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Technical Note

Comparative morphology between uredospores of species of agricultural importance

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Abstract

The knowlegde of phytopatogens is of extrema importance for activities linked to agriculture. The objective of this study was to gather more information from rust uredospore for easy identification. Uredospores of some rust species of agricultural importance were collected in the Farm School - UEL, analyzed and photographed in order to describe their morphology when compared using the optical microscope. It was observed variation in size of the spores of different species and also within the same species. The length, width, the length/width ratio and the coloration are very important in the identification of rusts.

Keywords: Uredinales, plant pathology, optical microscopy, *Phakopsora pachyrhizi*.

Morfologia comparativa entre uredósporos de espécies de ferrugens de importância agrícola

Resumo

O conhecimento sobre os fitopatógenos é de grande importância para as atividades associadas com a agricultura. O objetivo do trabalho foi reunir um maior número de informações morfológicas de uredósporos de ferrugens para facilitar sua identificação. Uredósporos de algumas espécies de ferrugens de importância agrícola foram coletados na Fazenda Escola - UEL, analisados e fotografados, com a finalidade de descrever sua morfologia quando comparadas ao microscópio ótico. Foi verificada variação na dimensão dos esporos de diferentes espécies e também dentro da mesma espécie. O comprimento, a largura, a relação comprimento/largura e a coloração se mostraram parâmetros importantes na identificação de ferrugens.

Palavras-chave: uredinales, fitopatógenos, microscopia óptica, *Phakopsora pachyrhizi*.

Morfología comparativa entre uredosporos de especies de roya de importancia agrícola

Resumen

El conocimiento de los fitopatógenos es de gran importancia para las actividades asociadas con la agricultura. El objetivo de este estudio fue recopilar un mayor número de informaciones morfológicas de uredosporos de las royas para facilitar su identificación. Se han recogido Uredosporos de algunas especies de royas de importancia agrícola en la hacienda Escuela - UEL, analizados y fotografiados, con el fin de describir su morfología en comparación con el microscopio óptico. Se observaron cambios en el tamaño de las esporas de diferentes especies y también dentro de la misma especie. La longitud, la anchura, la relación longitud / anchura y el color se mostrarán como parámetros importantes en la identificación de royas.

Palabras clave: Uredinales, fitopatógenos, microscopia óptica, *Phakopsora pachyrhizi*.

Introduction

The knowledge about pathogens is important for anyone who is associated with agriculture. Belonging to the order Uredinales, rusts are among the most widespread fungal pathogens in agricultural environment, affecting most of the crops in Brazil. Their damage can be very severe, causing yield losses of 70% in soybeans, 66.5% and 79.5% in wheat in white oat (YORINORI et al., 2005; RODRIGUES et al., 2002; KEYS et al. 2002).

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The fungi causer of the rusts is an obligatory parasite with high relation of specificity to their hosts, being recognized by the world, with around 120 genera of holomorphical rusts and 13 anamorphic (CUMMINS et al., 2003). In Brazil are reported around 800 species of rusts, inserted into 56 holomorphical genera and 9 anamorphic genera (HENNENet al., 2005).

Considering the importance that rusts represent for commercial crops in Brazil, the aim of the study was to gather information about morphological characteristics of the uredospore of rusts to facilitate and accelerate the identification of their species.

Material and Methods

Samples were collected of rust spores found in the Farm School, State University of Londrina, in 2011. After preliminary identification of pathogens and their hosts, the analysis was carried out in shoots of the plant, looking up for signs and symptoms of the pathogen. The rusts were recognized by morphological characters of the symptoms caused in their hosts and signs of the pathogen in the host, and compared with information from the specialized literature in order Uredinales, described by HENNEN et al. (2005).

To observe the spores of the rust was used the "CX41RF" Olympus microscope coupled to Digital video camera "Moticam 2300". Images were captured with 400 times of increase and measured the length, width and length / width ratio (L / W), with the aid of the program Motic Images Plus 2.0. Therefore, 50 spores of each pathogen were chosen randomly in the images captured by the camera.

The data obtained by the measurement of spores were analyzed by parameters of the descriptive statistics (minimum, maximum, mean and coefficient of variation).

We collected 4 species of rusts, described below with their scientific names, signs and symptoms, hosts and morphological characteristics of the spore. The characteristics of the uredospore presented are the shape, color, size (length and width) and the length / width ratio (L / W).

1. Leaf rust of oat - *Puccinia coronata* Corda, Icon. fung. (Prague) 1: 6 (1837).

Signs and Symptoms: Pustules of yellow-bright coloration containing masses of uredospore, which are exposed after skin rupture (CHAVES et al. 2005).

Infected Plant Species: Oat (*Avena sativa* Linnaeus).

Morphological characteristics of spores: predominant form ellipsoid to globose of dark orange color (Figure 1 - 2), measures of width x length ranged from 25-34 (7.49%) x 22-26 (3.83%) µm (average 28.5 x 23.9 µm), with the L / W ratio of 1, 19:1 (9.62%).

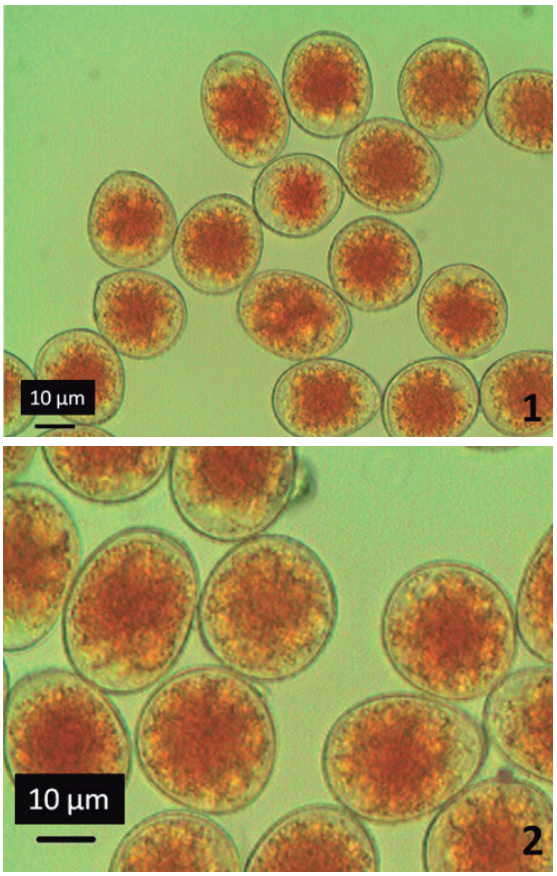


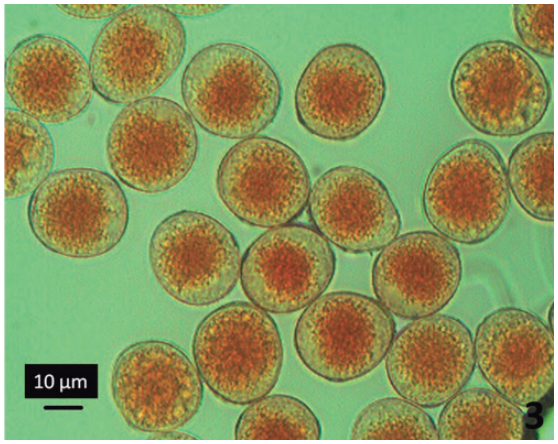
Figure 1-2. Uredospores of *Puccinia coronata*

2. Leaf rust of wheat - *Puccinia triticina Erikss.*, Annls Sci Nat, Bot., Ser. 8 9: 270 (1899).

Symptoms and Signs: The uredias usually appear on the upper surface of the leaf, with reddish-brown coloration and oval shape, and cause disruption of the epidermis. (PIRES, 2007).

Infected Plant Species: Wheat (*Triticum aestivum Linnaeus*).

Morphological characteristics of the spores: predominant form ellipsoid of orange-red color (Figure 3 - 4), measurements of width x length ranged from 23-34 (7.97%) x 20-26 (5.35%) µm (average of 27.49 x 24.09 µm) with the L / W ratio of 1.14:1 (9.16%).



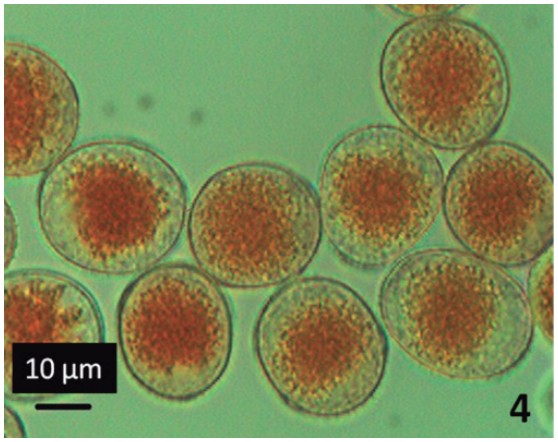


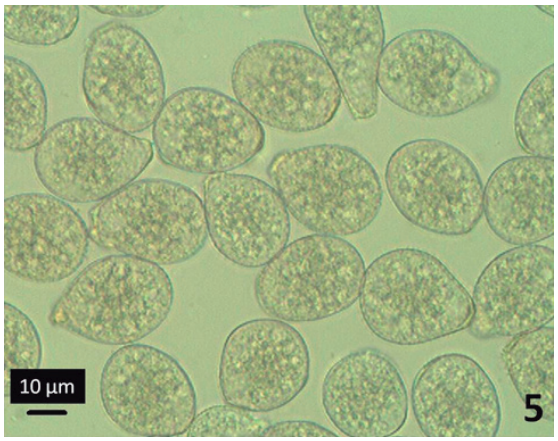
Figure 3-4. Uredospores of *Puccinia triticina*.

3. Asian rust of soybean - *Phakopsora pachyrhiziSyd. & P. Syd.,* Annls Mycol. 12 (2): 108 (1914).

Symptoms and Signs: Uredias initially gray-green, progressing to dark brown and reddish brown, globose and with abundant sporulation (UGALDE, 2005).

Infected Plant Species: Soybean (*Glicine max* Linnaeus).

Morphological Characteristics of the spores: predominant form ovoid to ellipsoidal, hyaline color to yellow-brownish (Figures 5 - 6), measures of width x length ranged from 25-39 (9.29%) x 19-26 (5.53%) µm (average of 31.76 x 22.9 µm), with the L / W ratio of 1.39:1 (11.8%).



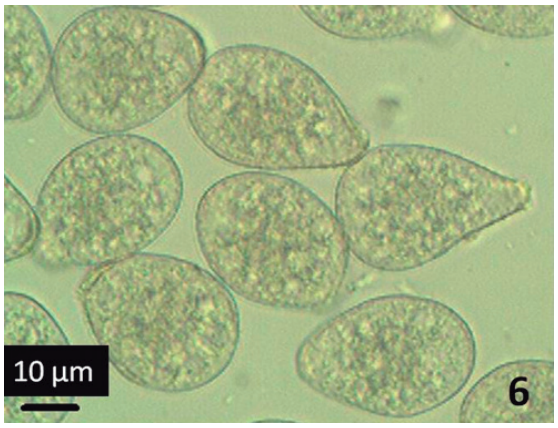


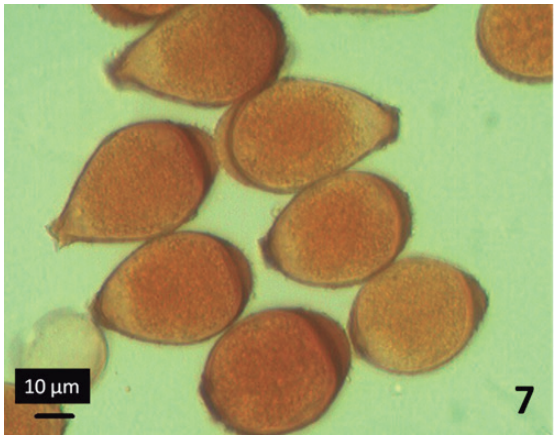
Figure 5-6. Uredospores of *Phakopsora pachyrhizi*.

4. Orange rust of sugar cane - *Puccinia kuehnii* (W. Krüger) EJ Butler, Annls mycol. 12 (2): 82 (1914).

Symptoms and Signs: The lesions formed are broken, forming the uredias or pustules of light orange coloration, usually shorter and oval when compared with the brown rust of the sugar cane (MARTINS, 2010).

Infected Plant Species: Sugar Cane (*Saccharum officinarum* Linnaeus).

Morphological Characteristics of the spores: predominant form ellipsoidal to ovoid of yellow to brown color (Figure 7 - 8), measures of width x length ranged from 34-59 (13.56%) x 23-34 (7.61%) µm (average of 43.94 x 29.97 µm) with the L / W ratio of 1.48:1 (18.38%).



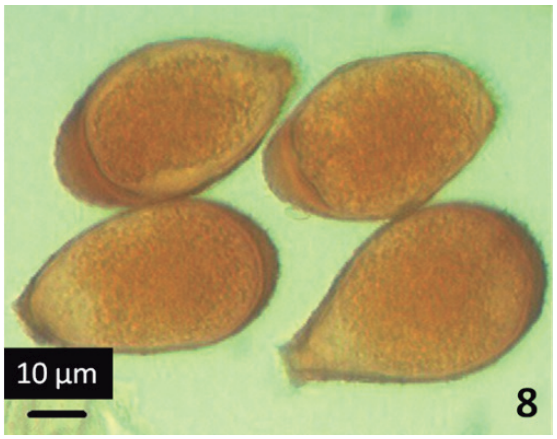


Figura 7-8. Uredospores of *Puccinia kuehnii*.

Results and Discussion

According to the data presented in Table 1, it appears that the uredospore of rusts have dimensions (width x length) varied. When observing the coefficient of variation (CV %), is noticed that even within the same species there is variation both in length as for width of spores, most evident in *P. kuehnii*.

An important characteristic in the identification of rust spore is the coloration. The uredospore *P. coronata* and *P. triticina* have similar dimensions and may be varied by coloration more reddish of the second kind, as seen in Figures 1, 2, 3 and 4.

The length / width ratio (L / W) shows us that the closer to the 1 factor, the greater proportionality exists between the length and width of the spore, which is more globular and uniform. *P. coronata* and *P. triticina* were the species that came closest to the factor 1. The reverse is also true, where the spores that are more distant from the L / W ratio, have an ovoid to ellipsoidal form, with a smaller proportionality between the length and width. The spores that had values more distant of the factor 1 were the species *P.pachyrhizi* and *P. kuehnii*.

The data are in agreement with CUMMINS et al. (2003) and HENNEN et al. (2005), which shows that the different genera and species of fungi present given similarity, being necessary to deepen knowledge in order to identify their differences with greater agility and precision.

Table 1. - Length, width and length / width ratio of the pathogens collected (*Puccinia coronata*, *Puccinia triticina*; *Phakopsora pachyrhizi*; *Puccinia kuehnii*).

		P. coronata	P. triticina	P. pachyrhizi	P. kuehnii
Length	Average (µm)	28.50	27.49	31.76	43.94
	min (µm)	24.50	22.85	25.36	33.98
	max (µm)	34.33	34.35	38.80	59.22
	CV (%)	7.49	7.97	9.29	13.56
Width	Average (µm)	23.99	24.09	22.90	29.97
	min (µm)	22.38	20.25	18.64	23.37
	max (µm)	26.16	26.30	25.60	34.02
	CV (%)	3.83	5.35	5.53	7.61
L/W Ratio	Average (µm)	1.190	1.143	1.392	1.480
	min (µm)	1.014	1.005	1.045	1.078
	max (µm)	1.480	1.500	1.895	2.534
	CV (%)	9.62	9.16	11.80	18.38

Conclusions

The characteristics length, width, length / width ratio and coloration of the uredospore species of agricultural importance, are essential for species identification, seen that some rusts present great similarity.

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