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First detection of tomato powdery mildew caused by *Oidium neolycopersici* in South Africa

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ABSTRACT

Oidium neolycopersici has a world-wide distribution causing severe epidemics mainly on greenhouse tomatoes. Currently, only *Leveillula taurica* has been reported on tomato from South Africa. However, another powdery mildew species on tomato was found recently. Based on morphological comparison and molecular analysis, its identity was confirmed as *O. neolycopersici*. The possible means of introduction and other aspects of this finding are discussed.

1. Introduction

Powdery mildew infections caused by *Oidium neolycopersici* L. Kiss have become a problem in tomato (*Solanum lycopersicum* L.) production from the late 1980s in many parts of the world (Kiss et al., 2001; Lebeda et al., 2014). Early after the appearance and rapid spread of the disease in Europe and North America (Kiss et al., 2005), breeding programs have been started because all the commercial tomato cultivars were susceptible to *O. neolycopersici* at that time (Lebeda et al., 2014; Seifi et al., 2014). Wild relatives of tomato were used as valuable sources of resistance (e.g., Lebeda et al., 2014) and the cytological and molecular background of powdery mildew resistance was also deciphered in *Solanum* spp. (e.g., Seifi et al., 2014). The biology, host range and sporulation mechanisms of the pathogen were studied in detail, as well (e.g., Mieslerová et al., 2004; Jankovics et al., 2008).

In Africa, this fungus was not a cause of concern so far; the pathogen was only reported once from Tanzania (Kiss et al., 2001) without being associated with economic loss. In a comprehensive book on the phytopathogenic fungi from South Africa, the occurrence of this pathogen is not reported (Crous et al., 2000). However, during early autumn 2013, symptoms typical of epiphytic powdery mildew infections were detected for the first time on tomato planted in fields as well as in tunnels in South Africa. The symptoms were very different from those caused by *Leveillula taurica*, a hemi-endophytic powdery mildew damaging tomatoes and many other crops (Braun and Cook, 2012). The occurrence of at least two different powdery mildew species on tomatoes in South Africa was briefly mentioned recently (Kerr, 2013).

The main objective of this study was to precisely identify the causal agent of these infections; in addition to *O. neolycopersici*, another powdery mildew, *O. lycopersici*, is also known to cause similar symptoms on tomatoes (Kiss et al., 2001). The presence of other powdery mildew fungi on the diseased tomatoes was also taken into consideration.

2. Materials and methods

2.1. Infected plant materials

Leaves and stems infected with powdery mildew were collected from tomato (*Solanum lycopersicum* L.) plants (unknown cvs. grown in field and in the tunnel) in April 2013 in Gauteng Province, South Africa. Material was collected by Prof. A. Lebeda and deposited in the herbarium of the Department of Botany, Palacký University, Olomouc, Czech Republic. To prevent the unwanted spread of the plant pathogenic fungi, the powdery mildew-infected plant samples were pressed and

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dried in South Africa and transported and used as herbarium specimens in the subsequent study. A detailed morphological and DNA-based study of these specimens was carried out in a Czech laboratory and a Hungarian laboratory.

2.2. Light microscopy studies

To determine the morphological characters of the hyphae, hyphal appressoria, conidiophores and conidia of the specimens, dried leaves and stems of the diseased plants were first rehydrated by boiling small pieces of the infected plant material in a drop of lactic acid on a microscope slide as described by Shin and La (1993). After boiling, the rehydrated mycelium was scraped off the leaf and mounted either in lactic acid or in cotton blue in lactic acid for light microscopy. The following morphological characters were determined: shape and position of hyphal appressoria, size and shape of conidia, characteristics of the conidiophores (e.g. type of conidiogenesis), size and shape of the foot cells and position of the basal septum.

For each characteristic 50 measurements were obtained if possible, and results were reported as mean ± SD (standard deviation) and range min–max. No subsequent statistical analysis was done. Descriptive statistics was performed using NCSS 2000 (Statistical Solutions Ltd., Cork, Ireland).

2.3. DNA extraction and PCR amplification and sequencing of the rDNA ITS sequences

Dried powdery mildew mycelia were scraped off the herbarium specimens using sterile razor blades, collected in Eppendorf tubes, and stored at −18 °C until whole-cell DNA was extracted from them using a Qiagen DNeasy Plant Mini Kit (Qiagen GmbH, Hilden, Germany). The internal transcribed spacer (ITS) region of the fungal ribosomal DNA

Fig. 1. Symptoms of infection of *O. neolycopersici* on herbarized tomato leaf (Origin: Gauteng Province, South Africa).