

# Powdery mildews on *Clitoria* in Australia

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**Abstract** An examination of Australian herbarium specimens of powdery mildew on *Clitoria* revealed two species. *Oidium clitoriae* is reported for the first time in Australia causing powdery mildew on *Clitoria* sp. in northern Queensland. *Golovinomyces* cf. *orontii* is reported for the first time on the genus *Clitoria*, from *Clitoria ternatea* in Queensland and the Northern Territory.

**Keywords** Erysiphales · *Pseudoidium*

Three herbaceous and perennial *Clitoria* spp. (Fabaceae) occur in Australia, namely one native species, *C. australis*, and two introduced weedy species, *C. laurifolia* and *C. ternatea* (Dunlop et al. 1995; Lazarides et al. 1997; Csurhes and Edwards 1998). *Clitoria ternatea*, commonly called butterfly pea or blue pea, is used as pasture legume or ornamental in northern Australia (Hall 1985).

The lists of plant diseases in Australia (Simmonds 1966; Pitkethley 1970; Chambers 1982; Sampson and Walker 1982; Cook and Dube 1989; Shivas 1989) do not contain any record of powdery mildew on *Clitoria*. There are five voucher specimens of powdery mildew (Erysiphales) on *Clitoria* collected in Australia and held in the State plant pathology herbaria (BRIP, DAR, DNAP and VPRI),

excluding duplicates. These specimens were re-examined. One specimen (DNAP 293) was in poor condition and could not be identified. Another specimen, previously identified as *Oidium* sp., was found to represent *Oidium clitoriae* Narayanas. & K. Ramakr., a member of the subgenus *Pseudoidium*, which is characterized by conidia produced singly. Three specimens were identified as *Golovinomyces* cf. *orontii* (Castagne) V.P. Heluta.

The morphology of the powdery mildews was examined in microscopic mounts in lactic acid. Observations and illustrations were prepared under a microscope Leica DM2500 equipped with a camera Leica DC500. Biometric data was obtained from the examination of turgid structures and only mature conidia (those unattached to conidiophores) were measured. The descriptions of the powdery mildew species based on the Australian specimens follow.

***Oidium clitoriae*** Narayanas. & K. Ramakr., The Madras Univ. Journ. 37–38: 89 “1967–1968” (1969) on *Clitoria* sp. Figs. 1 and 2

On leaves. Mycelium amphigenous. Superficial hyphae branched, septate, hyaline, flexuous, 5–10 µm wide; mycelial appressoria lobed. Conidiophores produced from the external mycelium, cylindrical, hyaline, smooth, unbranched, septate; foot-cells 15–53×7.5–9 µm, followed by 1–2 cells. Conidia produced singly, 26–46×11–23 µm, length/width ratio 1.5–2.8 (–3.4), aseptate, hyaline, cylindrical or doliform, smooth. The pattern on the conidial surface seen by scanning electron microscope is “pleated” (as defined by Braun et al. 2002). Usually one germ tube per conidium, up to the length of the conidium, with lobed appressorium. Teleomorph not seen.

**Specimen examined:** Australia, Queensland, Parada, May 1976, on *Clitoria* sp., *J.B. Staples* (BRIP 11641).

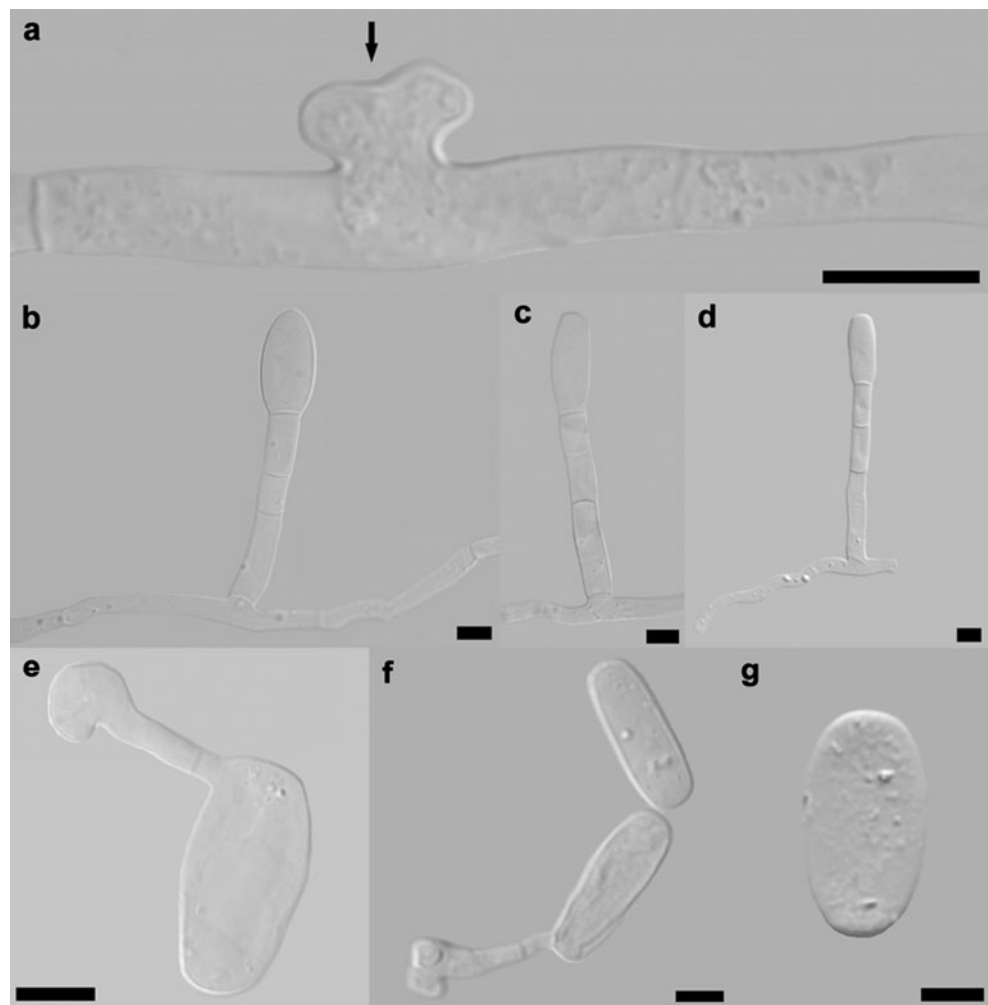
This appears to be the first report of *O. clitoriae* in Australia. *Oidium clitoriae* is the only powdery mildew

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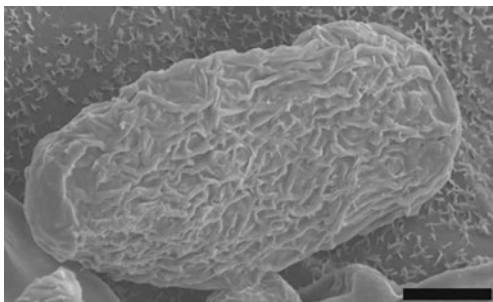
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**Fig. 1** *Oidium clitoriae* on *Clitoria* sp. (BRIP 11641). **a** Lobed hyphal appressorium (arrowed). **b–d** Pseudoidium type conidiophores. **e–f** Germinated conidia. **g** Conidium (Bars=10  $\mu$ m)



known to infect *Clitoria*. This powdery mildew has been reported in Cambodia, Ceylon, India, Java (Braun 1987), Brazil (Liberato et al. 1998) and Mexico (Ale-Agha et al. 2008). Amano (1986) listed *Erysiphe cruciferarum* Opiz ex L. Junell (as *Erysiphe communis* (Wallr.) Schltdl.), whose anamorph is a member of the subgenus *Pseudoidium*, on *C. ternatea* in Cambodia but this author did not provide details

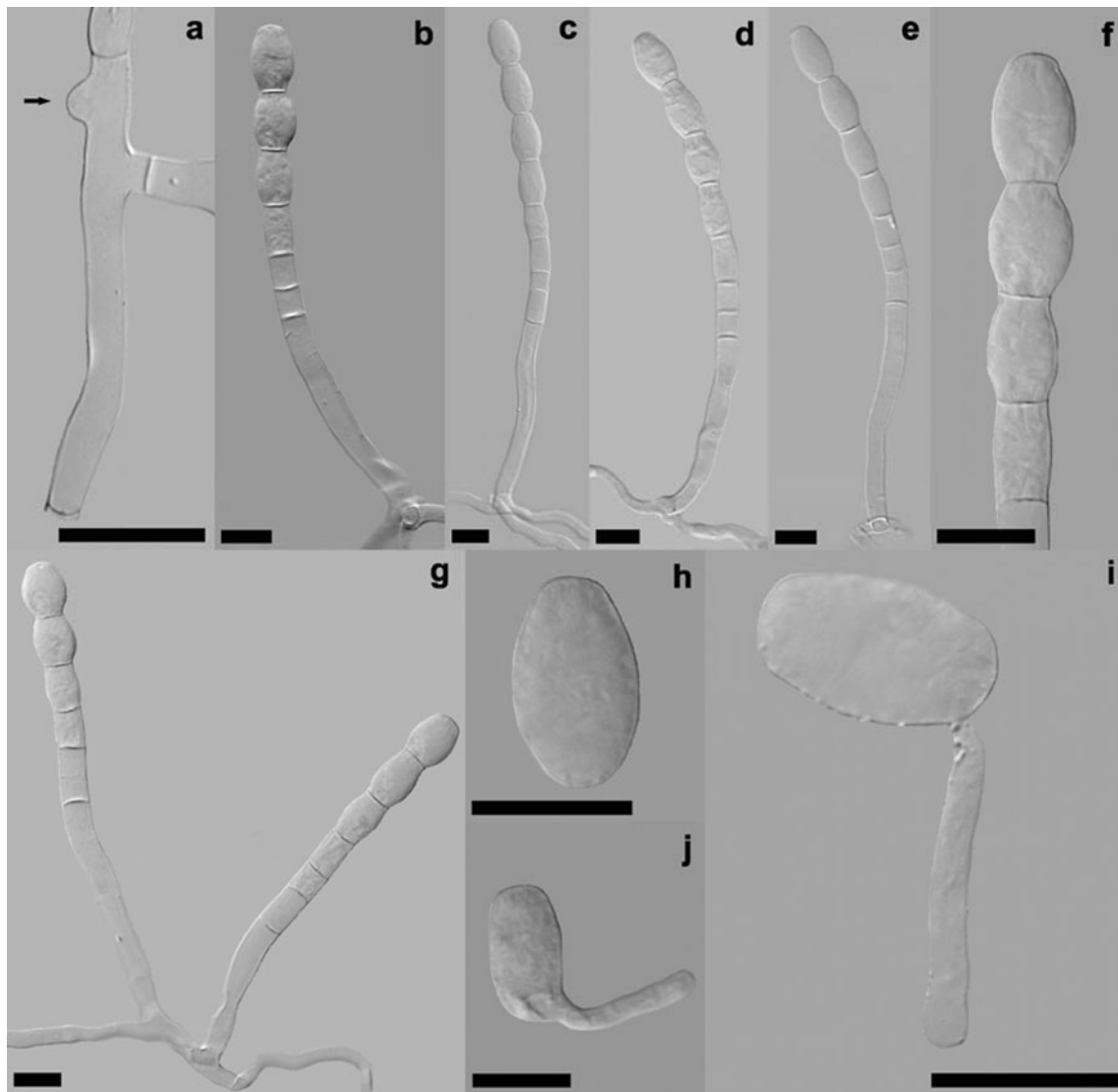


**Fig. 2** *Oidium clitoriae* on *Clitoria* sp. (BRIP 11641). Scanning electron micrograph of the surface of a wrinkled conidium (Bar=5  $\mu$ m)

for this record. *E. cruciferarum* infects hosts in the plant families Brassicaceae, Capparidaceae, Cleomaceae, Papaveraceae *sensu lato* and Resedaceae (Braun 1987).

Anamorphic *Golovinomyces* cf. *orontii* (Castagne) V.P. Heluta, Ukrayins'k. Bot. Zhurn. **45**(5): 63, 1988 on *Clitoria ternatea* L. Fig. 3

On leaves. Mycelium amphigenous, dense. Superficial hyphae branched, septate, hyaline, flexuous, 5–7.5  $\mu$ m wide; mycelial appressoria nipple-shaped. Conidiophores produced from the external mycelium, cylindrical, hyaline, smooth, unbranched, septate, foot-cells 40–138  $\times$  10–12.5  $\mu$ m, followed by 1–4(–5) shorter cells. Conidia catenate (2–4 conidia), 22–41  $\times$  12.5–23  $\mu$ m, length/width ratio 1.4–2.8, aseptate, hyaline, ovoid or doliform, sometimes cylindrical, smooth. Sinuate edge lines formed by linked immature conidia (*sensu* Shin and La 1993). Usually one germ tube per conidium, sometimes 2–4, up to the length of the conidium, with swollen tip. Microcyclic conidiogenesis (Kiss et al. 2010) was observed in one germinated conidium. Teleomorph not seen.



**Fig. 3** *Golovinomyces* cf. *orontii* on *Clitoria ternatea* (BRIP 2214). **a** Nipple-shaped mycelial appressorium (arrowed). **b–g** Conidiophores with immature conidia in chains. **h** Conidium. **i–j** Germinated conidia (Bars=20  $\mu$ m)

*Specimens examined on Clitoria ternatea*: Australia, Queensland, Gladstone, 4 May 1972, *J.L. Alcorn* (BRIP 2214); Walkamin, 31 July 1984, *R. Peterson* (BRIP 14462). Northern Territory, 10 May 1994, *S.J. Aldrick* (VPRI 20068).

This appears to be the first record of *G. orontii* on *Clitoria*. *Golovinomyces orontii* is a complex species with circumglobal distribution and a wide host range from about 40 botanical families (Braun and Cook 2012). However, records of *G. orontii* infecting plants belonging to the family *Fabaceae* are rare. Amano (1986) listed *Cajanus cajan* and *Phaseolus vulgaris* as hosts of *G. orontii* (referred as *Golovinomyces cichoracearum* (DC.) V.P. Heluta ( $\equiv$  *Erysiphe cichoracearum* DC.)), but details for these records are unknown. Recently

Gevens et al. (2009) published an abstract reporting *G. cichoracearum* on *Crotalaria juncea*. According to Braun and Cook (2012), *G. orontii* has often previously been confused with *G. cichoracearum*. These authors emended *G. cichoracearum* s. str. which is confined to hosts of the *Asteraceae* subfam. *Cichorioideae*, while *G. cichoracearum* s. lat. infects plant species belonging to other subfamilies of *Asteraceae*.

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