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Association of spores of *Phaeomoniella chlamydospora, Phaeoacremonium inflatipes,* and *Pm. aleophilum* with grapevine cordons in California

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Summary. Esca (black measles) of grapevine has long been known to occur wherever grapes are grown. *Phaeomoniella chlamydospora* and two species of *Phaeoacremonium, Pm. inflatipes* and *Pm. aleophilum,* have been associated with esca and Petri grapevine decline in major production regions of California. Though present in symptomatic grapevines and capable of causing foliar symptoms of esca, *Phaeomoniella chlamydospora* does not cause the typical symptoms on fruit. However, trapping studies showed that spores of *Pa. chlamydospora, Pm. inflatipes* and *Pm. aleophilum* were captured throughout the year in vineyards ranging from the north California coast to the southern San Joaquin Valley. They can be considered airborne fungi capable of being water-splashed by pruning or other wounds during part of their biological cycle. Trapping of spores coincided with rainfall events for *Pa. chlamydospora* and *Pm. inflatipes,* and to a lesser degree for *Pm. aleophilum*. However, this last species was trapped during periods of time when rainfall did not occur and was trapped longer into the summer.

Key words: *Vitis vinifera*, esca, black measles, airborne spores.

Introduction

Phaeomoniella chlamydospora and two species of *Phaeoacremonium, Pm. inflatipes* and *Pm. aleophilum,* have been associated with esca (black measles) and Petri grapevine decline[1] in major production regions of California. These diseases are characterized by the sudden wilting and death of bearing vines (apoplexy), the onset of foliar and fruit symptoms or the slow decline of young vines in midsummer. This study was carried out to determine when and under what conditions spores of the pathogens are released to potentially re-infect plants.

Materials and methods

Spore traps were placed in selected vineyards where esca and Petri grapevine decline were known to occur. These included: Napa County, Sonoma County, Mendocino County along the north coast, San Joaquin County, Madera County, Tulare County, Kern County, Solano County in the San Joaquin Valley, and San Luis Obispo County in the Central California coast. The traps were designed to catch spores of *Pa. chlamydospora, Pm. inflatipes* and

[1] At the general Assembly of the 2nd ICGTD meeting held in Lisbon 2001 it was unanimously decided that the disease will henceforth be called Petri disease.

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Pm. aleophilum on grapevine cordons. Spores were trapped on glass microscope slides coated on both sides with white petroleum jelly and affixed to the cordon. They were collected and changed each week. Spores were removed with 10 ml water, after which the water was passed through a 5 μm filter followed by passing through a 0.45 μm filter. The filter was then washed with 1 ml of sterile distilled water. Two hundred μl was then placed onto potato dextrose agar amended with 0.1 g l^{-1} tetracycline (PDA-tet). Slides were read for pathogen presence after 10 days. The colonies of each of *Pm. inflatipes, Pm. aleophilum*, and *Pa. chlamydospora* were counted and a representation of each fungus species was subcultured. Observations were recorded weekly.

Results and discussion

According to the counts taken from February to July 2001, spores of the three pathogens were trapped at different locations and at different times of year. Spores of *Pa. chlamydospora* were trapped in Napa County, Sonoma County, Mendocino County, San Joaquin County, San Luis Obispo County and Solano County. Successful trapping at each location was correlated with rainfall events, shown in Fig. 2 for Mendocino County. These results show conclusively that *Pa. chlamydospora, Pm. inflatipes* and *Pm. aleophilum* spread as airborne inoculum in California vineyards during winter and spring. Additionally, symptomatic grape berries were collected from different regions in California during

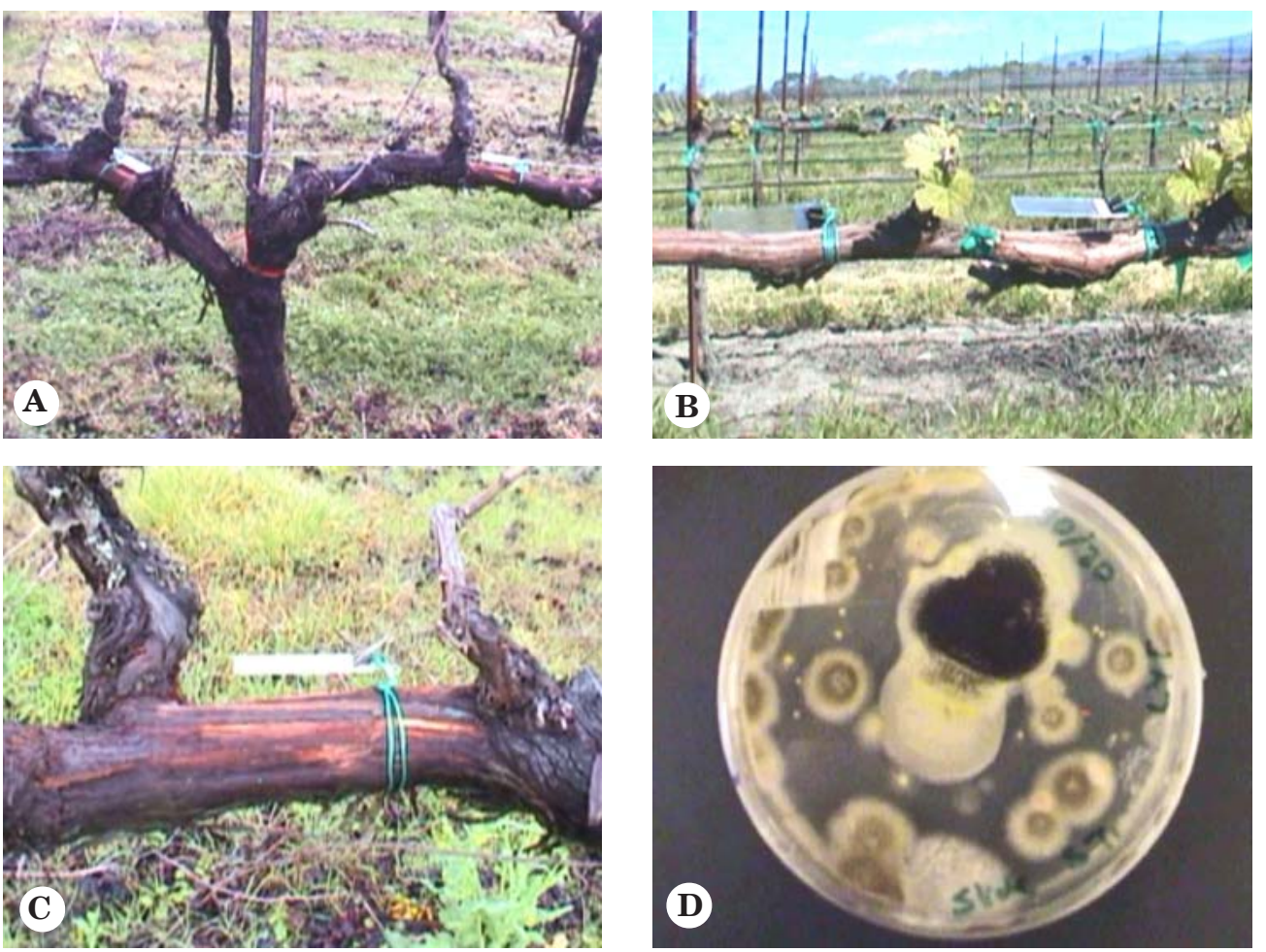

Fig. 1. A, B and C, spore trap slides, both sides coated with white petroleum jelly. D, trapped *Phaeoacremonium aleophilum, Pm. inflatipes* and *Phaeomoniella chlamydospora* growing on potato dextrose agar amended with 0.1 g l^{-1} tetracycline.

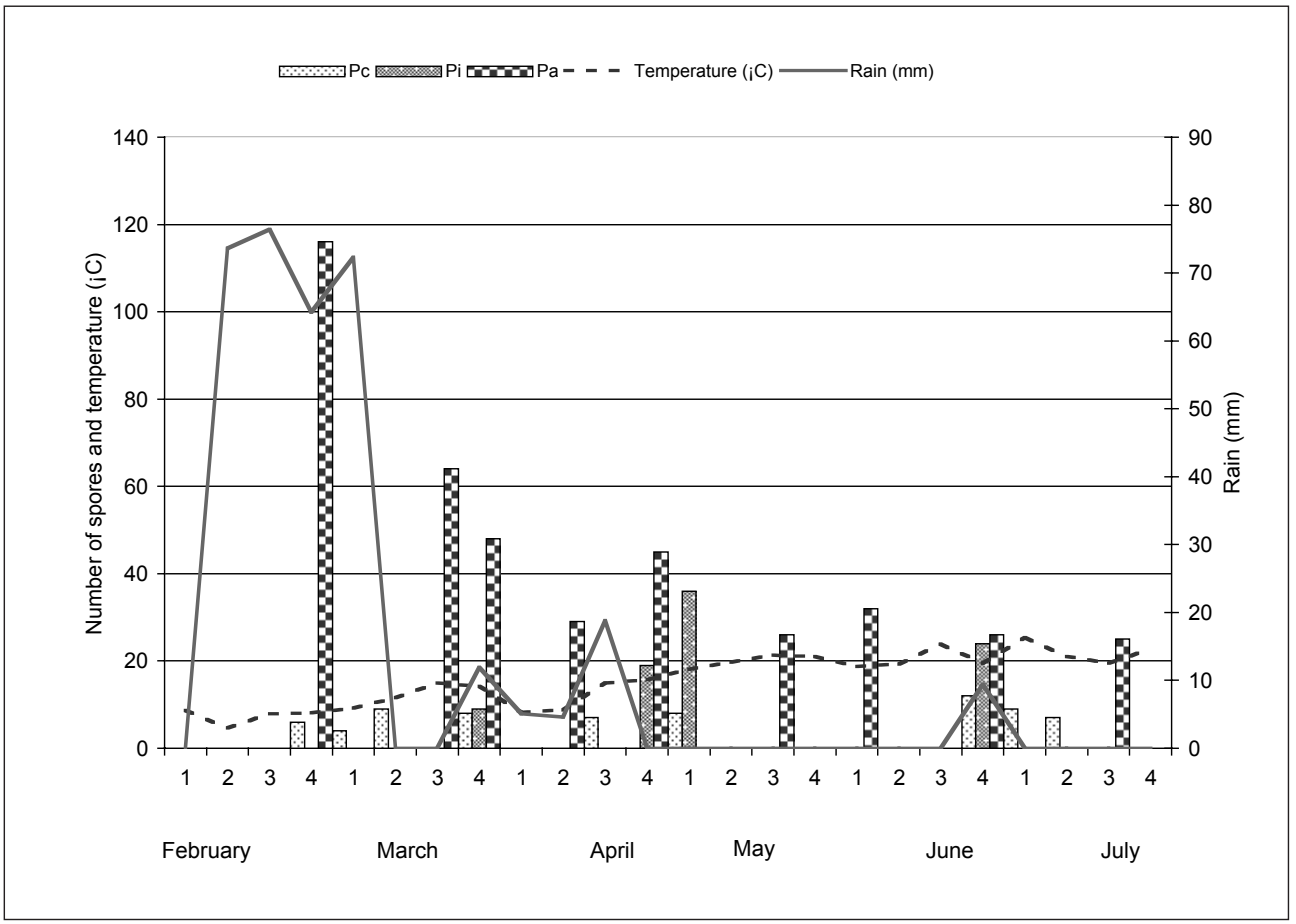

Fig. 2. Number of spores trapped per week and rainfall at Mendocino County (California, USA) from February to July 2001.

ripening and were found to be contaminated with conidia of *Pm. inflatipes* and *Pm. aleophilum*.

Pa. chlamydospora and *Pm. inflatipes* spore release occurred during and following rainfall in late winter and early spring. Spores of *Pa. chlamydospora* are thought to be released from pycnidia which reside on cordons and spurs. *Pm. aleophilum* spores were also trapped at a number of locations but release of these spores was not always correlated with rainfall. *Pm. aleophilum* was more commonly trapped in early to mid-summer, whereas *Pm. inflatipes* was present throughout the trapping period. All three species are water splashed and airborne.

All three species were isolated from symptomatic berry clusters late in the season. Spore release of *Pa. chlamydospora* and *Pm. inflatipes* coincided with pruning and the pruning wounds, which may explain the high infection rate of pruning wounds in California production areas.

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