Relation with weather conditions and airborne spores of *Blumeria graminis* on wheat

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1. INTRODUCTION

The wheat is one of the most important crops around the world and winter wheat are frequently affected by a complex of leaf spotting diseases such as tan spot caused by *Pyrenophora tritici-repentis* (Died.) Drechs., the septoria complex caused by *Zymoseptoria tritici* (Desm.) and *Parastagonospora nodorum* (Berk.), spot blotch caused by *Bipolaris sorokiniana* (Sacc.) and powdery mildew caused by *Blumeria graminis* (DC.) f.sp. *tritici* (MURRAY et al., 2015). The prevalence of leaf spotting pathogens varies with soil-climatic region such as rainfall and high minimum daily temperatures, wheat genotypes, the crop production system, for example conventional or no-till production, and the diversity of crop rotation (FERNANDEZ et al., 2016).

For some pathogens it is important the monitoring of their presence specially those disseminated by the air, because this is one of principal mechanisms the dispersion through the field for many plant pathogens (BROWN; HOVMØLLER, 2002). Sometimes this can be related with the beginning of the development of some epidemics produce by the initial and secondary inoculum in the crop (MORRIS et al., 2013). For example, powdery mildew is wind dispersed and infects volunteers after harvest, and then infects autumn sown crops. Disease cycles can continue during the winter if temperatures are mild and in spring, as the temperature rises and humidity is high, growth increases rapidly and it infects the leaves (WIESE, 1987). Moreover, for *B. graminis* this factor can be important especially in years where the weather conditions are favorable to disease and this can produce damage at initial of growth state. In this case temperatures between 15-22 ºC and humidity of 60 - 100% can produce infection in fields (JORGENSEN, 2016). However, this pathogen germinates best at a high relative humidity (>95%), and temperature between 10 - 22°C. Then if the temperature increase for example 25°C the disease development will decline rapidly (JONES; CLIFFORD, 1983). Despite of this knowledge, there are few substantial analyses of field data to determine what weather factors are associated to the airborne inoculum, and could be used for forecasting.

The objective of this study was related weather conditions and airborne spores of *Blumeria graminis* on winter wheat during the first growth stage GS13 (three leaves) to GS39 (flag leaf).

2. METODOLOGY

Field experiments has been conducted at the Agriculture Center "The Palma", Capão do Leão, RS, Brazil, during the first growth stage GS13 to GS39 since July 2019.

Two cultivars TBIO Audaz (moderately resistant) e TBIO Tibagi (susceptible) to leaf diseases was planted on 800 m^2. In this area four collectors to spore was placed on zig-zag separated for 8 meter each; the design of the instrument was development following PONTES; AMARAL; IGARASHI (2018). In each collector was placed one microscope slide with 5 cm transparent double face adhesive tape and after 7 days was taken and was quantified the number of spores to *B. graminis* under optical miscrocope (400X).

Furthermore, since the growth GS13 was quantified the disease incidence, and the severity was estimated on 10 whole plants using the McFadden Scale MCFADDEN (1991) only in GS39; both were expressed in percentage.

The meteorological conditions data used for analyze was obtain digitally of the EMBRAPA – Meteorology Laboratory (http://agromet.cpact.embrapa.br/).

3. RESULTS AND DISCUSSION

Weather variables could be related to damaging epidemics and disease severity. Those conditions during the growing stage GS13 to GS39 vary in the field. The high temperatures were atypical for this period and was observed during de GS25-GS30, were the highest average temperature was 23,6°C. This could be associated with the increment on the spores during this period. Another factor observed was the changes with the humidity from approximated to 90% to 70%, as a result of that the apparition of the first symptoms on the susceptible cultivars was observed. According to the Figure 1., the number of spores was incremented when the temperature of 15°C reaches the high 23,6°C. These are in broad agreement with previous measurements of the optimal temperature range for powdery mildew between 15 - 22°C (TE BEEST et al., 2008). Since this period the incidence cases on the crop was observed more frequently both cultivars.

Another relationship with disease incidence can be the rain (data not shown). In the South of Brazil this conditions are predominant and it is suggests that the effect of rain on humidity have opposing effects, because heavy rain is often followed by high relative humidity, creating good conditions for powdery mildew, but rain can also wash away spores (JONES; CLIFFORD, 1983; TE BEEST et al., 2008).

Our result suggests that the airborne spores can be reduced after this condition and began to increase the incidence of the disease in this period GS25-GS30. In this way it is important the use of the monitoring systems targeting periods of risk indicated by air-trajectory analysis, knowledge of likely sources, the effect of weather on the biology of spore release and the density of susceptible crops, which can be indicated even by remote sensing.

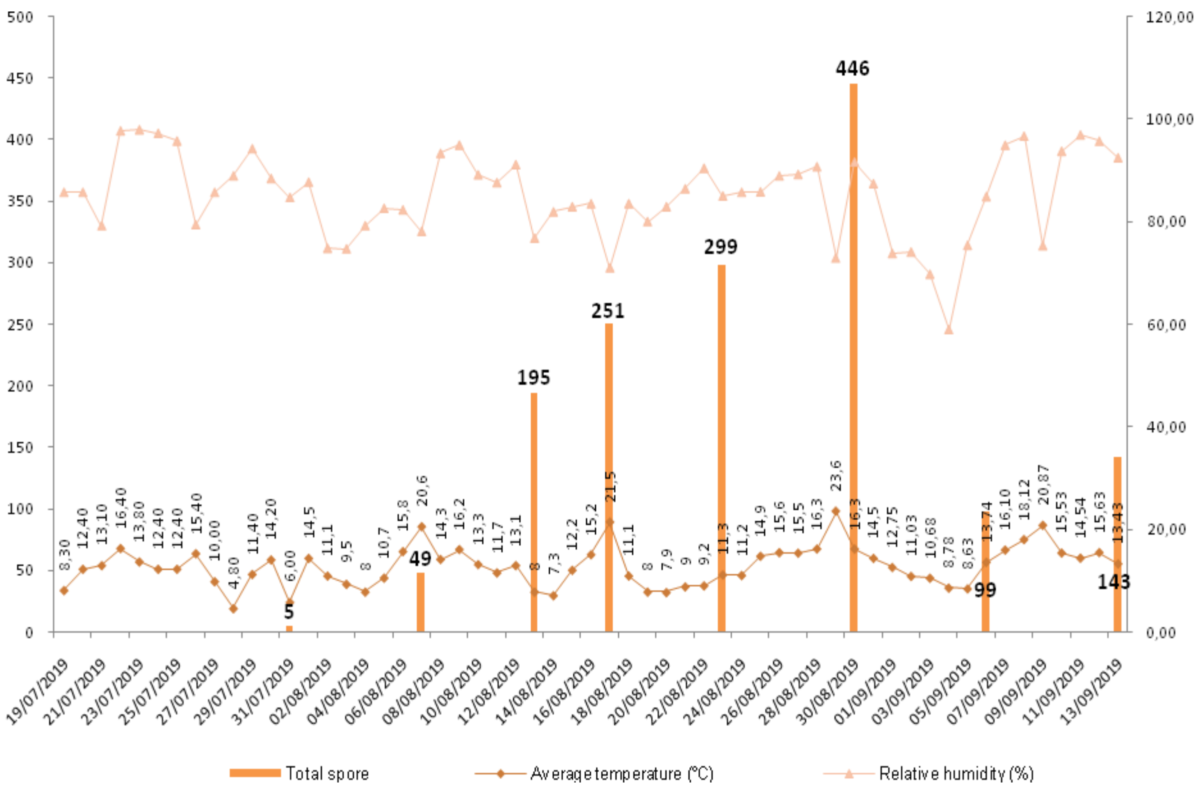

Figure 1. Relation the *Blumeria graminis* spores with average temperature and relative humidity GS13 to GS39.

Clearly, integration with precise diagnostic methods will continue to provide new information about the epidemiology of pathogens and also the occurrence of genetic traits such as fungicide resistance, new pathotypes and disease forecast (KACZMAREK et al., 2014).

4. CONCLUSION

For powdery mildew the relationships identified could be used to develop of models or for disease forecast to guide fungicide treatment decisions during different stage to development of the plant.

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