ENVIRONMENTAL FACTORS AFFECTING THE RELEASE AND DISPERSAL OF PYCNIDIOSPORES AND ASCOSPORES OF *MYCOSPHAERELLA GRAMINICOLA* .

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Introduction

Leaf blotch of wheat, caused by *Mycosphaerella graminicola* is an important wheat disease that produces yield losses in different regions of the world. The dispersal of fungal spores into the atmosphere and it deposition on the host surface at different distances from sources are affecting the epidemiology of Leaf blotch of wheat (Chen and McDonald 1996). Shaw and Royle (1989) showed that *S.tritici* was trapped throughout the autumn and occasionally, during winter and spring. They attribute this infection to ascospores. Brown et al.1978, Sanderson and Hampton 1978 showed that in Australia and New Zealand, ascospores of *M graminicola* rose in autumn to a maximum during winter and then decline in spring. Hunter et al. (1999) demonstrating that ascospores have a tendency to be released throughout the year. Chen and McDonald (1996) suggested that ascospores are the major part of the primary inoculum and the pycnidiospores are playing a role in epidemiology on small spatial scale (1-2m); ascospores probably play a more important role in the population biology and the epidemiology of the diseases on regional scale (10 to 100 of kilometers). Hunter et al. 1999 suggested that airborn ascospore dispersal play a larger role in the epidemiology during the growing season and with splash dispersal spores, both have implications for the forecasting of the disease. Different studies (Cordo et al. 1999, Eriksen and Munk 2002), have confirmed that during spring and the beginning of summer the severity of the epidemic was conditioned by pycnidiospores produced in the crop; for Eriksen and Munk 2002, a few ascopores have a negligible influence on it. The objective of this research was to study the spatial and temporal patterns of discharge and dissemination of *M. graminicola* ascospores and *S.tritici* conidia in a field environment during two years in the wheat-producing areas of Argentina and model relationship between their release and some variables like distance from the dispersal source, rainfall, relative air humidity and air temperature.

Materials and methods

The inoculum level of airborne spores were measured in Julio Hirschhorn Experimental Station in Los Hornos locality during October 1998 to September 1999 and October 1999 to September 2000. Spore traps were used to monitor both ascospores and pycnidiospores when the wheat crop was in the vegetative and debris states. Spore traps were made of PVC capsules containing slides covered with petroleum jelly. The capsules were fixed 0,50m above the soil surface. Glass tubes 0.03m in diameter and 0,16m long were placed near the capsules to catch rain-splashed spores. Samples were taken weekly. Data of pycnidiospores in water, in petroleum jelly (PJ), and ascospores in petroleum jelly (PJ) were recorded. In the first period spore traps were located at different distances (1 and 12m) from an inoculated bread wheat plot 30m long and 10m wide; in the second period distances were: 1, 25 and 50m from the same inoculum sources. The rain-splashed spores, pycnidiospores in PJ and ascospores were counted under microscope observations. Climatic variables (air temperature, relative humidity, rainfall as mm and mm/h) were recorded in Los Hornos locality inside of the Experimental Station. Multiple regression analysis were used to explore the relationship between the number of different spores and the mentioned weather variables registered

3, 7,15 and 30 days before the sampling day. The average number of spores was transformed to arc.sine√x to adjust data to a normal distribution and stabilize the residual variance. A Variance Analysis was performed considering distances and weeks as factors.

Results and Discussions

The ascospores were the predominant sources of inoculum in the field for both periods and they were release from the pseudothecia throughout the year. The multiple regression model using weather variables as independent variables (FIG.1) explained between 16.11 and 40.63% of the variation in the dependent variables (pycnidiospores in water, in PJ and ascospores in PJ). For both periods pycnidiospores in water showed significant differences for weeks and distance (Table 1) as was observes previously (Cordo et al. 1999), confirming the splash dispersion event; for it in PJ there were significant differences for weeks but not for distance; finally, and in coincidence with Mondal et al (2003),Chen and McDonald (1994) ascospores in PJ showed significant differences between distances, . For both periods spore trapping showed a fluctuating pattern of ascospores and pycnidiospores discharge (FIG.2).During the first period ascospores and pycnidiospores in PJ were the predominant number. Pycnidiospores in rain water increased in association with a high rainfall regimen in which intense rains lasting as long as five hours occur without interruption. In coincidence with Shaw (1987) it was possible a uniform catch up of spores to a height of 50cm. As Hunter et al, (1999) mentioned, the number of ascospores trapped increased from early summer of 1998 to early winter of 1999 when the crop stubble period was established in the field. The release of pycnidiospores was associated with the increase of rainfall one week before the date of sampling and the increase of temperature between 15 to 30 days before the same date causing an increase in the amount of pycnidiospores in water and PJ. Related to this Eyal (1971) explained that the alternate cycles of wet and dry on pycnidia in the leaf infected tissues release the cirrhus charged of pycnidiospores. Shaner (1981) demonstrated that pycnidiospores require a long moist period to release and also depends on temperature .This spores in a cirrhus can maintain the viability for 15 days when the temperature increase to 25ºC .Our results confirm that the ascospores release was associated with an increase in the amount of rain frequency (rainfall per hour) (Brown et al. 1978, Mondal et al. 2003), specially with a light rain. Greater numbers of airborne ascospores were associated with longer periods of rains (Shaner 1981, Cordo et. al. 1999). Alternative wetting and drying periods seems to promote maturation of asci (Shaner;1981). As Hunter et al.(1999), in this study ascospores release are also related with a decrease in temperature because this event occur also under low temperatures of the South Cone in autumn and winter. For the second period, the increase of ascospores caught in PJ was detectable when the precipitation decreased 30 days before the date of sampling. It could be explained because they were caught on days without precipitation (Hunter et al 1999, Mondal et al 2003), or when the strong rain was changed to a light rain. Also this event was associated with the increase of the temperature and the rain frequency 30 days before this date as was demonstrated for the first period.

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Leaf blotch of wheat, caused by *Mycosphaerella graminicola* is an important wheat disease that produces yield losses in different regions of the world. The objectives of this study were to examine the relative abundance of *M. graminicola* ascospores and conidia in a field environment throughout a period of two years and establish the relationship between their release and the climatic conditions. This inoculum posses a risk to crop production and may be important to the epidemiology of septoria diseases in the wheat producing areas of Argentina. The inoculum level of airborne spores was measured in Julio Hirschron Experimental Station at Los Hornos locality during October 1998 to September 1999 and October 1999 to September 2000. Spore traps were used to monitor both ascospores and pycnidiospores when the wheat crop was in the vegetative and debris states. Samples were taken weekly. Data of pycnidiospores in water, in petroleum jelly and ascospores in petroleum jelly were recorded. In the first period distance from the sources of inoculum was 1 and 12m and in the second period 1, 25 and 50m. The ascospores were the predominant sources of inoculum in the field for both periods. Pycnidiospores in water, in petroleum jelly and ascospores in petroleum jelly shown significant differences for weeks and distance from the sources. Weather variables such as rainfall, relative humidity, air temperature, and radiation were analysed in relation to the spore dispersal. The multiple regression model using weather variables as independent variables explained between 16.11 and 40.63% of the variation in the dependent variables (pycnidiospores in water, in petroleum jelly and ascospores in petroleum jelly). For the firs period the increase of rainfall, one week before the data of sampling and the increase of temperature between 15 to 30 days before the same data caused an increase in the amount of pycnidiospores in water and petroleum jelly. The ascospore release was associated with a decrease in temperature and relative humidity, and an increase in the amount of rain frequency (rainfall per hour). In the second period de increase of ascospores caught on petroleum jelly was detectable when the precipitation and radiation decrease 30 days before the data of sampling and the temperature and rain frequency events increased 30 days before this date. Ascospore and pycnidiospore numbers declined linealy with horizontal distance from the sources.

The variation of the horizontal dispersal of pycnidiospores of *Septoria tritici* and ascospores of *Mycosphaerella graminicola* has been influenced by the climatic variables throughout the weeks in addition to the disease cycle of the pathogen on the wheat canopy.