# Plant diseases on grapevines and their dispersal as bioaerosols

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Bioaerosole Retreat

## Introduction

Species of Botryosphaeria (Fig. 1) are major pathogens of grapevines worldwide. The Botryosphaeriaceae family includes among others, genera like *Neofusicoccum, Diplodia* and *Dothiorella*. Other ascomycetes plant pathogens are *Phaeoacremonium, Phomopsis, Phaeomoniella chlamydospora,* and *Eutypa lata.*[1,2,3] Like other bioaerosols, spores of these fungi are airborne and infect especially fresh pruning wounds of vines (Fig. 2). Based on a reduced use of fungicides the plant pathogen becomes a growing problem in viniculture. Because Botryosphaeria infections could lead to enormous crop failure it is necessary to develop new strategies to prevent a widespread expansion of spores and a consequent infection of vines in a vineyard.[4]

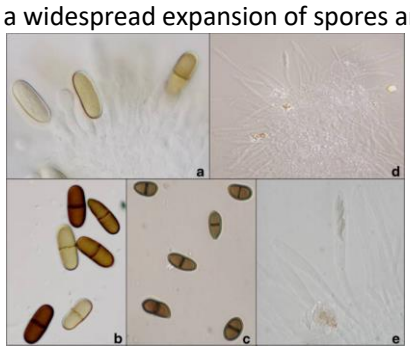


**Fig. 1:** Microscopic structures of grapevine trunk pathogens within Botryosphaeriaceae a. Conidia and conidiogeneous cells of *Dothiorella spp.* (100× magnification under oil immersion), b. Conidia of *Dothiorella spp*., c. Conidia of *Diplodia spp.* (100× oil immersion), d. Mature and immature asci of *Eutypalata* (100× oil immersion) and e. Mature *Eutypa lata* ascus with ascospores surrounded by immature asci (40× magnification).[2]

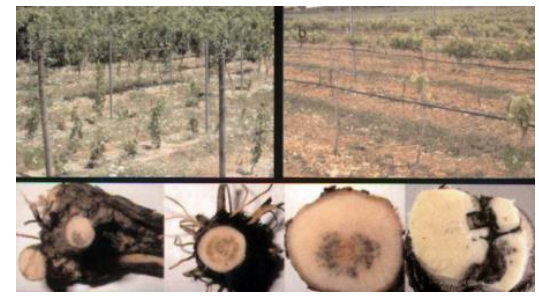

**Fig. 2:** „Esca of young vines" caused by *Phaeomoniella chlamydospora* and *Phaeoacremonium spp*.[5]

## Sampling Methods

Diverse methods are used for trapping spores. To trap airborne spores petroleum jelly coated glass slides (Fig. 3), as well as HIRST-BURKARD volumetric traps (Fig. 4) were applied. Rainwater traps attached to a vine trunk (Fig. 5) are used to collect waterborne spores.

**Fig. 3**: Glass slide spore trap.[1]

**Fig. 4**: Volumetric spore trap.[1]

**Fig. 5**: Rainwater spore trap.[3]

## Results

Regression analysis of glass slide spore trapping data (Fig. 6a), as well as from volumetric spore trapping data (Fig. 6b) indicate a positive relationship between spore release and precipitation.
The relation between humidity and spore release becomes very evident by considering the periods of main spore release. Spores were generally trapped in rainy seasons, from mid-fall to early spring with a maximum spore record in months with very high precipitation rates (Fig. 7). Additionally spore release is highly increased during irrigation periods (Fig. 8).[1]

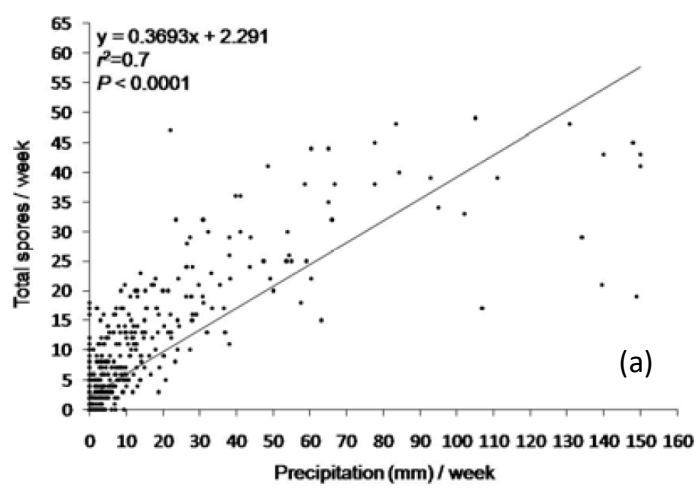


**Fig. 6**: Scatter plots of the relationship between trapped spores by glass slide spore trapping (a) and volumetric spore trapping (b) and precipitation.[1]

The presented results referring to spore-trapping studies in California vineyards.[1] However, the behavior of spore dispersal during and after rainfall is also observed in studies from South Africa and New Zealand.[2,3] This shows the global similarity of that dispersal mechanism. In addition, to the strong correlation between spore release and precipitation, other factors such as wind force, temperature and humidity play a role, which may explain the deviation in the scatter plots.

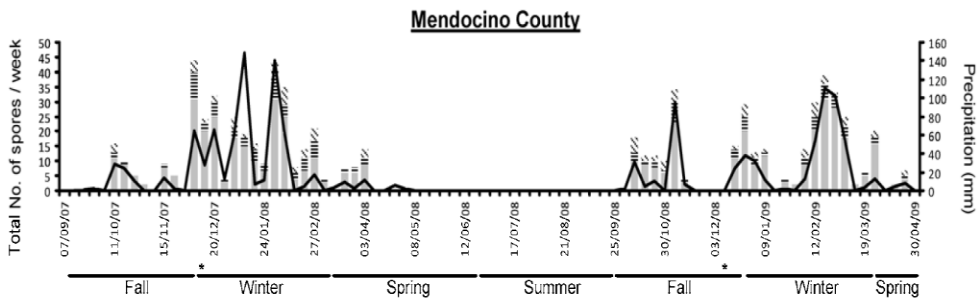


**Fig. 7**: Total number of Botryosphaeriaceae spores trapped per week using glass microscope slides and rainfall.[1]

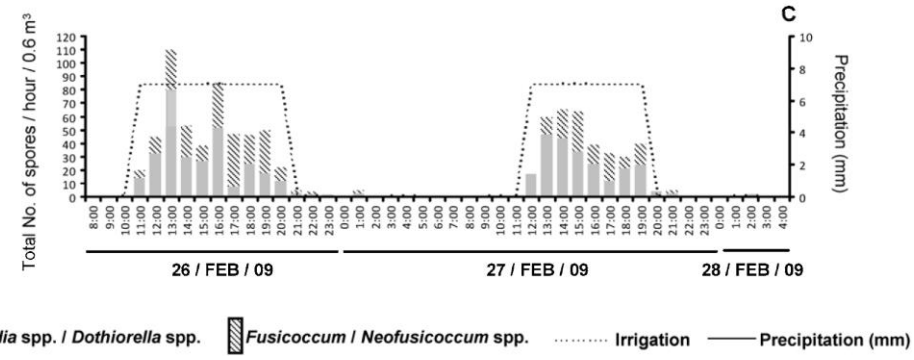


**Fig. 8**: Botryosphaeriaceae spores detected during overhead sprinkler irrigation (6.9 mm $ha^{-1}$ $h^{-1}$).[1]

## Discussion and Conclusion

The results of the presented studies show a clear seasonal pattern of Botryosphaeriaceae spore occurrence and suggest a humidly dependent spore release mechanism. This gained knowledge provides the basis to develop a new plant protection strategy against fungal infections.
The grapevine pruning is between December and March which is also the most wet season, but is necessary to increase quality and quantity of vine grapes. To prevent a distinct infection of fresh pruning wounds it is necessary to postpone the pruning time before dry days where the spore release is greatly reduced as well as to adjust the irrigation periods to pruning purpose.

## References

[1] J. R. Úrbez-Torres et al., *Plant Dis*. **2010**, *94*, 717-724.
[2] J. M. van Niekerk et al., *Eur. J. Plant. Pathol.* **2010**, *127*, 375-390.
[3] N. T. Amponsah et al., *N. Z. Plant Prot*. **2009**, *62*, 228-233.
[4] Action FA1303 at European Cooperation in Science and Technology (COST). **2013**.
[5] H. Oliveira: Diagnose der Holzerkrankungen der Rebe (http://www.vinetowinecircle.com/de/innovation/artikel/diagnose-der-holzerkrankungen-der-rebe/) 7.11.2017).