
The anamorphic state of *Leveillula taurica* recorded on *Cleome spinosa* in north-eastern Brazil

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The anamorphic state of *Leveillula taurica* was found causing a powdery mildew disease on *Cleome spinosa* in north-eastern Brazil. Its chasmothecial state was not observed on the collected samples. The fungus is illustrated and described. This report represents the first record of this fungus on *Cleome spinosa* in Brazil.

Key words – Erysiphales – *Oidiopsis* – powdery mildew – spiny spiderflower

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Introduction

The genus *Cleome* L. belongs to Cleomaceae (Capparaceae s.l.) and has approximately 250 species; most are adapted to seasonal drought. Several species are used as medicinal or ornamental, while a few are regarded as weeds (Mabberley 2008). *Cleome spinosa* Jacq., popularly known as spiny spider-flower could be included in the last category. In semiarid regions of north-eastern Brazil, where drought is quite frequent, this plant is widespread, but occurs mainly near humid lowlands (Lorenzi 2000).

In December of 2010 scattered plants of *C. spinosa* with a white powdery mass covering its leaves were observed in the experimental field of the Embrapa Algodão (Brazilian Center of Cotton Research) in Paraíba State. A sample was collected and examined under a microscope revealing the presence of a fungus that was identified as belonging to the genus *Oidiopsis* Scalia, the anamorphic state of *Leveillula* G. Arnaud. After that, during field trips in 2011 and 2012 plants of *C. spinosa* showing the same white

powdery mass were observed in several new locations through Paraíba State. New samples were collected and after a microscopic examination a fungus with similar morphology of that previously identified as *Oidiopsis* was observed. There are several erysiphaceous fungi recorded on the genus *Cleome*, but only two belonging to *Leveillula*, viz. *L. taurica* (Lév.) G. Arnaud (Farr & Rossman 2012) and *L. cleomes* Simonyan & V.P. Heluta (Simonyan & Heluta 1989). The aim of this study was describe the morphology and identify the species of the powdery mildew fungus occurring on *C. spinosa* in north-eastern Brazil.

Methods

Examined samples

Leaves of *Cleome spinosa* covered with a white powdery mass were collected from the municipalities of Campina Grande (December 2010, January 2012), Juazeirinho (December 2011) and Pombal (December 2011) in Paraíba State, north-eastern Brazil. The samples were

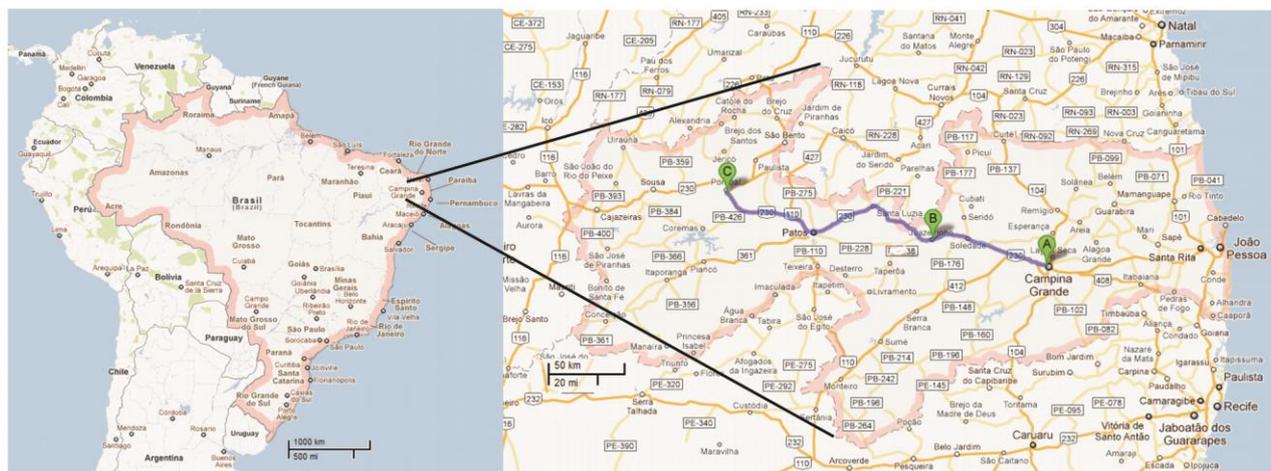


Fig. 1 – Map of Brazil with Paraíba State enlarged showing the three localities where samples were collected. **A** Campina Grande. **B** Juazeirinho. **C** Pombal. (Images from Google Maps®)

dried in a plant press and later examined under a stereomicroscope. Representative material of each of the examined samples was deposited in the Herbarium of the ‘Universidade Federal de Viçosa’ (Herbarium VIC).

Morphological studies

To identify the powdery mildew fungus microscope slides were prepared by free-hand section, scraping the colonies with a scalpel, and also by using an adhesive tape. Lactic acid, lacto-fuchsin and water were used as mounting media. The microscope slides were prepared from fresh and dried specimens and gently warmed. Measurements were made at a magnification of 1000 X using an Olympus microscope.

Results

Five samples, three from Campina Grande (VIC 31815; VIC 31816; VIC 31819), one from Juazeirinho (VIC 31818) and one from Pombal (VIC 31817), all in Paraíba State, in north-eastern Brazil (Fig. 1), were collected showing similar symptoms (Fig. 2). The disease is characterized by amphigenous white powdery colonies, initially as small circular to irregular colonies, becoming somewhat vein-delimited and later usually covering the entire leaf blade, mainly on the lower surface. Mycelium hemi-endophytic; internal mycelium tortuous, ca 2–5 μm diam., hyaline, reaching the palisade parenchyma and bearing globose to mulberry-like haustoria; superficial mycelium hyaline, 5–7.5 μm diam., flexuous, bearing branched coral-like appressoria;

conidiophores originate from the internal mycelium, emerging singly or in bundles through the stomata; straight to slightly flexuous, usually ramified, mostly with 1-septum near the base and 2–3-septa at the distal end, 5–7 μm diam. near the base, up to 300 μm long, hyaline; conidia dimorphic; primary conidia lanceolate, hyaline, (51–)60–68(–75) \times (11–)13–15.5 μm , l/w ratio 3.5–5.4; secondary conidia subcylindrical to slightly clavate, hyaline, (41–)50–60(–68) \times (11–)13–15(–17) μm , l/w ratio 2.9–5.8, apex usually rounded, base somewhat truncate; germination, on natural substrata, usually at basal end with or without appressoria formation (Fig. 2).

Discussion

Two *Leveillula* species are known from *Cleome spinosa* (viz. *L. taurica* and *L. cleomes*) Based in the morphological and biometric description the fungus collected in north-eastern Brazil was identified as the anamorphic stage of *Leveillula taurica* [= *Oidiopsis haplophyllii* (H. Magn.) Rulamort]. The main distinctions between our specimens and *L. cleomes* are the slender conidia and bigger l/w ratio. *L. cleomes* has primary and secondary conidia varying from 48–79 \times 14–21 μm and 51–70 \times 13–21 μm , with l/w ratio 2.6–4.5 and 2.7–4.8, respectively. Our samples have somewhat narrower primary and secondary conidia varying from 51–79 \times 11–15.5 μm and 41–68 \times 11–17 μm , with a larger l/w ratio of 3.5–5.4 and 2.9–5.8, respectively. On the other hand, *L. taurica* has conidia varying from 30–80 \times 12–22 μm , with l/w ratio

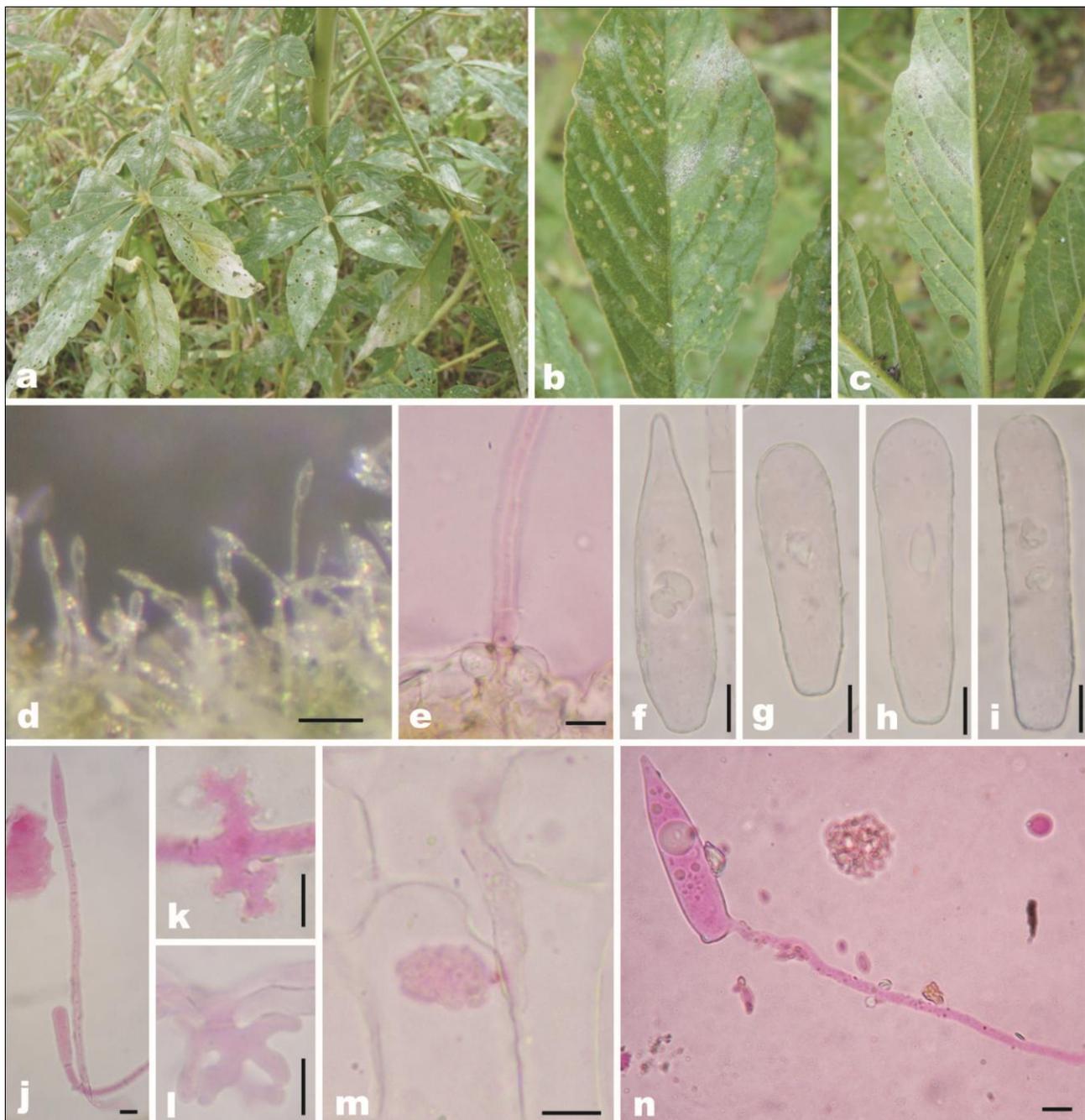


Fig. 2 – *Leveillula taurica* on *Cleome spinosa*. **a, b, c** Symptoms on leaves. **d** Conidia and conidiophores. **e** Detail of a conidiophore arising through a stoma. **f** Primary conidium. **g, h, i** Secondary conidia. **j** Conidiophore with a young conidium. **k, l** Branched, coral-like appressoria. **m** Mulberry-like haustorium. **n** A primary conidium germinating at base without appressorium formation – Bars = 10 μm , except in **d** = 100 μm .

2.5–4.5 (Braun 1987). Additionally *L. taurica* is a polyphagous pathogen occurring on more than 100 genera of host plants, with a worldwide distribution while *L. cleomes* is known only from the type collection from Armenia (Simonyan & Heluta 1989). *L. taurica* has been recorded on *C. spinosa* in Europe and Africa (Farr & Rossman 2012), and also on *C. hassleriana* in North America

(Sampangi et al. 2007). Several papers have been published recently on the taxonomic status of species within the genus *Leveillula*, especially *L. taurica*, using molecular tools (Khodaparast et al. 2001, 2002, 2007, 2011) and some new species have been segregated from *L. taurica* s.l. However, its taxonomical status remains controversial. In view of this, and the fact that the size of the conidia of *L.*

taurica on different host plants as well as on a single host is extremely variable (Braun 1980), we decided to adopt a conservative point of view about our specimens.

This record represents the first report of *L. taurica* on *C. spinosa* in Brazil and also for the American continent. *Cleome spinosa* has no commercial interest in Brazil, but is usually regarded a weed; this host has a wide distribution throughout the country and it may be a reservoir of this pathogen for a diverse range of crops.

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