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02-04: Early detection of the grapevine disease Esca using hyperspectral sensors

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The Esca complex, Botryosphaeria dieback and Eutypa dieback are the three most important grapevine trunk diseases (GTDs), which are caused by several xylem-inhabiting biotrophic fungi. The major causal agents of the Esca complex are the ascomycetes *Phaeoacremonium aleophilum* (Pal) and *Phaeomoniella chlamydospora* (Pch) as well as the basidiomycete *Fomitiporia mediterranea* (Fmed). The infection occurs mainly in the winter through pruning wounds. But Pal and Pch are also able to infect young vines in nurseries. Thus, the spreading by young grafted vines cannot be excluded [1].

The fungi destroy the wood causing various types of wood necrosis. However, visible leaf symptoms do generally not become apparent until 5-7 years after infection. The acute form of Esca (apoplexy) causes the sudden death of vines within a few days. Typical chronic foliar symptoms show interveinal chlorosis and necrosis producing a tiger-stripe pattern. So far, no correlation between the severity of wood symptoms and the appearance of foliar symptoms could be shown, because infected vines do not develop leaf symptoms consecutively [2]. Therefore, an annual monitoring becomes fundamental to determine the true incidence of the disease in a vineyard.

Traditionally, monitoring depends on visual ratings by experts, thus, being time consuming and subjective. As a new field phenotyping platform, the 'Phenoliner', was constructed to enable the high throughput acquisition of phenotypic data under standardized conditions. In this study, ground-based hyperspectral data in the range of 400 – 2.500 nm were collected. Hyperspectral images of symptomatic and asymptomatic vines were analyzed to identify significant differences in their spectra as a basis for further practical applications (e.g. airborne multispectral imaging). Furthermore, the spectra of pre-symptomatic vines were examined to identify the time frame in which non-symptomatic and symptomatic vines can be differentiated before the appearance of symptoms. The early detection of Esca is important not only to study symptom development but also to evaluate the efficacy of the few control strategies available.

References

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