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Section III – Viticulture

Plamopara viticola quality white vine
varieties worldwide

Technical and scientific reviews

J.L. Andrés Ares

Consultorías Noroeste S.C.



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Professional Plant Protection

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Ideario de la Revista

Professional Plant Protection es una revista internacional que versa sobre aspectos relacionados con la Protección Vegetal Profesional. Publica revisiones, artículos y comunicaciones cortas acerca de resultados de investigación original, experimentación y experiencias profesionales en el campo de la Protección Vegetal. Se trata de una revista realizada por y para el sector de la Protección Vegetal Profesional: los trabajos incluidos deberán estar basados en experiencias realizadas en explotaciones comerciales de producción hortícola, vitícola u ornamental. Incluirá solo trabajos de investigación aplicada. También está abierta para todos aquellos técnicos y responsables de la protección vegetal de explotaciones y empresas comerciales que deseen describir sus experiencias relacionadas con la Protección Vegetal. Esta abierta, así mismo, a todos los equipos de investigación tanto pública como privada, sea de centros específicos de investigación como de las diferentes universidades públicas o privadas, pero los trabajos a publicar deberán haber sido llevados a cabo en explotaciones de producción comercial.

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Professional Plant Protection is an international journal on aspects of Professional Plant Protection. It publishes critical reviews, papers and short communications on the results of original research, experimentation or professional experiences related to plant protection. It is a journal carried out by plant protection professionals for the plant protection and plant production companies: all of the works to be published in the journal must be based in experiences carried out in commercial enterprises, being these horticultural, ornamental or viticultural companies. The journal will only include applied investigation. The journal will willingly accept experiences related to Plant protection described either by technicians or plant protection managers. The journal will also accept investigation carried out by formal investigation groups, either private or public, belonging to formal investigation centers or to private or public universities, but always based on experiences carried out in commercial production companies.

This journal has no impact factor.

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Technical Revision – *Revisión técnica.*

Abstract

In the present paper the author carries out a bibliographic revision about the epidemiological aspects that are common in the interaction of *Plasmopara viticola* – *Vitis vinifera* in quality white varieties worldwide.

Key words: downy mildew, vineyards

Resumen

En el presente trabajo el autor realiza una revisión bibliográfica acerca de los aspectos epidemiológicos más característicos de la interacción Plasmopara viticola – Vitis vinifera en las diferentes variedades de vino blanco de calidad en el mundo.

Palabras clave: mildiu, viñedos

1. Production zones of white quality wines in the world

There is not much information about the origin of the white quality vine varieties in the world. The most probable origin of this quality vine varieties lies in central Europe, in an area that belongs to Germany, France, Italy and Switzerland. There are certain references that point out the existence of good wine in such areas in ages of the Roman Empire. The religious companies such as Augustinians, Benedictines, Cistercians and the order of Cluny might have had an important role in the dispersion of this type of wine to Spain and Portugal. In Galicia (NW Spain) the variety Albariño is said to be introduced by the Cluny Congregation and the white cultivar Godello has possibly an Alsacian origin. Certain of these varieties were also introduced in certain formerly Spanish colonies, such as Argentina and Chile, by the massive immigration

from Southern Europe that took place in the early XXth century. Formerly British colonies such as Australia and New Zealand, introduced these white varieties by the influence of German settlers. In South African they were introduced by the influence of Dutch settlers. The introduction of this type of wine in California, USA, took place late in the XX century due to the expansion of the modern wineries.

The most important wine zones that produce quality white wine in the northern hemisphere are the following: Alsace in France with 15300 ha of vines, Rheingau in Germany with a total surface of 3125 ha, Trentino in Italy with 5260 ha, Region of Vinhos Verdes in Portugal that has a total surface of 34000 ha, Steier Mark in Austria with 4240 ha, Monterrey in California –USA– with a vine surface that reaches 14471 ha and Rias Baixas in Spain with a global vine surface of 4027 ha in the year 2014.



Photo 6. Godello leaf infected by *Plasmopara viticola*. © Consultorías Noroeste S.C.



Photo 9. Albariño leaf infected by *Plasmopara viticola*. © Consultorías Noroeste S.C.



Photo 7. Godello leaf infected by *Plasmopara viticola*. © Consultorías Noroeste S.C.



Photo 8. Godello leaf infected by *Plasmopara viticola*. © Consultorías Noroeste S.C.



Photo 10. Godello leaf infected by *Plasmopara viticola*. © Consultorías Noroeste S.C. 2016



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Scientific Revision – Revisión científica

Abstract

In the present paper the author carries out a bibliographic revision about the pathogenic variation of *Plasmopara viticola* in quality white varieties worldwide. Points out the possible existence of, at least, three different pathotypes of the chromist in Europe and studies the possibilities of controlling the disease by genetic methods.

Key words: downy mildew, pathotypes, vineyards.

Resumen

En el presente trabajo el autor realiza una revision bibliográfica acerca de la variación patogénica de Plasmopara viticola en las variedades blancas de calidad en Europa. Apunta la posibilidad de existencia de al menos 3 patotipos diferenciados del cromista en Europa y estudia las posibilidades de control del cromista por medio de métodos genéticos. Palabras clave: midiu, viñedos

Palabras clave: midiu, patotipos, viñedos.

1. General concepts about pathotypes and disease resistance to pathogens

The term physiological race was defined by Robinson as “the subdivision of any species based on a specific physiological criterium” (Robinson, 1969). This term has been so firmly established, that will stand for a long time. This same author defined a new concept directly related with the previous term, which is the pathotype concept. It was defined by him in the following way “a pathotype is a population of a pathogen with a common particular character owned by every individual member of the population” (Robinson, 1969). For this author there were as many classes of pathotypes as pathogenicity criteria,

defining two well delimited types: the vertical and the horizontal pathotype. The term vertical pathotype is directly associated with the concept of physiological race.

Robinson improves the previous theories developed by other plant pathologists as Van der Plank (1986), introducing two new concepts in order to define what he names as the vertical subsystem of a pathosystem: the gen-for-gen interaction, previously defined by Flor (1942) and the concept of differential interactions. Flor defines the gen to gen relation as the presence of a gen in a host population, corresponding with the continuous presence of another gen in another population of the pathogen, leading the interaction of these two gens to the unique phenotypic

expression by means of which you can recognize the presence or lack of such gen on either organisms.

The differential interaction, necessary for the detection of vertical pathotypes, was defined by Robinson (1969, 1971, 1973, 1976, 1980, 1987) and Van der Plank (1968) in the following way: “when a variety has more resistance to certain races of a pathogen than other, the resistance is defined as vertical or perpendicular”. The vertical resistance only exists, according to Van der Plank (1968), when there is a differential interaction between varieties and races of the pathogen.

Robinson improves the concept of Van der Plank in the following way: “ If you inoculate several pathodems –host population with a similar character of resistance to a certain disease– with several pathotypes –pathogen population with a common pathogenicity character –you can observe a differential interaction or not. If it takes place, the reaction of each pathodem, to each series of pathotypes will be completely different”. This will also take place if we consider the reaction of each pathotype in relation to the different series of pathodems. The differential interaction is the main character of the gen to gen relation as well as of the vertical subsystem.

TABLE 1 A. PATHOGENIC VARIATION OF EUROPEAN *PLASMOPARA VITICOLA* ISOLATES FROM DIFFERENT ORIGIN

<i>Vitis vivifera</i> Variety	Level of resistance/susceptibility to <i>Plasmopara viticola</i>		
	<i>Plasmopara viticola</i> isolates		
	Galician isolate (NW Spain)	German isolate	Isolate from Madrid (Central Spain)
White Caiño	Highly susceptible (4)	Resistant (2)	Highly susceptible (4)
Red Caiño *	Highly susceptible (4)	Highly Resistant (1)	Resistant (2)
Albariño	Extremely Susceptible (5)	Susceptible (3)	Highly susceptible (4)
Mencia *	Susceptible (3)	Susceptible (3)	Susceptible (3)
Torrontés	Extremely Susceptible (5)	Susceptible (3)	Highly susceptible (4)
Treixadura	Extremely Susceptible (5)	Susceptible (3)	Susceptible (3)
Cabernet Sauvignon *	Susceptible (3)	Extremely Susceptible (5)	Extremely Susceptible (5)
Tempranillo *	No information	Extremely Susceptible (5)	Extremely Susceptible (5)
Müller-Thurgau	No information	Highly susceptible (4)	Extremely Susceptible (5)

* Red varieties

Degrees of resistance/susceptibility to *Plasmopara viticola* following Gaforio *et al.*,(2015); Boso & Kassemeyer, (2008) and Boso *et al.*, (2014):

1. Highly Resistant
2. Resistant
3. Susceptible
4. Highly Susceptible
5. Extremely Susceptible

TABLE 1 B. DIFFERENTIAL VARIETIES USED TO CLASSIFY PATHOTYPES OF *PLASMOPARA VITICOLA* PROPOSED BY THE AUTHOR

<i>Vitis vivifera</i> Variety	Differential interactions of <i>Plasmopara viticola</i> with differential <i>Vitis vinifera</i> varieties		
	<i>Plasmopara viticola</i> proposed pathotypes		
	Pathotype 1 (Galician isolate)	Pathotype 2 (German isolate)	Pathotype 3 (Central Spain)
White Caiño	Highly susceptible (4)	Resistant (2)	Highly susceptible (4)
Red Caiño *	Highly susceptible (4)	Highly Resistant (1)	Resistant (2)
Cabernet Sauvignon*	Susceptible (3)	Extremely susceptible (5)	Extremely susceptible (5)

* Red varieties



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J.L. Andrés Ares

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Technical Revision – *Revisión Técnica*

Abstract

In the present paper the author carries out a bibliographic revision about the different methods of controlling *Plasmopara viticola* in quality white varieties worldwide: cultural methods and chemical protection.

Key words: downy mildew, vineyards

Resumen

En el presente trabajo el autor realiza una revision bibliográfica acerca de los diferentes métodos de control de Plasmopara viticola en las diferentes variedades blancas para la producción de vino blanco de calidad en el mundo: técnicas culturales así como estrategias de protección química.

Palabras clave: mildew, viñedos

1. The history of *Plasmopara viticola* control

It was Millardet who, in 1882 and in a casual way, discovered the effect of copper against downy mildew. To avoid passersby from eating from grapevines close to road, the vines were sprayed with a mixture of copper sulphate and lime that was both visible and bad-tasting. Millardet noticed that the treated plants remained free from downy mildew symptoms while the rest of the vineyard suffered from the disease. The qualities of Bordeaux mixture –the name that that mixture received– received almost immediate worldwide recognition, particularly its strong adhesion to the leaves, its long persistence in the vineyard and its colour, which allowed the applicator to easily verify the distribution of the treatment.

From the end of the 19th century to the beginning of the 20th an important number of copper compounds were tested against downy mildew that can be classified as follows: copper solutions obtained by dissolving a highly soluble copper salt in water; copper mixtures which are precipitates obtained after the neutralization of copper salts –Bordeaux mixtures and Burgundy mixtures–; aqueous suspensions of a copper salt that are not very soluble –copper oxide, basic sulphate oxychloride, carbonate– and dusts. Bordeaux mixture was always more effective than copper oxychlorides and copper oxides tested. However other forms of copper were found to be less phytotoxic and cause less injuries to young shoots.

TABLE 5. CHARACTERISTIC OF THE GROUPS OF FUNGICIDES REGISTERED IN SPAIN FOR THE CONTROL OF *PLASMOPARA VITICOLA*

Characteristic	Type of fungicide depending on its mode of action			
	Systemic	Penetrant	Cuticular action	Contact action
Plant penetration	Yes	Yes	No	No
Movement inside the plant	Yes	No	No ⁶	No
Protection of shoots formed after the application	Yes up to 10-12 days	No	No	No
Washed by rain	No if it rains 1 hour after the application. Exceptions: ciazofamide & zohamide (2 hours); azoxystrobin (4 h.) benelaxyl (6 h.)			Yes with > 10 l/m ² of rain
Persistence	12 days	10 days	10 days	7 days
Preventive action ¹	Yes	Yes	Yes	Yes
Stop action ²	Fosetil-al – 2 days Iprovalicarb – 3 days Benalaxyl – 4 days	2 days	No Exception: ciazofamide: 2 days	No
Erradicant action ³	Yes Exception: fosetil-al	No	No	No
Control of sporulation ⁴	Yes	Yes	No Exception: ciazofamide	No
Resistance risk ⁵	Yes Exception: fosetil-al	Yes	No	No
Adequate period of application	Up to berries pea-sized	From berries pea-sized to berry touch		From berry touch to harvest

¹. It prevents the pathogen from introducing itself in the plant

². It can stop the pathogen development after the penetration

³. Capable of drying the oilspots

⁴. Capable of avoiding the development of the pathogen conidia

⁵. Resistance: reduction of the fungicide effectiveness

⁶. It has traslaminar action and can move inside the plant up to a certain point.



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Control of *Plasmopara viticola* in albariño commercial vineyards of NW Spain

Control de Plasmopara viticola en explotaciones comerciales del Noroeste español

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Technical Revision – *Revisión Técnica*

Abstract

In the present paper the author carries out a bibliographic revision about the control measures employed in albariño commercial vineyards in W Spain in order to control *Plasmopara viticola*. He also describes his own experiences, managing the pathogen in Albariño commercial vineyards, as independent consultant.

Key words: downy mildew, vineyards

Resumen

En el presente trabajo el autor realiza una revision bibliográfica describiendo los métodos de control de Plasmopara viticola empleados en las explotaciones comerciales de cultivo de albariño del noroeste español. El autor describe, así mismo, sus experiencias de manejo del patógeno en su labor como consultor independiente en las explotaciones comerciales del noroeste español

Palabras clave: mildiu, viñedos

1. Introduction: description of the Rias Baixas wine zone

The Rias Baixas wine region protected zone was founded in 1988 (Order of the 17th march of 1988 of the Agricultural Regional Government Department). It is situated in the Galician –NW Spain– provinces of Pontevedra and south of A Coruña with 6 different production zones –Val do Salnés, Condado do Tea, O Rosal, Soutomaior and Ribeira do Ulla– that sum a total vineyard surface of 4027 ha, 6031 growers and 179 wineries. On year 2014 it had a global grape production of 24.180.221 kg. and 19.300.200 litres of wine which had an economic value of 96.501.000 €.

The preferential white varieties are the following: Albariño, White Loureiro, Treixadura and White

Caiño. The white varieties Torrontés and Godello are also permitted in the wine zone. The following red varieties are also permitted in Rias Baixas: Red Caiño, Espadeiro, Red Loureiro and Sousón as preferential and Mencía, Brancellao, Pedral and Castaña as permitted.

The region produces 7 different classes of white wines: Rias Baixas albariño –elaborated only with Albariño variety–, Rias Baixas Condado do Tea –70 % of the grapes must be Albariño and Treixadura and the rest white permitted varieties, all produced in the region Condado do Tea–, Rias Baixas Rosal –70 % of the grapes must be Albariño and Loureiro and the rest white permitted varieties, all produced in the region Rosal–, Rias Baixas Salnés –70% of the grapes must be preferential white