INCIDENCE OF DOWNY MILDEW *PLASMOPARA VITICOLA* (BERK. ET CURTIS EX. DE BARY) BERL. ET DE TONI IN TERCEIRA ISLAND, AZORES

MATEJ ZORMAN[4], DAVID JOÃO HORTA LOPES[2], JORGE OLIVEIRA MARTINS[3], CARMELO PRENDES[1], CARMEN DIAS LORENZO[1], RAIMUNDO CABRERA[1]

ABSTRACT

Downy mildew is one of the most economically important disease affecting vine production in Terceira island, Azores. By its incidence, frequency and quantity of pathogens, supported with favourable temperate humid climate conditions, this disease is difficult to control in terms of sustainable integrated plant protection policy. The objectives of INTERFRUTA project were to determine the incidence of the disease, to better understand it and to adopt an adequate forecasting model with necessary adjustments to predict the disease appearance and its in-time integrated plant protection control measures. *Plasmopara viticola* was directly observed in two weeks time periods on seven representative vineyards at different altitudes. Three of the monitored plots were established during study inside one plantation. Incidence was registered as result of visual symptoms in percentage, where 10% of plants in each vineyard were observed. Seasonal evolution of the disease was studied in one of the wine producing area.

Key words: Azores, downy mildew, forecasting model, grapevine.

[1] U.D.I. Fitopatología. Facultad de Biología. Universidad de la Laguna, Canarias. Espanha
[2] Centro de Biotecnologia dos Açores, Portugal
[3] Serviço de Desenvolvimento Agrário da Terceira, Açores, Portugal
[4] Faculty of Agriculture, Vrbanska 30, Maribor, Slovenia

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RESUMO

O Míldio é uma das doenças que mais afecta a vinha, na ilha Terceira, Açores. É uma doença fúngica de difícil controlo, pela sua incidência e frequência de aparecimento. Os objectivos do projecto INTERFRUTA II foram determinar a incidência desta doença para melhorar o conhecimento sobre esta e adoptar e validar um modelo matemático adequado à previsão do aparecimento da doença de modo a permitir a aplicação de medidas de protecção integrada. A evolução do míldio foi acompanhada em sete parcelas de vinha, da área vitivinícola dos Biscoitos, através da observação visual de folhas. Numa das parcelas, três dos talhões não foram tratados para servirem de controlo. Em cada parcela foram observadas 10% das plantas, tendo sido registada a percentagem de plantas com sintomas visuais da presença de míldio.

Palavras-chave: Açores, míldio, previsão, vinha.

INTRODUCTION

The analyses of agro meteorological variables as well as phenological studies are of great concern for integrated crop protection on Terceira island in Azores. Downy mildew *Plasmopara viticola* (Berk. et Curtis ex. de Bary) Berl. et de Toni and powdery mildew *Uncinula necator* (Schweinf.) Burrill infections and agro meteorological variables can be related using simulation models built after collected and analysed field data based on meteorological and phenological observations. Consequently, development and outbreak of pathogens may be controlled in economic acceptable limits in a sustainable integrated way. Essential knowledge about biological potential, phenological characteristics of cultivars, nature of growth, cultural practices in comparison to meteorological relations are under continued investigation within the patrimony of Interfruta II project.

The lack of natural pathogens for biotechnical control is commonly associated to a high level of chemical control. A correct planning of chemical control actions is essential for the economical viability of vine production systems and depends upon knowledge about phenology development and pathogen life cycle.

The establishment of an economic level attack implies analysis between the results of risk estimative (which includes the intensive attack observation and the influence of the harmful factor analysis on the predictable damage) and predictable control resources cost estimative (Amaro & Baggiolini, 1982).

If control is inadequate, in some seasons, regional crop losses can range from 10 to 20%, and reach 100% if severe infection is not controlled before budding, near flowering and after harvesting.

MATERIALS AND METHODS

Samples of 10 leaves randomly chosen from at least 20 plants in the studied orchard were collected from April to October in 2006 and 2007 within seven (2006) and five (2007) observed orchards in different plantations at the wine growing region of Biscoitos. The collected leaves were visually observed in the laboratory, under a magnifier, and grown in humid holding chambers and, afterwards, identified under a microscope if needed.

RESULTS

Downy and powdery mildew occurrence varies considerably from season to season depending on previous levels of infection and cultural management techniques, which determine the subsequent carryover of spores in infected vineyard floor litter, and on favourable weather conditions which promote disease development and spread. Vineyard situations, which increase soil moisture with higher OM content as observed in plantations of Biscoitos (average value 16,4%) and humidity, most predispose vines to potential infection by downy and powdery mildew.

The results exposed show similar infection potential upon recent years of observations (Barcelos, 1997). That leads us to assume that newest ways of chemical, biological and cultural control against diseases in a 10 year period did not significantly improve disease control even after implementation of the latest findings on phytosanitary scientific field of research. The questions we have to resolve in future are: what are the most important factors which influence disease development; what are the triggers; can the cultural practice be improved together with traditional way of production; can the quality be increased and economically significant; can the chemical control be reduced to economically significant levels, according to prediction, and the quantity of labour hours decreased.

Main values of 48% (2006) for downy mildew and 30% (2006) for powdery mildew (Fig. 1), in comparison with 1997 (Barcelos, 1997) observations of 44% for downy mildew and 26% for powdery mildew infestation, present significant economic impact on quantitative and qualitative wine production for Terceira wine growing region of Biscoitos.

Distribution of powdery mildew was according to circumstances under highest control in comparison to downy mildew, as a consequence of implemented treatments against downy mildew. The highest potential was noticed in V1, a non treated parcel used as control. The levels on other parcels (V2, V3, V4, V5, V6 and V7) were not of significant importance and were kept under observation during the growing season.

Following visual field observations, we related the disease appearance to temperate climatic regions, on Terceira island, con-

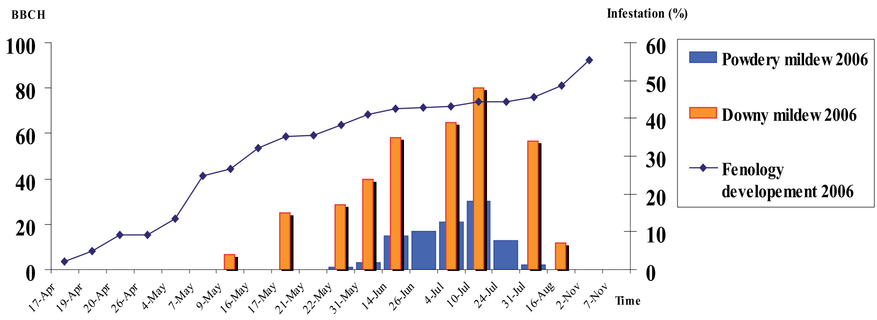

Figure 1 – Phenology, development and infestation appearance.

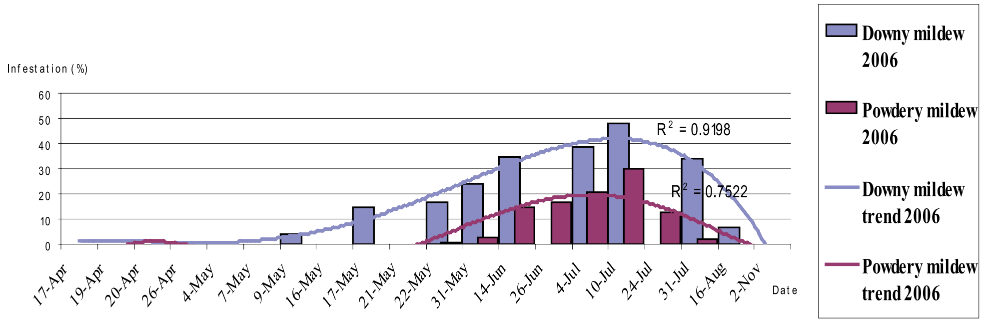

Figure 2 – description of powdery and downy mildew appearance.

cerning downy and powdery mildew. The studied parcels showed linear dependency on terrain inclination, altitude and sea distance, where there is no need to expose the vines to biochemical preventive and curative control to avoid biological pathogen limitation.

An average expense of 620€ estimated for treatments each year per hectare (8-10 depending on season) presents a consequent decrease of the financial income which can be avoided with implementation of biotechnical control measures built upon observations (Barcelos, 1997). Downy mildew can account for almost 50% of the financial impact on production if not kept under control, having powdery mildew smaller visual impact (30%), affecting berries quality and quantity in almost the same amount as downy mildew.

Infections started to appear at the beginning of May, near the phenological stage of five unrolled and fully developed new leaves (Figure 1). The first treatments were done at the beginning of March, before budding which started in the first week of April. The first treatment on V6, against downy mildew, was done on the 3rd of May, 2006, corresponding to the phenological stage of two developed leaves. Forteen treatments were done in V6, leading to 0% downy and 6% powdery mildew infection and we can conclude that economical impact is significant.

The trend showed, with significant consistency, a peak at a certain time frame between the 10 and 20th of July both for downy and powdery mildew with some delay according to phenological development for powdery mildew and its biological cycle (Figure 2).

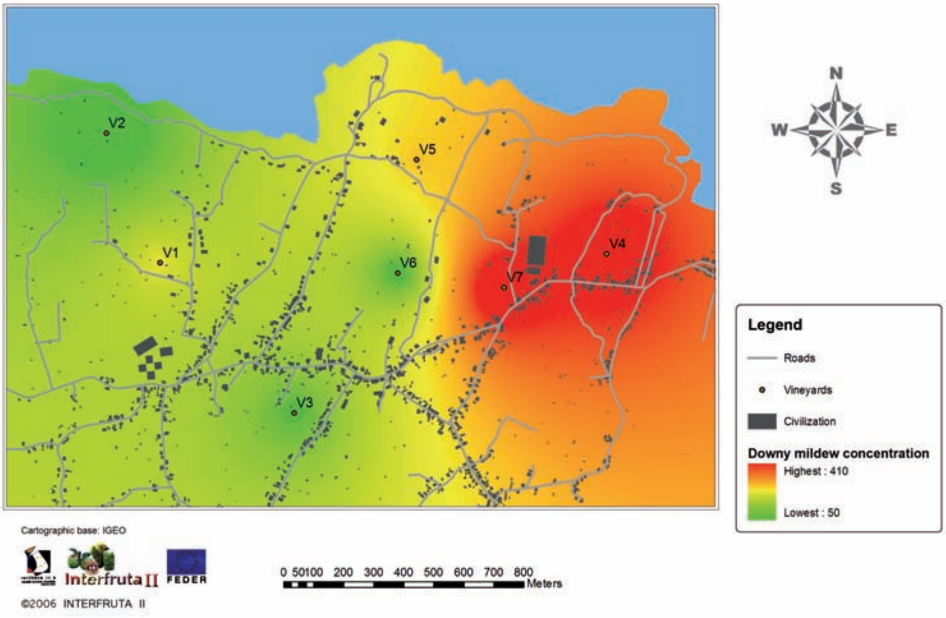

Figure 3 – Geographical distribution of downy mildew in 2006.

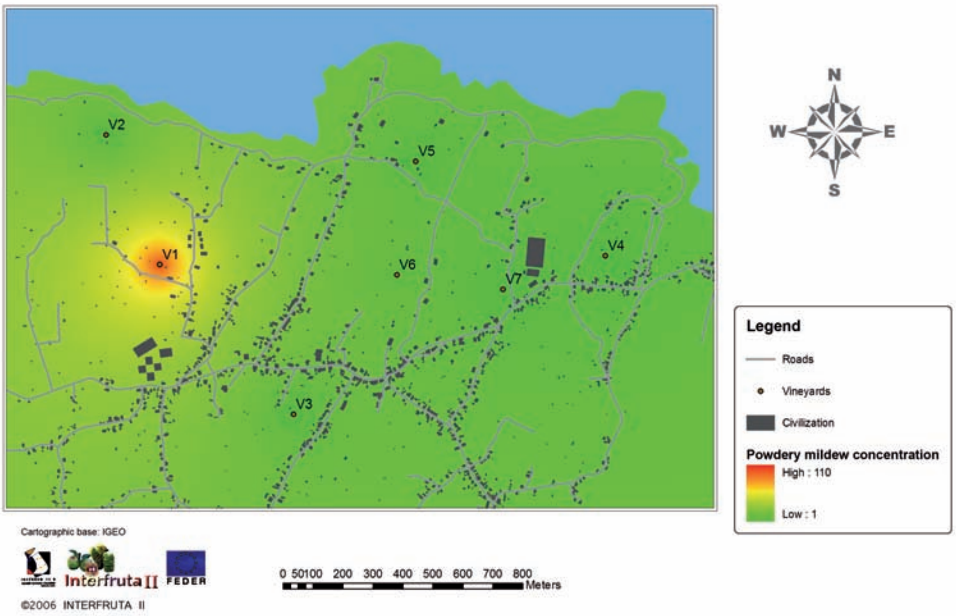

Figure 4 – Geographical distribution of powdery mildew in 2006.

With ArcView® modelling we established disease dispersion risk assessment according to collected field data and possible intensity of attack for the vineyards under study. The model leads us to assume that disease favourable micro climate conditions concerning V4 and V5 are, no matter the chemical control, of highest economical importance affecting the vineyards (Figure 3). Herewith, microclimate for vineyard parcel placing is a preliminary decision factor, prior to establishing a vineyard.

As seen on Figure 4, the only powdery mildew epidemic centre was in V1 which was the control untreated parcel, being the other parcels under control measures. The best results were observed in the vineyard V2 in which the distance to the sea was the largest compared to the other parcels and so, was less affected by the sea water carried by the wind. We still have to improve our investigations in that direction to obtain more reliable results.

CONCLUSIONS

Concerning diseases, there is some variation in the symptoms, which almost always develop as a result of infection. Removal and destruction of infected plant parts reduces the spread of disease during the same season and also reduces the build-up of epidemics during the following seasons. To implement this method, the farmer should be able to detect infected plants at an early stage following prior informative leaflets.

Plant disease epidemics on agricultural crops affects agriculture each year. It affects the economic value, quantity and quality of food and fibre products (Main, 1977).

Therefore, future forecasting systems will be dependant on timely and well-documented disease reports. Despite cultural practices and breeding for resistance, chemical control remains the most effective and economic measure currently used to protect crops from downy mildew and powdery mildew disease. According to advising services recommendations, practices well applied on time will avoid high potential economic risks.

Due to high disease risk potential, environmental impact assessments have to be carefully considered. For providing on-line accessible essential information, a web page of Interfruta II project will be available, containning information about areas of investigation as well as interpretations of all collected data (Lopes, 2006).

Treatments have high costs, depending on the infection level and the necessity of early interventions and should be done according to field observations. Integrating these observations in a disease prediction model, in future, is essential. Necessity of additional and new studies is pointed out as a result of this pilot study. Vineyards need more investigation work on Terceira to improve future prediction models in order to help the farmer reducing financial costs, improving integrated disease control and making the control measures more effective (Cabrera, 2007).

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