

First report of *Oidium heliotropii-indici* on *Heliotropium indicum* from Brazil

D. J. Soares

Embrapa Algodão, Rua Oswaldo Cruz, 1143 Centenário, 58428-095 Campina Grande, PB, Brazil.

Email: dartjs@yahoo.com.br

Abstract. A powdery mildew fungus belonging to the genus *Oidium* subgen. *Fibroidium* was found on *Heliotropium indicum* in north-east Brazil. This fungus was identified as *Oidium heliotropii-indici* and is described for the first time on this host from Brazil.

Heliotropium indicum L. is an herbaceous plant popularly known as Indian heliotrope that has a pantropical distribution and is usually regarded as a weed. Although widely spread throughout Brazil (Melo and Sales 2004; Melo and Semir 2008), it is of relatively low importance (Lorenzi 2000). In north-east Brazil this plant is frequently found in small populations near humid areas and sometimes as scattered plants throughout drier areas.

In the last 2 years a powdery mildew fungus was consistently found on scattered plants of *H. indicum* growing inside or near

experimental areas of the Embrapa Algodão (Brazilian Center of Cotton Research), in the state of Paraíba. Diseased samples were collected, dried in a botanical press and deposited at the Herbarium of the Universidade Federal de Viçosa, Viçosa, MG, Brazil (Herbarium VIC) (accession number: Vic. 31382).

To identify the powdery mildew fungus microscope slides were prepared by 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

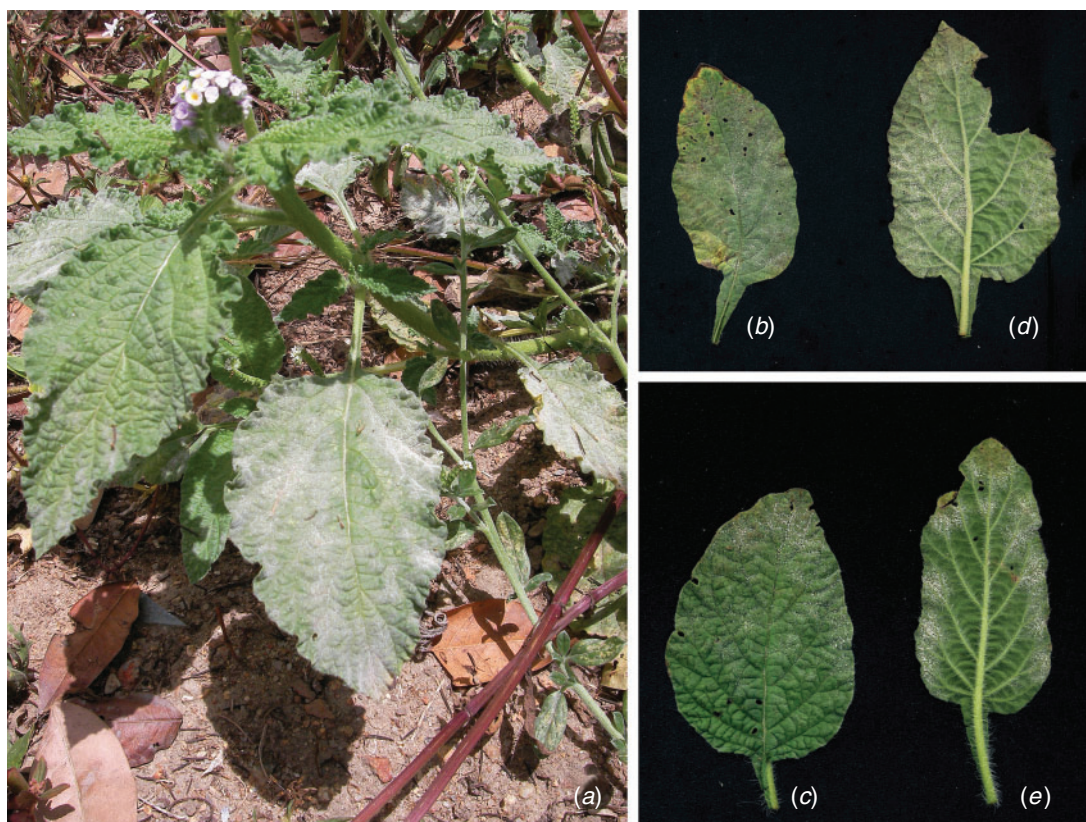


Fig. 1. Powdery mildew on *Heliotropium indicum*. General aspect of the affected plant (a). Close-up of the fungus colonies in the upper (b and c) and lower leaf side (d and e).

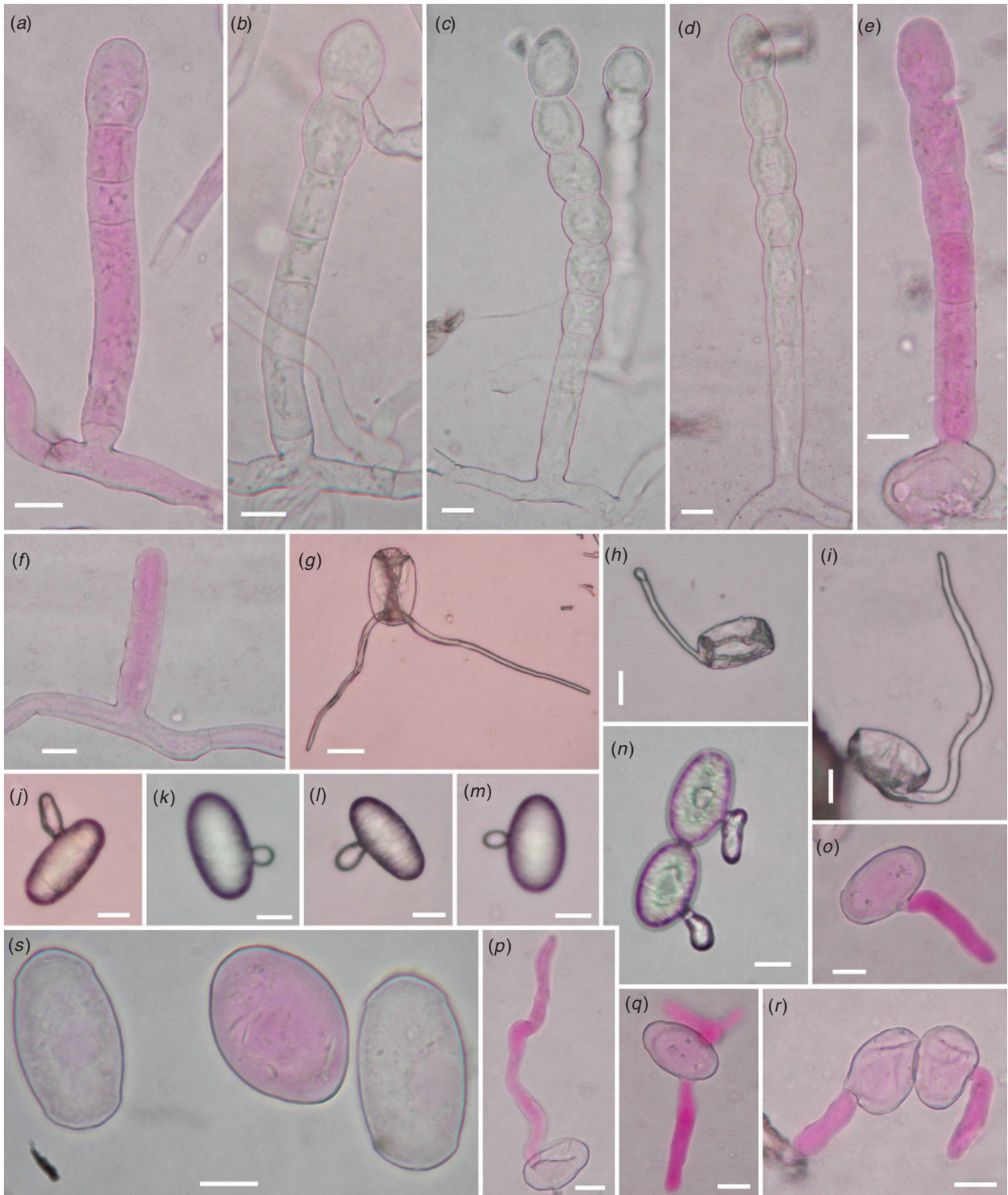


Fig. 2. *Oidium heliotropii-indici* (subgen. *Fibroidium*) ex *Heliotropium indicum*. Conidiophores (a–e). Conidia being formed in chains from conidiophores (c, d). A conidiophore arising directly from a conidium (e). Young conidiophore (f). Pattern of germination of old conidia in glass slides after 24 h at 100% RH (g–i). Pattern of germination of young conidia in Petri plate lids (j–m) and in glass slides (n) after 24 h at 100% RH. Pattern of conidia germination on natural substrate (o–r). Ellipsoid-ovoid and doliform conidia (s). Scale bars = 10 μ m.

from fresh material and gently warmed. Measurements were made at a magnification of 1000× using an Olympus microscope. The conidia germination pattern was determined by examining germinated conidia on the natural substrate and following the methodologies described in Cook and Braun (2009).

The fungus description is as follows: colonies white, powdery, on both sides of the leaf, initially as small circular to irregular colonies, later usually covering the entire leaf blade, giving a silvery aspect to the upper side of the leaves (Fig. 1). Mycelium superficial, effuse, 5–10 µm wide, flexuous, hyaline; appressoria indistinct or rarely very slightly nipple-shaped; conidiophores erect, straight to slightly curved, cylindrical, foot cell 45–60 × 10–15 µm, followed by 1–3 shorter cells, hyaline; conidia maturing in chains, ellipsoid-ovoid to doliform, 22–33 × 15–20 µm, l/w ratio 1.5–2.2, usually 1.8, with fibrosin bodies (Fig. 2); germ tubes variable with conidia age, usually lateral; old conidia producing *orthotubus* subtype of *Fibroidium* in glass slides at 100% RH; young conidia producing *brevitubus* subtype of *Fibroidium* in glass slides and Petri plate lids at 100% RH; no germination was observed on Petri plate lids at 97% RH; on natural substrates germination was consistent with the *brevitubus* subtype of *Fibroidium*.

Based on the description above, the fungus was identified as belonging to the genus *Oidium* subgen. *Fibroidium*, anamorph of *Podosphaera*. According to Cook and Braun (2009) the germination pattern observed here is restricted to *Podosphaera* sect. *Sphaerotheca* subsect. *Magnicellulatae*, although typically ‘branched germ tubes’, were rarely seen (Fig. 2g–r).

No powdery mildews were reported on *H. indicum* in Brazil (Embrapa 2010; Farr *et al.* 2010) but several members of Erysiphales have been reported on *H. indicum* worldwide, namely, *Golovinomyces cichoracearum* (DC.) V.P. Heluta, *Golovinomyces cynoglossi* (Wallr.) V.P. Heluta, *Erysiphe coluteae* (Kom.) U. Braun & S. Takam., *Leveillula boraginacearum* Golovin, *Leveillula boraginacearum* f. *heliotropii* Teich ex Golovin, *Leveillula taurica* (Lév.) G. Arnaud, *Oidium erysiphoides* Fr., *Oidium heliotropii-indici* Sawada, *Oidium heliotropii-strigosi* [as *heliotropii-strigosum*] N. Ahmad, A.K. Sarbhoy, Kamal & D.K. Agarwal, *Ovulariopsis boraginaceis* (Golovin) Cif. & Sousa da Câmara and *Podosphaera fuliginea* (Schltdl.) U. Braun & S. Takam. (Amano 1986; Farr *et al.* 2010). Among these *L. boraginacearum*, *L. boraginacearum* f. *heliotropii* and *O. boraginaceis* are regarded by Braun (1987) as invalid names, but regardless of their nomenclatural status, these species, together with *L. taurica*, are easily differentiated from the fungus described here since it clearly belongs to the genus *Oidium*. *Golovinomyces cichoracearum* and *G. cynoglossi* can be distinguished mainly by their nipple-shaped appressoria, conidia without fibrosin bodies and germ tube patterns, while *E. coluteae* can be distinguished by its conidia formed singly and cylindrical in shape. *Oidium erysiphoides* is regarded as a synonym of *P. fuliginea* (Braun and Takamatsu 2000). Both *P. fuliginea* and *O. heliotropii-indici* are closely related to the fungus described here. In his monograph Braun (1987) considered *O. heliotropii-indici* as an anamorph with uncertain position, and as far the author could ascertain no further treatment was applied to this fungus name. Descriptions of *O. heliotropii-indici* and the anamorphic state of *P. fuliginea* provided in Braun’s monograph (Braun 1987)

are similar and the main difference is the nipple-shaped appressoria in *O. heliotropii-indici* in contrast to the indistinct appressoria in *P. fuliginea*. However, regarding a more recent treatise (Braun *et al.* 2002) *Podosphaera* can have either indistinct or nipple-shaped appressoria.

Oidium heliotropii-strigosi recently described on *H. strigosum* has a similar morphology with *O. heliotropii-indici*, but *O. heliotropii-strigosi* differs from *O. heliotropii-indici* by the following distinctive characteristic: ‘solitary conidia formed on conidiophores with wide foot-cells followed by 1–2 shorter cells’ (Ahmad *et al.* 2005). The presence of solitary conidia in contrast to catenate conidia is a distinctive characteristic to separate the subgenus *Euoidium* from *Pseudoidium* and *Fibroidium*. However, depending on conditions of the examined specimen, this characteristic can be misinterpreted.

According to Braun’s monograph, *P. fuliginea* is restricted to *Veronica* and *Veronicastrum* hosts within Plantaginaceae and Scrophulariaceae (Braun 1987), so the powdery mildew here fits better with *O. heliotropii-indici*. Hence this is the first record of this fungus on *H. indicum* from Brazil.

Acknowledgements

The author thanks the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for financial support.

References

- Ahmad N, Sarbhoy AK, Kamal, Agarwal DK (2005) Five new anamorphic powdery mildews from India. *Indian Phytopathology* **58**, 100–105.
- Amano K (1986) ‘Host range and geographical distribution of the powdery mildew fungi.’ (Japan Scientific Society Press: Tokyo, Japan)
- Braun U (1987) A monograph of the Erysiphales (powdery mildews). *Beih. Nova Hedwigia* **89**, 1–700.
- Braun U, Takamatsu S (2000) Phylogeny of *Erysiphe*, *Microsphaera*, *Uncinula* (Erysiphaceae) and *Cystotheca*, *Podosphaera*, *Sphaerotheca* (Cystothecaceae) inferred from rDNA ITS sequences: some taxonomic consequences. *Schlechtendalia* **42**, 1–33.
- Braun U, Cook RTA, Inman AJ, Shin HD (2002) The taxonomy of the powdery mildew fungi. In ‘The powdery mildews: a comprehensive treatise.’ (Eds RR Bélanger, WR Bushnell, AJ Dik, TLW Carver) pp. 13–55. (APS Press: St. Paul, MN, US)
- Cook RTA, Braun U (2009) Conidia germination patterns in powdery mildews. *Mycological Research* **113**, 616–636. doi:10.1016/j.mycres.2009.01.010
- Embrapa (2010) ‘Banco de dados: Fungos relatados em plantas no Brasil, Embrapa Recursos Genéticos e Biotecnologia’ Available at <http://pragawall.cenargen.embrapa.br/aiqweb/michtml/micbanco01.asp> (verified 10 May 2010)
- Farr DF, Rossman AY, Palm ME, McCray EB (2010) ‘Fungal databases, systematic botany and mycology laboratory, ARS, USDA.’ Available at <http://nt.ars-grin.gov/fungaldbatabases/> (verified 10 May 2010)
- Lorenzi H (2000) ‘Plantas Daninhas do Brasil.’ (Instituto Plantarum de Estudos da Flora Ltda: Nova Odessa, Brazil)
- Melo JIM, Sales MF (2004) *Heliotropium* L. (Boraginaceae – Heliotropioidae) de Pernambuco, Nordeste do Brasil. *Rodriguésia* **55**, 65–87.
- Melo JIM, Semir J (2008) Taxonomia do gênero *Heliotropium* (Heliotropiaceae) no Brasil. *Acta Botânica Brasileira* **22**, 754–770.

Manuscript received 14 June 2010, accepted 21 July 2010