



## Presence of orange rust on sugarcane in the state of Pernambuco, Brazil

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### ABSTRACT

Sugarcane leaf rust symptoms were observed on seven month-old plants in March 2012 at Santa Teresa Farm, north coast of Pernambuco, Brazil. Plants were identified as a genotype coded as RBUFRPE0032 developed by the Sugarcane Breeding Program of Universidade Federal Rural de Pernambuco (UFRPE/EECAC). Evaluations under field conditions showed characteristic leaf rust symptoms and high severity. Analysis of symptomatic leaves under the optical microscope at the Plant Pathology Laboratory of UFRPE/EECAC confirmed the presence of fungal urediniospores showing specific characteristics of the fungus. Molecular evaluation by real-time PCR yielded positive results for *Puccinia kuenhii*. This is the first report of sugarcane leaf rust in Pernambuco. Although the disease has been reported in other Brazilian states, producers and researchers are worried since the behavior of promising commercial varieties and clones from breeding programs directed at the soil and climatic conditions of the state is unknown. The Ministry of Agriculture in Pernambuco was officially informed for notification purposes.

**Key words:** *Puccinia kuenhii*, *Saccharum*, epidemiology, plant protection

The worldwide concern for the adoption of clean energy techniques has caused an expansion of sugarcane growing areas for ethanol production in Brazil, contributing to the country's leadership in the world ranking of sugarcane producers with more than 9 million hectares cultivated with the crop (IBGE, 2012). Because of Brazil's continental dimensions, investigators routinely screen sugarcane genotypes for greater adaptability and stability under specific regional conditions, rather than to more general features such as pest and disease resistance.

Historically, orange rust caused by *Puccinia kuenhii* E. J. Butler has occurred in sugarcane producing countries of Asia since the 1890's (Ryan and Egan, 1989). This disease was considered secondary in Australia up to the end of the 1990's, when it became epidemic on the variety Q124 which was then grown over large areas, resulting in high economic losses for the sugar/ethanol industries of that country (Magarey et al., 2001). Subsequently, the disease was reported in Florida (Comstock et al., 2008), Guatemala (Ovalle et al., 2008), Mexico, El Salvador and Panama (Flores et al., 2009), Cuba (Pérez-Vicente et al., 2009), Costa Rica and Nicaragua (Chavarría et al., 2009) and in Colombia (Cadavid et al., 2012), reducing agricultural productivity of susceptible sugarcane genotypes (Zhao et al., 2011).

In Brazil, the disease was initially reported in sugarcane fields of São Paulo and Paraná states (Barbasso et al., 2010) attracting the attention of infestigators worldwide due to its aggressiveness and fast dissemination (Infante et al., 2009). Up to 2010, orange rust had been reported in the states of Minas Gerais, Goiás, Espírito Santo, Mato Grosso do Sul and Rio de Janeiro (Ferrari et al., 2010). In 2012, the disease was reported in Northeastern Brazil in the state of Rio Grande do Norte (Cruz et al., 2012).

In anticipation of the arrival of orange rust in Brazilian sugarcane fields, the Rede Interuniversitária para o Desenvolvimento do Setor Sucroalcooleiro ("Interuniversity Network for The Sugar/Ethanol Industries", RIDESA), which integrates sugarcane breeding programs of all Federal universities in the country, had been sending commercial varieties and promising genotypes for countries where the disease was taking place, so they could be planted and evaluated for orange rust resistance. With the arrival of orange rust in São Paulo, the behavior of these materials under the soil and climate conditions of northeastern Brazil became especially relevant.

The main concern relates to RB72454, a parental of RB867515 (extensively planted throughout the country) which showed high susceptibility when planted in other countries (Magarey, 2007), although subsequent studies

demonstrated resistance of RB867515 in areas affected by the disease both within and outside Brazil. The most susceptible varieties reported in Brazilian sugarcane fields, especially in São Paulo and Paraná, are RB72454, SP89-1115 and SP84-2025 (MAPA, 2010), whereas RB855156 and SP81-3250 are less susceptible and present lower disease severity. According to Hoffmann et al. (2010), 25.3 % of the sugarcane growing area in Brazil is cultivated with genotypes with a response similar to RB867515.

Since growing susceptible varieties under favorable conditions for disease development should be avoided (Martins, 2010), the increase in use of *P. kuenhii* resistant genotypes may affect genotype resistance due to the pathogen's variability (Magarey et al., 2001). Occurrence of rain associated with high relative humidity and high summer temperatures, as well as frequent shifts in heat and cold temperatures during autumn (Ovalle et al., 2009; Magarey, 2000) are favorable conditions for disease development. Use of resistant varieties, chemical and cultural control (Huang, 2004; Flores, 2009) are the most frequently used techniques for orange rust management. However, genotype response and the plant age are the conditions that mostly affect disease progress in field. In highly susceptible varieties disease breaks out in four to five months (Minchio et al., 2011).

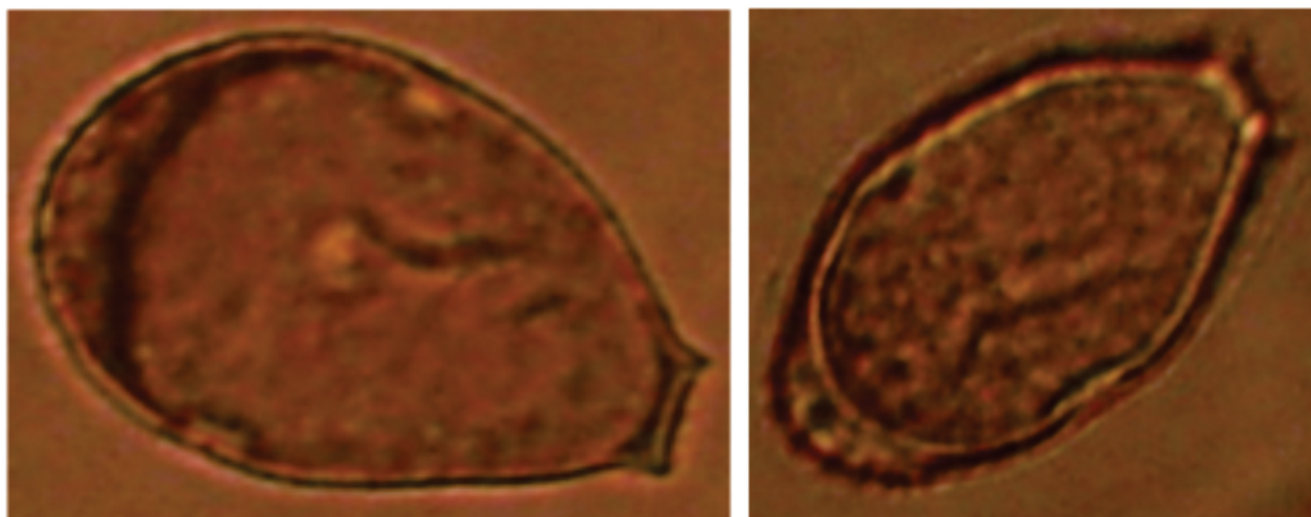
Aware of the economic losses resulting from orange rust spreading to Pernambuco, the sugarcane breeding program of the Universidade Federal Rural de Pernambuco/ Estação Experimental de Cana-de-açúcar do Carpina (PMGCA/UFRPE/EECAC) was alert to *P. kuenhii* detection

in sugarcane fields. In March 2012, when monitoring experimental fields in Santa Teresa Factory - Purgatory Farm, Goiana, Pernambuco (07°45'49"S and 35°05'35"W), typical symptoms of orange rust were observed on seven month-old plants of the genotype RBUFRPE0032. This genotype was present in a field of competition varieties, along with sixteen other promising genotypes developed by the breeding program of PMGCA/UFRPE/EECAC. Disease severity evaluation on +3 leaf using a diagrammatic scale (Amorim et al., 1986) characterized susceptibility to the disease. Chlorotic spots in the leaves progressed to exposing spores lesions. Grouped orange rust pustules were ordinarily found in the middle third and bottom of the leaves (Figure 1), a specific characteristic of *P. kuenhii* in sugarcane, also described by Martins (2010) and Glynn et al. (2010). According to Glynn et al. (2010), these symptoms distinguish *P. kuenhii* from *Puccinia melanocephala*, reported in Pernambuco since the 1980s and quite common in sugarcane fields in northeastern Brazil.

Symptomatic leaves were collected and taken to the Plant Pathology Laboratory of the Sugarcane Experimental Station. Characterization of fungal structures under the optical microscope showed yellowish to light brown ovoid spores presenting equatorial pores and thicker wall at the apical region, reaching 11.5 micrometers (Figure 2), characteristic features of *P. kuenhii* described by Hsieh & Fang (1983) and by Cruz et al. (2012) when diagnosing this disease in Rio Grande do Norte state. A detailed official document reporting the event was sent to Superintendence of the Agriculture Department of Pernambuco for notification



**FIGURE 1** - Symptoms of orange rust (*Puccinia kuenhii*) in sugarcane leaves of the RBUFRPE0032 genotype. Leaf rust pustules present in the middle third and bottom of the leaves, observed in the experimental field in Goiana, PE, March 2012.



**FIGURE 2** - Urediniospores of *Puccinia kuenhii* collected from leaves of sugarcane plants grown in Goiana, PE, observed in the optical microscope showing equatorial pores and wall thickening in the anterior region.

of orange rust arrival in the state of Pernambuco. Supported by State and Federal agencies, a real-time PCR assay was developed using primers PK2-F/PK2-R and probe PK2-P, from DNA extracted from sugarcane symptomatic leaf samples. Some of the material was sent a commercial diagnostics laboratory for diagnosis of the problem in plants. The Plant Health Diagnostic Laud 10580/2012 originated from those agencies concluded there was 98% coverage of *Puccinia kuenhii* sequences, characterizing a positive response for *Puccinia kuenhii*.

The presence of orange rust in the state of Pernambuco demonstrates that this disease is rapidly spreading in Brazilian sugarcane fields.

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