

 <p>ISSN NO. 2320-5407</p>	<p>Journal Homepage: -www.journalijar.com</p> <h2>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)</h2> <p>Article DOI:10.21474/IJAR01/4221 DOI URL: http://dx.doi.org/10.21474/IJAR01/4221</p>	 <p>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR) ISSN 2320-5407 Journal homepage: http://www.journalijar.com Journal DOI:10.21474/IJAR01</p>
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RESEARCH ARTICLE

MORPHOLOGICAL CHARACTERIZATION OF *Alternaria padwickii* IN RICE LEAVES (*Oryza sativa* L.) AND ITS PREVALENCE IN THE DEPARTMENTS OF ITAPÚA, MISIONES AND CAAZAPA.

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Manuscript Info

Manuscript History

Received: 18 March 2017
Final Accepted: 21 April 2017
Published: May 2017

Key words:-

Alternaria padwickii (*Trichoconiella padwickii*, rice crop, foliar spot

Abstract

The climatic conditions of continuous rains and high temperatures prevailing during 2014/2015 rice crop season, due to the occurrence of the "Niño phenomenon", were very favorable for the development of fungal diseases in rice cultivation. Among pathogens that attack rice and produce foliar spots, *Alternaria padwickii* (*Trichoconiella padwickii* (Ganguly) Jain) is mentioned. This fungus also affects the grain of rice panicles, affecting the quality and seed germination. In the rice crop season 2014/2015, a high incidence of foliar spots was observed in the rice field. At this situation a phytopathological diagnosis was made in order to detect the occurrence of *A. padwickii* in the crop, to describe the morphological characterization of the fungus and its prevalence in the Departments of Itapúa, Misiones and Caazapá.

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Introduction:-

Rice (*Oryza sativa* L.) is one of the crops that have been increasing gradually in relation to the area destined to the production in Paraguay. In the 2013/2014 rice crop season, 120,000 h were sown (MAG, 2014), increasing to 152,000 h in the 2014/2015 rice crop season, with an approximate production of 800,000 t (INBIO, 2015). The cereal is mainly located in the Departments of Misiones, Itapúa and Caazapá and to a lesser extent in Paraguari, Cordillera and other Departments of Paraguay (MAG, 2008).

The factors that have influenced basically the growth of the national production were based in the application of better technologies and the use of improved varieties (Ramírez, 2009). However, in spite of the increases in yields achieved in recent years, the massive use of these tools and climatic variations contributed to the increase of diseases incidence, especially in the 2015 harvest due to the climatic conditions of continuous rains and high temperatures prevailing during the crop season -Niño phenomenon- (Quintana et al., 2005a; Quintana et al., 2015b).

The fungus *Alternaria padwickii* was first identified in the United States in rice leaves and later in panicles as the cause of grain staining (Mew and González, 2002). This fungus has been recorded worldwide, mainly in rice tropical regions (CAB, 2001).

This fungus mainly affects the grains of the rice paddy, which affects the quality and also the germination when sowing the infected seeds (Ou, 1985; Mew & Misra, 1994; Mew & Gonzales, 2002). In addition, seed incidence rates have been reported from 4% to 74.25% (Gutiérrez et al., 2010; Lovato et al., 2011; Lovato et al., 2013). It is currently one of the main pathogens associated with rice-stained grain and is also the cause of *Alternaria* spot in rice

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is of the on the presence of this fungus associated with foliar rice spot, as well as the frequency of this *Alternaria* species in the main rice production regions of the country. In the year 2015 a high incidence of foliar spots was observed in the field, most of them characterized as oval or circular spots with a yellowish brown center and dark edges. In this situation, a phytopathological diagnosis was carried out to determine the presence of *Alternaria padwickii* associated to leaf spots, morphological characteristics and their prevalence in rice crops planted in the main rice producing regions in the 2014/2015 rice crop season.

Materials and Methods:-

The research was carried out in the laboratory of Microbiology of the Faculty of Sciences and Technology of the National University of Itapúa, Campus Encarnación, Paraguay.

Sample Collection:-

Field monitoring was done between January and April of 2015 year to extract rice plants samples with leaf spot symptoms, located in the Departments of Itapúa, Caazapá and Misiones, totaling 72 samples. These samples were taken at random and placed in paper bags, labeled and transported to the laboratory.

Description of pathogen symptomatology and Isolation:-

A visual description of the symptomatology was done with the samples of the leaves extracted from the different localities. For the isolation of the fungus was used the blotter method (ISTA, 2012). Small pieces of the infected material were surface disinfested with 2% sodium hypochlorite and placed them into Petri dishes (5 samples/plate) containing 3 blotting disks moistened in sterile distilled water and incubated for 8-10 days at room temperature (25°C + 1°C) at 12 hours light/dark regime.

Morphological characterization of fungal structures:-

Fungal structures of taxonomic value, such as mycelial type and color, number of septa and length of conidia, as well as the characteristics of the conidiophores were observed and described. The fungus was identified in its natural substrate by the reproductive structures (conidia) observed with a stereoscopic (20x) and microscope (40x). Identification manuals were used for identification of the species (Ellis, 1992a; Ellis, 1993b; Mew and González 2002; ISTA, 2012).

Analysis of variance and a correlation test was used to determine the frequency of the fungus in the different localities.

Results and Discussion:-

Description of the symptomology of infected leaves:-

Symptoms on leaves were presented as oval-to-circular tanned spots, 3 to 10 mm in diameter, which then became grayer to white with a narrow dark brown border.

Morphological characterization of the fungus *A. padwickii*:-

Samples examined on blotting paper with the help of the stereoscope show the growth habit of the fungus as conidia that grow solitary in short conidiophores arising directly from the substrate or in conidiophores between soft fluffy white mycelia.

The conidium at the beginning are sub hyaline and later acquires a straw to brown color, darker than the mycelium with a prominent appendix. Observations under the microscope (40x) show conidia (3-5 septa), often constricted in the celled with conical basal cells and long peaks (95-170 µm × 11-20 µm) (Fig. 1). These morphological

characteristics coincide with that described for *A. padwickii* by Ou (1985), Ellis (1992a), Ellis (1993b), Mew and González (2002), ISTA (2012).



Fig.1:-Conidia of the fungus *Alternaria padwickii* (40x)

Prevalence of *Alternaria padwickii* in three rice producing regions:-

The fungus was found in the three localities evaluated in the 2014/2015 rice crop season, Departments of Itapúa, Misiones and Caazapá (Fig.2).

The means presented significant differences in the analysis of variance; statistically the presence of *A. padwickii* in the department of Itapúa was superior to the Department of Caazapá but similar to the average of Misiones. Likewise, the averages of departments of Caazapá and Misiones were similar to each other.

The correlation of the presence of *A. padwickii* in the three departments evaluated in this study was high (0.96), showing that this species of *Alternaria* has a high occurrence in the main rice producing regions in Paraguay.

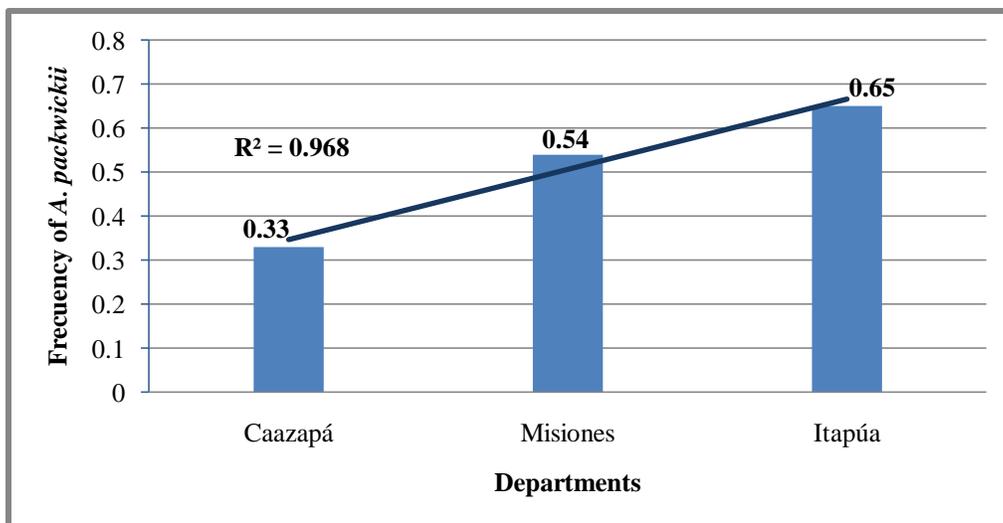


Fig.2:- Frequency of *A. padwickii* in three departments.

Gutiérrez (2010), Gutiérrez et al. (2010) mention this fungus as one of the main pathogens causing rice leaf spot at several districts of the province of Corrientes, Argentina.

Viedma (2010) reported that *A. padwickii* was present with an average incidence of 18% on seed collected from the departments of Itapúa, Misiones and Caazapá. Quintana (2013) also reports the presence of this fungus in seed of four rice cultivars of different districts of the mentioned departments. This indicates that the seed contaminated with this fungus could constitute the main source of inoculum for the development of leaf spot of *Alternaria* on rice crop in Paraguay.

Conclusion:-

The morphological characteristics of the fungus isolated in rice leaves from the Departments of Itapúa, Misiones and Caazapá in Paraguay correspond to the species of *Alternaria padwickii*, associated with rice foliar spots.

The correlation of the presence of *A. padwickii* in the three departments was high (0.96), which indicate that this species of *Alternaria* is presents frequently in the main rice producing regions of Paraguay.

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