieback
  - Symptomatology and Damage
  - Brief Description of the Biology and Epidemiology
  - Esca (Esca syndrome)
  - Symptomatology and Damage
  - Brief Description of the Biology and Epidemiology

Guide to Distinguish Symptoms Associated with Wood Diseases

Risk Estimate for Esca and Eutypa Dieback

Factors that influence the disease

Means of Protection

Strategies to Control Wood Diseases

Bibliography
Introduction and Objectives

Wood diseases are today responsible for significant damage to vines worldwide. Eutypa Dieback and Esca are two grapevine wood diseases that cause slow decline and losses of productivity at all the stages of grapevine growth, both through infected propagation material, affecting the growth of young vines, and through pruning wounds on established vines. They may also lead to the destruction of our vineyard heritage and reduce the quality of wines.

Studies carried out in the Douro by FREITAS et al. in 1992 already referred to a worrying expansion of those diseases in our region, since in a vineyard with a collection of 12 cultivars secondary symptoms of those diseases were detected in 19% of the vines. And when dead vines, faults, replacement rootstocks and young vines due to attacks from these diseases are calculated, this percentage rises to 35%, resulting in a loss of 22% of production potential. Among the cultivars observed, Aragonez was notably the most susceptible to these diseases.

This is therefore a problem that concerns all wine growers and the whole wine industry, particularly as there is no curative treatment for the infected plants and as they are diseases that can go unnoticed during most of their development, often only becoming apparent when damage is already irreparable. It is therefore important to understand the symptoms of wood diseases for early detection, and to recommend means of control that minimise the problem.
Eutypa Dieback

Eutypa Dieback is caused by a fungus called *Eutypa lata* that infects the grapevine through recent wounds, such as pruning wounds.

**Symptomatology and Damage**

The symptoms resulting from the action of the pathogen occur:

- On the vine (arms and trunk), showing the primary symptoms that result from the direct action of the fungus and which consist of hard necrotic cankers in the wood, sector-shaped in cross section and brownish in colour. This death of the wood starts at a wound and moves downwards along the branch (Photos 1, 2, 3, and 4). Fungi of the *Botryosphaeria* genus may cause similar symptoms. Surveys in our country (REGO et al., 2004; OLIVEIRA et al., 2004) on vines with symptoms associated with wood diseases showed that fungi of the *Botryosphaeriaceae* are consistently identified.

- Externally the symptoms of Eutypa Dieback, considered secondary symptoms (Photos 5 and 6), are attributed to the toxins produced by the fungus, appearing normally 5 years after contamination:
  - Effects in the canes, similar to those of fanleaf, but with uniformly short internodes and absence of zigzags, double nodes, fasciation and bifurcation;
  - The leaves are reduced in size, wrinkled, with marginal necrosis that may extend to the whole leaf;
  - On clusters a high percentage of aborted buds before flowering or else millerandage.

These symptoms worsen from year to year and the death of the arms or the vine trunk normally occurs 3 to 5 years after appearance of the first symptoms.

The damage of this disease is reflected in production, millerandage and a falling production, in the loss of quality, and in certain cultivars there may be a reduction in the aromatic component, and economic losses due to the replacement of dead grapevine plants.

**Brief Description of the Biology and Epidemiology**

The fungus is overwinters in the dead wood, and can remain fertile for more or less 5 years. Thus, the dead vine wood in vineyards is a source of infection that will contaminate the adjacent grapevine plants.

The fungus infects after at least 5mm rain (2 hours after the start of the rain and for 2 to 3 days) and cold weather also favours the development of the disease. Its dissemination is ensured by wind over large distances, sometimes dozens of kilometres and ascospores remain viable for at least two months.

Infection occurs through pruning wounds, and the fungus penetrates the vascular tissue of the grapevine; its mycelia spread through the adjacent tissues around 4 to 14 days after infecting the grapevine. It thus develops in woody tissues and forms the characteristic sector-shaped necrosis.

The susceptibility of pruning wounds to the infection of the fungus varies from three weeks in early winter to less than one day in spring.
Esca (Esca Syndrome)

Unlike Eutypa Dieback, Esca comprises a number of distinct diseases caused by a complex of fungi. These include: Phaeomoniella chlamydospora, Phaeoacremonium aleophilum, Phaeoacremonium inflatipes and other species of the genus Phaeoacremonium, Eutypa lata, Botryosphaeria spp., and the basidiomycetes Fomitioporia spp. and Stereum hirsutum.

It is currently considered that there are two processes responsible for the wood colonization leading to tissue degradation characteristic of Esca. The first process resulting in formation of central light-colored soft necrosis that involves “pioneer fungi” and the second process which causes the typical decay of esca and involves the “Esca fungi” themselves.

This disease should therefore be considered a complex of diseases caused by a complex of fungi that invades the vines not only through wounds applied in the field but also as a result of nursery practices. This aspect should be taken into account in the controls to be implemented.

Symptomatology and Damage

The symptoms of Esca are attributed to xylem dysfunction resulting from the development of the fungi (vascular occlusion). The first symptoms appear in early summer and the damage is done during the summer. As with Eutypa Dieback the symptoms may appear or not from one year to the next, but the disease has progressed in the meantime.

Symptoms on Green Tissue

Mild (chronic) form - characterised by necrosis of the leaf edges extending to the centre (Photos 7 and 8), spots appear between the leaf veins (yellowish in white grape varieties and reddish in red varieties, Photos 9, 10 and 11) that eventually coalesce forming a single elongated necrosis.

Severe (apoplexy) form – is characterized by the sudden wilting of different parts of the vegetation: shoots, leaves and fruits dry. This rare and aggressive form of the disease appears generally when vegetation is abundant and transpiration is intense. It normally appears during the hot period of the year, following abundant rain, and tends to affect vigorous and apparently healthy vine plants that generally do not produce new shoots the following year. The leaves and clusters due to poor or interrupted sap circulation. The disease may thus be mistaken for the physiological changes known in French as “folletage”.

Symptoms on the Grapevine plant (Arms/Trunk)

A cross-section of arms or vine trunk shows a necrosed area extending from the pith which, at a more advanced stage, becomes spongy in texture and whitish in the central part with the outer part darker, separated from the healthy part by a black line (Photos 18, 19, 20 and 21). It thus does not form a defined sector, but instead a general area, unlike Eutypa Dieback.
Esca was considered an old vine disease, but recently it has also attacked young vines (1 to 3 years old) causing their death, due to propagation through infected plant material (scions, rootstock and grafted plants).

The apoplectic form of the disease causes the rapid death of vine plants and the slow development of the disease gradually affects production and the sugar content of the must.

Brief Description of the Biology and Epidemiology

The complex of fungi causing Esca survives in infected wood along dormant season. They are spread by wind and penetrate the grapevine through pruning wounds. They attack wood tissues “from a distance”, through toxins, causing the death of cells (precursor fungi) and consequently necrosis in the wood. These tissues thus darken but remain of hard consistency. Subsequently, decay fungi colonize and degrades infected tissues transforming them into a whitish spongy rotted wood. Then it once again produces toxins to decay adjacent healthy tissues and thus advances into the wood from the top down, starting from the wound where it entered.

Around the tissues colonized by fungi, a healthy area of the trunk is maintained which temporarily continues functional. This situation tends to progressively deteriorate.

Risk Estimate for Esca and Eutypa Dieback

- The risk estimate is conducted through sampling, based on visual observation of disease symptoms and determination of the incidence and severity of the disease, expressed in a percentage of vine plants that present symptoms.
- In the case of Eutypa Dieback, from May to the end of June, vine plants that present secondary symptoms on leaves and shoots must be observed, marking the affected vines.
- The symptoms of Esca in its mild form are quite characteristic and they should be identified in the summer. The apoplectic form of the disease, as already noted, can be mistaken for other symptomatology and it should be identified after the grapevine has been uprooted.

The economic injury level is considered to be the presence of the disease.
Factors that influence the disease

The factors that influence the progress of these diseases include:

- Climate (temperature and humidity) plays an important role in the development of these diseases. Periods of rain and cold during the pruning season are favourable to the dispersion of the spores and to the development of Eutypa Dieback. Esca is considered a disease of hot regions. The most favourable conditions occur when temperatures rise above 20-25 ºC. This is the reason why the apoplectic form of the disease occurs in the summer, after heavy rains, when the plant’s transpiration is not compensated by an adequate supply of water within the grapevine plant;
- Early pruning, especially after periods of rain and cold, for the case of Eutypa Dieback. The pruning wounds remain receptive to the disease for quite long periods: 2 to 3 weeks for pruning at the start of winter. Susceptibility to the disease being reduced when the pruning is at the end of winter or in early spring;
- All pruning systems that cause large wounds encourage the establishment of these diseases, the Guyot training system considered more favourable to Esca than cordon pruning;
- The grapevine’s susceptibility to disease is also related to its age, in other words, mature vines 25-30 years old exhibit high susceptibility, although young vines can be contaminated;
- There are authors who have referred to the influence of certain rootstocks cultivars, such as the Rupestris, in the development of Esca (due to its high levels of tannins);
- Factors that increase the vigour of the grapevine, especially in the first five years after planting (fertile soils, vigorous rootstock, excessive fertilisation);
- All the cultural techniques that may cause wounds (large pruning cuts, accidents with machines and equipment, deep scarifying, etc.);
- Lack of disinfection of the cutting tools as well as dead grapevine plants left in the soil favour the dissemination of the fungi responsible for these diseases.

Means of Protection

In the past sodium arsenite was used as a curative treatment. However, the recent banning of sodium arsenite, carcinogenic agent and thus a toxicological hazard for human and animal health, has required reassessment of techniques to control Esca and Eutypa Dieback to limit the risk of increasing its presence in vineyards, since in countries in which sodium arsenite has been banned for some years there has been a disturbing advance in these diseases, particularly Esca.

In the absence of effective chemical treatment, it is imperative to adopt prophylactic measures (cultural control) in order to limit sources of infection and the risk of contamination, and at the same time to convert or replant affected vines, in order to reduce the impacts of these diseases.

Cultural Control

- Use healthy material when planting new vineyards. On a sample of the material, look for the possible existence of necroses in the wood and, if they are found, conduct a microbiological analysis;
- Adopt training systems that require less severe pruning;
- Avoid all operations that increase the vigour of the grapevine plants, particularly in the first five years after planting, and favour the development of Eutypa Dieback. The most common causes are fertile soils, excessive fertilisation and vigorous rootstock;
- Identify the plants affected in spring (Eutypa Dieback) and summer (Esca), mark them and leave the pruning of these sick vines until last;
- The pruning season is also an important factor for the receptivity of vine stock to disease, especially, as already mentioned, in the case of Eutypa Dieback. Pruning should thus be carried out as late as possible, during dry periods with no wind;
- Avoid large pruning wounds, in order to limit the possibilities for the fungus to enter the plant;
- Avoid all cultural practices that may cause wounds;
- Pull up dead or with severe infections grapevines and, cut the attacked arms as far as healthy tissue. This material should not be left in the field, but immediately burned;
- Disinfect pruning tools whenever they are used on attacked vines, with bleach (sodium hypochlorite) or alcohol;
- Not only in relation to this disease but for all wood diseases, wounds (particularly larger wounds) should be protected with a grafting paste or industrial bitumen.

Means of Chemical Control

After pruning, all pruning cuts should be disinfected and protected, and particularly larger cuts.

Biological control, using Trichoderma, which is a fungus that acts against certain diseases, has shown some effectiveness; however there is still considerable debate about its usefulness for wood diseases of the grapevine, and additional research is required.

Strategies to Control Wood Diseases

If the presence of these wood diseases is detected, control practices must be started with cultural and chemical measures aimed at the recovery of the vines (Figure 3):

- Identify the plants affected in spring (Eutypa Dieback) and summer (Esca), mark them and leave the pruning of these sick vines until last;
- The pruning season is also an important factor for the receptivity of vine stock to disease, especially, as already mentioned, in the case of Eutypa Dieback. Pruning should thus be carried out as late as possible, during dry periods with no wind;
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Figure 3 – Strategy for the control of Esca and Eutypa Dieback.
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ADVID is a non-profit association set up in 1982 by companies associated with the production and marketing of wine in the Demarcated Douro Region.

Following the change in its statutes in 1997, winegrowing enterprises with different organisational levels, from companies to individual winegrowers, could also join as full or associate members. Its purpose is the study, experimentation, demonstration and dissemination of viticultural techniques suited to the specific characteristics of the Demarcated Douro Region, with a view to the competitiveness and quality of its wines.

Recognised since 2009 as the management entity of the Demarcated Douro Region Wine Cluster, its mission is to contribute to a dynamic and consolidated wine production sector in the Douro Region, through a sustainable technology strategy applied to all its stakeholders.

The following companies are full members (updated in 2012):

Adriano Ramos Pinto - Vinhos, S.A.
Niepoort (Vinhos), S.A.
Sogrape Vinhos, S.A.
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