

Severidade da mancha-das-folhas (*Isariopsis clavispora*) em videiras cultivadas em clima subtropical**Severity of leaf spots (*Isariopsis clavispora*) on grapevines cultivated in a subtropical climate**

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ABSTRACT

Grapevine cultivation is of great importance, because it generates jobs and regional development. Its production is intended for natural consumption and industrialization, serving as raw material to produce wine, sparkling wine, juices, candies, jams and other by-products. However, fungal diseases cause serious damage to this cultivation and may affect the production and the quality of the grapes. The objective of this study was to evaluate the severity of the leaf spot (*Isariopsis clavispora*), one of the main fungal diseases that affect the grapevine at the end of its cycle. The grapevine varieties used were: Bordô, BRS Carmem, BRS Lorena, BRS Magna, BRS Rúbea, BRS Violeta, Concord, Concord Clone 30, Isabel, Isabel Precoce, Moscato Embrapa, Moscato Bailey, Niagara Branca, Niagara Rosada and Seibel 5455. The study was conducted in the Federal Technological University of Paraná, Campus Dois Vizinhos, Paraná State, Brazil, in the 2015/2016 harvest. The evaluations were held weekly with the assessment of the diagrammatic scale. All evaluated varieties manifested symptoms of leaf spot at some point of the cycle, allowing us to classify them into four groups, with emphasis to the group of the most tolerant: BRS Carmem, BRS Rúbea, Concord, Moscato Embrapa and Seibel 5455.

Keywords: *Vitis labrusca*, Varieties, Disease, Diagrammatic scale.

RESUMO

A cultura da videira é de grande importância, pois gera empregos e desenvolvimento regional. Sua produção é destinada tanto para consumo “*in natura*” quanto para a industrialização, servindo de matéria prima para fabricação de vinhos, espumantes, sucos, doces, geleias e outros derivados. Entretanto, as doenças fúngicas causam sérios danos a essa cultura, podendo afetar a produção e a qualidade das uvas. O objetivo do trabalho foi avaliar a severidade da mancha-das-folhas (*Isariopsis clavispora*), uma das principais doenças fúngicas que acomete a videira no final do ciclo no Sudoeste do Paraná. As variedades de videiras utilizadas foram: Bordô, BRS Carmen, BRS Lorena, BRS Magna, BRS Rúbea, BRS Violeta, Concord, Concord Clone 30, Isabel, Isabel Precoce, Moscato Embrapa, Moscato Bailey, Niágara Branca, Niágara Rosada e Seibel 5455. O trabalho foi realizado no setor de Fruticultura da Universidade Tecnológica Federal do Paraná, Campus Dois Vizinhos, na safra 2015/2016. As avaliações foram realizadas semanalmente com o auxílio de escala diagramática. Todas as variedades avaliadas manifestaram sintomas de mancha das folhas em algum momento do ciclo, permitindo classificá-las em quatro grupos, com destaque para o grupo das mais tolerantes: BRS Carmen, BRS Rúbea, Concord, Moscato Embrapa e Seibel 5455.

Palavras-chave: *Vitis labrusca*, Variedades, Doença, Escala diagramática.

1 INTRODUCTION

The vitiviculture is an activity of great importance of the small properties in Brazil. It brings development and generates jobs, both in production and processing of table grapes (MELLO, 2013). Brazil produced in 2018 1,591,986 tonnes of grapes in a harvest area of 74.472 hectares. Paraná State produced in the same year 56,981 tonnes in a harvest area of 3,939 hectares (IBGE/SIDRA, 2019).

One of the several alternatives of grape exploitation is the preparation of juice (RIZZON; MENEGUZZO, 2007). In the national market, the Rio Grande do Sul outstands as the State that produces grapes and grape juices in greater quantity (MELLO, 2013). Due to the ease of preparation, together with the organoleptic characteristics (color, odor and flavor) and its nutritional value, the grape juice can contribute on the food diet, because its nutritional characteristics are compared to the *in natura* grape. The grape juice is considered a distinct beverage, considering both the energetic aspect and the nutritional and therapeutic ones (RIZZON; MENEGUZZO, 2007).

Currently, the common or American grapevines (*Vitis labrusca*) form the basis of the Brazilian grape juice, being the Isabel, Bordô and Concord the most important varieties. However, other varieties, hybrids included, were recently released to the market (CAMARGO et al. 2010; MARCON, 2013). They require to be better studied considering the adaptation

and susceptibility to the main fungal diseases, in the most varied climatic conditions of the country.

Fungal diseases are the main obstacles to the expansion of the cultivation of grapevines, causing quantitative and qualitative losses. In regions where climatic conditions are favorable to the development of fungal diseases, the phytosanitary treatments can reach 30% of the production cost of the grapes. The leaf spot is caused by the *Isariopsis clavispora* fungus and has great importance in the American and hybrid varieties in regions of hot climates, where it quickly evolves. The main damage is the premature defoliation, weakening the plant and compromising the following years' production (SÔNEGO et al. 2005).

The disease control is conducted preventively in the agroecological system. It begins with the choice of tolerant varieties, implantation in appropriate place, with windbreaks, adequate handling of the plant, aiming greater sunlight and air circulation to reduce the foliar water uptake and use of hot spring in the winter and summer (GARRIDO et al. 2007).

Given this, the aim of the study was to evaluate the severity of leaf spots (*Isariopsis clavispora*) in 15 varieties of grapevines in subtropical climates.

2 MATERIALS AND METHODS

The study was conducted in the Federal Technological University of Paraná, Campus Dois Vizinhos, Paraná State, Brazil (25°45'00" latitude, 53°03'25"W longitude). The climate of the region is humid subtropical (Cfa), according to the Köppen classification, with average annual temperature of 22°C in warmest months, and less than 18°C in colder months, showing average precipitation of 2,025 mm per year (ALVAREZ et al. 2013).

Fifteen varieties of grapevines were assessed: Bordô, BRS Carmem, BRS Lorena, BRS Magna, BRS Rúbea, BRS Violeta, Concord, Concord Clone 30, Isabel, Isabel Precoce, Moscato Embrapa, Moscato Bailey, Niagara Branca, Niagara Rosada and Seibel 5455, being the majority of them destined to the elaboration of 100% grape juice. The rootstock used was the Paulsen 1103.

The conducting system of the plants was of vertical shoot positioning trellis system with four horizontal levels of wire, in the spacing of 1.5 m x 2.3 m, with pruning in bilateral cordons (short pruning in two buds). The experimental design was completely randomized with four repetitions of four plants, with the central two only used as useful flowers. The fertilization of the plants was conducted according to the analysis results of soil and foliar tissue. We used as fertilizers the natural phosphate (Yorin), vegetable ash and organic

compound matured with poultry litter. To control invasive species, especially African stargrass (*Cynodon plectostachyus*) and nut grass (*Cyperus rotundus*), there were held weeding and manual digging (crowning of plants), as well as the sowing of jack bean (*Canavalia ensiformis*) in the line spaces of the grapevines, which also served as green fertilizer, providing nitrogen to the grapevines using symbiotic fixation. Still on the control of invasive species, in the rows of grapevines, two sprayings of a natural herbicide known as Compound H were conducted, at the dosage of 30 mL.L⁻¹ of water.

For winter treatment and as a stimulant of sprouting of plants, an application of lime sulfur (50%; 5% Ca; CaSO₄) at 5% + mineral oil (Assist) at 2% was held. The phytosanitary handling of grapevines of spring/summer was held weekly, under rainy conditions, and every 15 days, under conditions of low rainfall. Applications of copper-based mixtures, such as the Bordeaux, Bordasul (20% Cu; 10% S; 3% Ca) and Supera (copper hydroxide) were conducted. The Viçosa mixture (8% K₂O; 0,8% Mg; 8% S; 9% Cu; 3% Zn; 3% B) was intermingled to these products to increase the nutritional status of plants.

To evaluate the severity of the disease, in the 2015/2016 harvest, two branches per useful plant were selected, which were evaluated up to the height of the fifth leaf, from the base of the branch. Because it is a disease that happens at the end of the cycle, it was monitored weekly, starting from December 09, 2015, when the first symptoms emerged, which characterized the incidence. From this moment, severity levels were attributed according to the diagrammatic scale proposed by Lenz et al. (2009), until February 24, 2016, when most of the evaluated leaves (basal) had already fallen.

With the weekly indexes of the disease severity, we obtained the areas under the curve of disease progress (AUCDP), using the equation used by Mazaro (2007), as follows:

$$AUCDP = \Sigma \left(\frac{S_i + S_{i+1}}{2} (T_{i+1} - T_i) \right)$$

in which: S_i = disease severity in the time of evaluation i; T_i = time of evaluation i. Maximum indexes of disease severity were verified considering the normality using the Bartlett's test. The analysis of variance was applied subsequently. The means were grouped using the Scott and Knott test at a 5% probability of error, through the statistical program Assistat.

Data on disease severity were related to the meteorological variables of temperature, rainfall and relative air humidity, from the meteorological station at the National Institute of

Meteorology (INMET, 2016), placed less than 300 meters from the collection of evaluated grapevines.

3 RESULTS AND DISCUSSION

All evaluated varieties had symptoms of *Isariopsis* leaf spots at some moment of the cycle (Table 1).

We could verify significative differences for AUCDP among the varieties for the leaf spots using the Scott and Knott test, being possible to classify them into four groups: 1- Susceptible: Bordô, Niágara Branca and Niágara Rosada; 2- Moderately susceptible: BRS Violeta, Isabel, Isabel Precoce; 3- Moderately tolerant: BRS Lorena, BRS Magna, Concord Clone 30 e Moscato Bailey; 4- Tolerant: BRS Carmem, BRS Rúbea, Concord, Moscato Embrapa and Seibel 5455 (Table 1). The BRS Carmem and Seibel 5455 varieties, despite not statistically differing from Concord, BRS Rúbea and Moscato Embrapa, show AUCDP values a little below from the others (Table 1).

Table 1. Area under the curve of disease progress (AUCDP) to the leaf spots (*Isariopsis clavispora*) of 15 varieties of grapevines in year-harvest 2015/2016. UTFPR/DV, Dois Vizinhos, Paraná State, 2019.

Varieties	AUCDP
Bordô	1820.36 a
BRS Carmem	420.69 d
BRS Lorena	1002.88 c
BRS Magna	946.14 c
BRS Rúbea	541.75 d
BRS Violeta	1355.02 b
Concord	661.55 d
Concord Clone 30	831.46 c
Isabel	1285.11 b
Isabel Precoce	1336.55 b
Moscato Bailey	917.00 c
Moscato Embrapa	680.08 d
Niagara Branca	1730.68 a
Niagara Rosada	1810.60 a
Seibel 5455	344.76 d
CV%	29.07

Means followed by the same letter do not statistically differ between themselves using the Scott and Knott Test ($p \leq 0.05$).

Figure 1 allows a better visualization of the grouping differences of grapevine varieties evaluated in relation to the AUCDP, as well as the variability of the meteorological variables occurred in time.

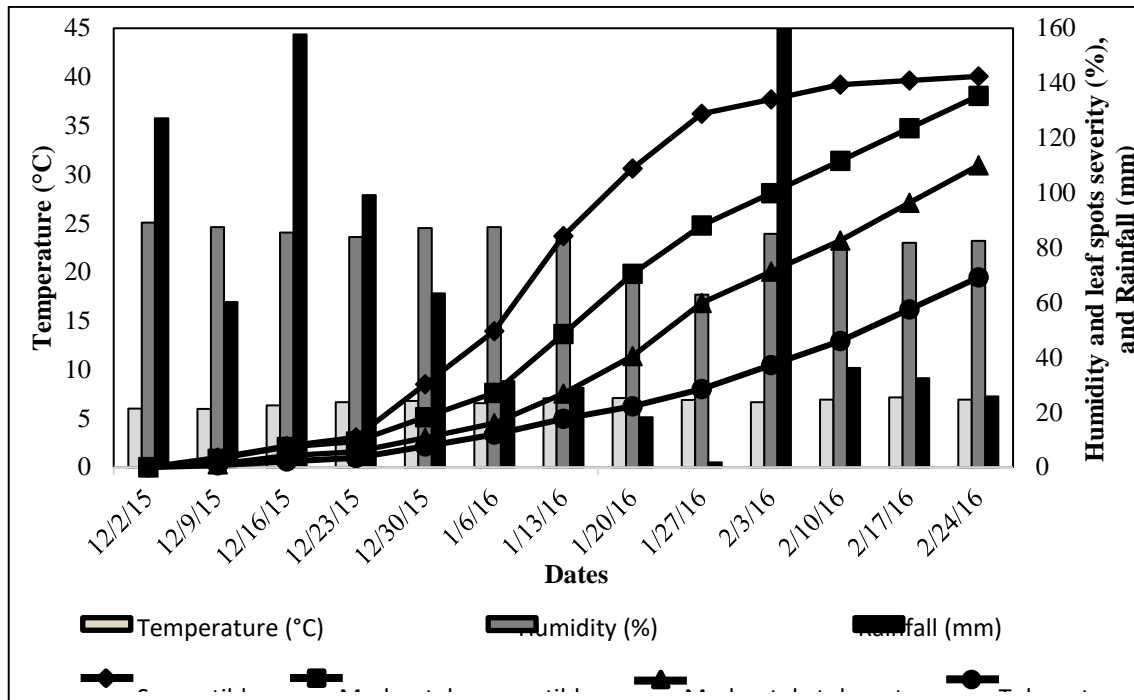


Figure 1. Evolution of the severity of the leaf spots (Percentage of damaged leaf area) on grapevines in function of temperature, air humidity and rainfall in the period from 12/02/2015 to 02/24/2016. UTFPR/DV, Dois Vizinhos, Paraná State, 2019.

We also verified the more accelerated progress of the disease in periods of greater rainfall (Figure 1), in which the first symptoms of the disease appeared in December 9, 2015, after the occurrence of above-average rains, especially in the week previous to the first evaluation, with rain regime that lasted a few weeks, accelerating the disease progress. To the great rainfall in the favoring of the development of the fungus, the great relative air humidity is summed (above 80%) during most part of this period.

In this study, the maximum severity of leaf spots (*Isariopsis clavispora*) was observed in February 24, 2016, when the greatest part of the leaves of some varieties had already fallen due to the disease (index six of the diagrammatic scale), which corresponds to 40.2% of the foliar area (Figure 1).

Isariopsis leaf spots this disease has great importance for American and hybrid cultivations (Lenz, et al. 2009). This was observed in the present research, even with the regular application of preventive fungicides. One of the aspects observed was that the varieties most used by the producers in the Southwest of Paraná, such as the Bordô, Niagara Branca and Niagara Rosada had the greatest AUCDP, being grouped as the ones with more susceptibility to the disease.

According to Otobelli (2013), the Bordô aroused the interest of winegrowers from the 18th century, due to the resistance to the Oidium, but it's tolerant to Isariopsis leaf spots. The Niagara Branca and Niagara Rosada varieties had medium susceptibility to the main fungal diseases (CAMARGO; NACHTIGAL, 2007) and, thus, preventive sprayings against these diseases are recommended.

In BRS Carmem, the low disease severity may be linked, according to Camargo et al. (2008), to its late cycle, as well as having good resistance to the main fungal diseases. As for Seibel 5455, this result is due to the fact that it is a vigorous variety and of great resistance to diseases (RIBAS, 1967).

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According to Shimano; Sentelhas (2013), the occurrence of diseases on plants is resulting from a complex interaction between pathogen, host and environment, and that for an effective control of fungal diseases on American grapes, there is the need to be surveyed and taken into consideration at least the rainfall data, because in more humid regions, there is the requirement of conducting more applications of fungicides.

Maia (2014) verified in 2011 lower severity of leaf spot in grapevines in relation to the 2012 harvest, because in this past year, a good part of the productive cycle of the grapevine occurred in the rainy season, with 510 mm accumulated and relative humidity of approximately 70% during the vegetative cycle.

Thus, in periods of greater rainfall volumes, the continued handling of the plants, even after harvest, becomes essential by the producers. This practice is not always adopted among winegrowers of the region. In the postharvest, the conduction of fertilization to increase the nutritional status and resistance to illnesses can be necessary, as well as maintaining the phytosanitary treatments to delay to the utmost the fall of leaves due to the disease, thus reducing the consequent losses in the next harvest, by the reduced quantity of accumulated reserves when the leaves fall prematurely.

4 CONCLUSION

We conclude that the leaf spots stroke the grapevines in the 2015/2016 harvest, given that all evaluated varieties had symptoms. The BRS Carmem, BRS Rúbea, Concord, Moscato Embrapa and Seibel 5455 were less susceptible to the disease.

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