

Sporisorium cymbopogonis-bombycini sp. nov. (Ustilaginomycetes) from Australia

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Abstract. A new smut fungus, *Sporisorium cymbopogonis-bombycini*, is described on the grass *Cymbopogon bombycinus* from Australia. The fourteen known smut fungi, all *Sporisorium* species, on *Cymbopogon* are enumerated with their taxonomic synonyms, host plant range and distribution. A key for identifying and differentiating these fungi, and a host plant – smut fungus list are given.

Key words: Australia, *Cymbopogon*, smut fungi, *Sporisorium cymbopogonis-bombycini*, taxonomy, Ustilaginomycetes

Introduction

Cymbopogon Spreng., in the subfam. Panicoideae, tribe Andropogoneae, subtribe Andropogoninae, is a fairly homogeneous genus of c. 40 species in the Old World tropics and subtropics; some species are introduced to tropical America (Clayton & Renvoize 1986: 351). In Australia, the genus is represented by 11 species (Sharp & Simon 2002). The smut fungi of *Cymbopogon* were revised by Vánky (2003: 20–32), who recognised 13 species and 17 synonyms. An additional synonym was added recently (Vánky 2004: 113). All known smut fungi of *Cymbopogon* belong to the genus *Sporisorium*. A smut fungus on *C. bombycinus*, collected several years ago by the senior author, represents a new species:

Taxonomy

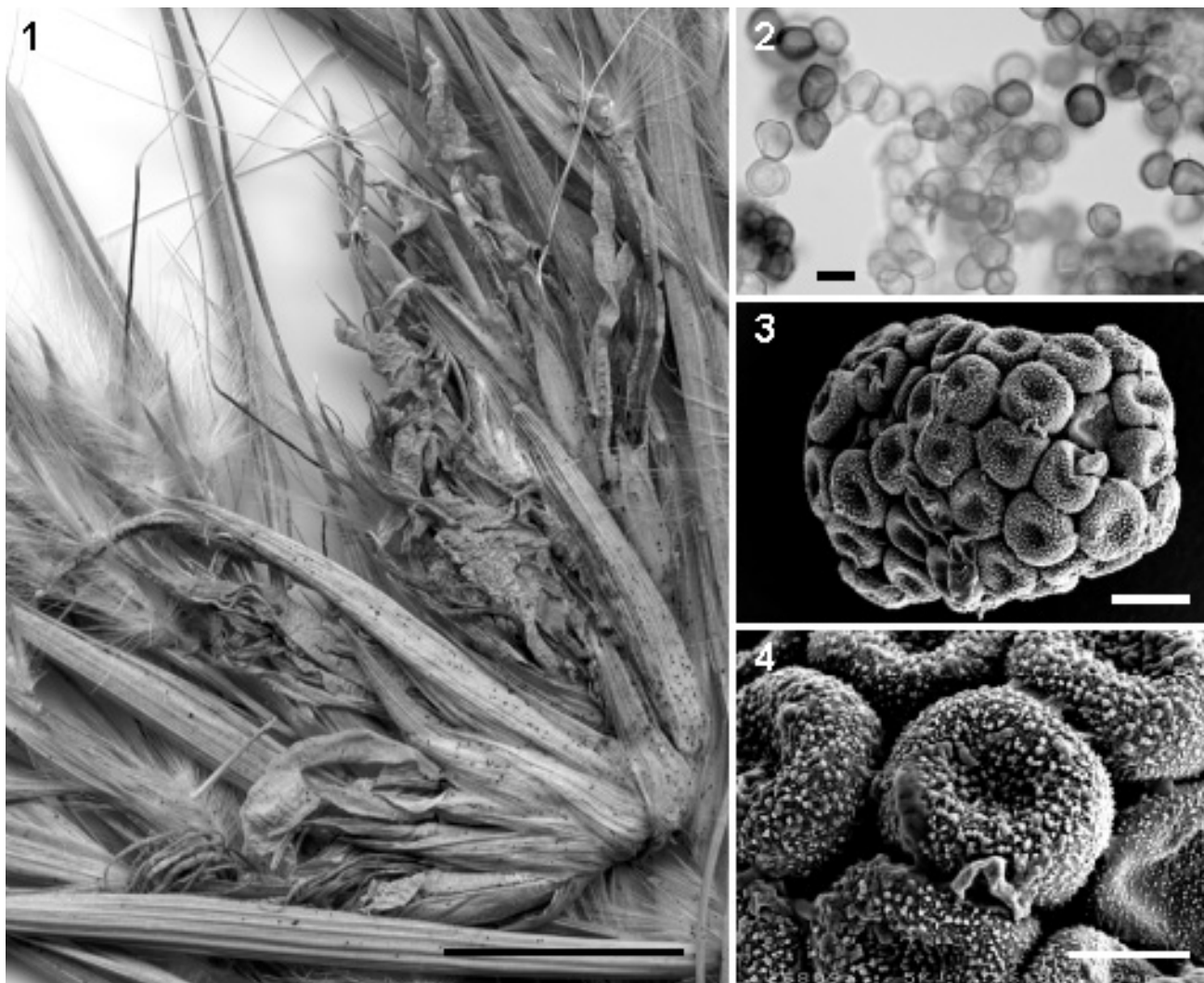
1. *Sporisorium cymbopogonis-bombycini* R.G. Shivas & Vánky, sp. nov.

Holotypus in matrice *Cymbopogon bombycinus*, Australia, Western Australia, Wyndham, 3.IV.1989, leg. R.G. Shivas (PERTH 00 927 260). *Isotypi* in BRIP 26 809 et H.U.V. 17 448.

Sori plerumque spiculas omnes racemi eiusdem destruentes sed tantem nonnulli racemorum inflorescentiae eiusdem affecti, elongate-lineares, cca. 1 mm lati, usque ad 15 mm longi, involucris floralibus et spatheolis partim occulti, peridio flavidobrunneo cooperti, quo maturo longitudinaliter in fascias nonnullas dissoluto massam nigram, granulosopulveream glomerulorum sporarum columellas nonnullas filiformes circumdantium ostendentes. **Glomeruli sporarum** globosi, ovoidei, oblongi usque subpolyedrice irregulares, 40–80 × 50–125 µm, rubellobrunnei usque subopaci, e pluribus decem sporis pressu facile separabilibus compositi. **Sporae** globosae, subglobosae, ellipsoideales usque rotundate subpolyedrice irregulares, dimorphae; sporae externae 9–13 × 9,5–14,5 µm, mediocriter atro-flavidobrunneae vel rubrobrunneae; pariete inaequali, 0,5–1,5 µm crasso, alternatim cum areis tenuioribus crassioribusque, deinde in medio parietis liberi cum area tenui, rotunda (porus germinationis?), in lateribus contactis levibus vel paene levibus, sed in superficie libera moderate usque dense punctato-verrucoso; imago obliqua sporarum undulata usque leniter serrulata; in SEM verrucae humiles, magnitudine variae, obtusae vel subacutae; sporae internae 8–11 × 8,5–13,5 µm, pallide flavidobrunneae, pariete tenui, cca. 0,5 µm, aequali vel parum inaequaliter crasso. **Cellulae steriles** absentes.

Sori (Fig. 1) destroying the spikelets, usually every spikelet in a raceme, but only a few racemes in an inflorescence are affected, long linear, c. 1 mm wide, up to 15 mm long, partly

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Figs 1-4. *Sporisorium cymbopogonis-bombycini* (from holotype). 1. Sori destroying the spikelets of *Cymbopogon bombycinus*. Bar = 1 cm. 2. Dimorphic spores in LM. Bar = 10 µm. 3. Spore ball in SEM. Bar = 10 µm. 4. Surface ornamentation of outer spores in SEM. Bar = 5 µm

hidden by floral envelopes and spatheolae, covered by a yellowish brown peridium which at maturity splits longitudinally into several bands, disclosing the black, granular-powdery mass of spore balls surrounding several filiform columellae. **Spore balls** (Fig. 3) globose, ovoid, oblong to subpolyhedrally irregular, 40-80 × 50-125 µm, reddish brown to subopaque, composed of tens of spores which separate easily by pressure. **Spores** (Fig. 2) globose, subglobose, ellipsoidal to rounded subpolyhedrally irregular, dimorphic; outer spores 9-13 × 9.5-14.5 µm, medium dark yellowish or reddish brown; wall uneven, 0.5-1.5 µm thick, with alternatively thinner and thicker areas, with a thin, rounded area (germ pore?) in the centre of the free wall, contact sides smooth or nearly so, free surface moderately to densely punctate-verrucose, spore profile wavy to finely serrulate, in SEM (Fig. 4) warts low, variable in size, blunt or subacute; inner spores 8-11 × 8.5-13.5 µm, pale yellowish brown, wall thin, c. 0.5 µm, even or slightly unevenly thick, smooth. **Sterile cells** absent.

Distribution: on *Cymbopogon bombycinus* (R. Br.) Domin; Australia. It is known only from the type specimen.

2. *Sporisorium barberi* (Mundk.) Vánky (2003: 20). Type on *C. coloratus*, India.

= *Sorosporium cornutum* Pavgi & Thirum. Type on *C. nardus* var. *confertiflorus*, India.

Distribution: on *Cymbopogon coloratus*, *C. flexuosus*, *C. nardus* var. *confertiflorus* (*C. confertiflorus*); S. Asia (India).

3. *Sporisorium bengalense* (Syd., P. Syd. & E.J. Butler) Vánky (2003: 21). Type on *C. pendulus*, India.

Distribution: on *Cymbopogon pendulus*; S. Asia (India).

4. *Sporisorium compactum* Vánky (2003: 23). Type on *C. giganteus*, Senegal.

Distribution: on *Cymbopogon giganteus*; W. Africa (Senegal).

5. *Sporisorium cymbicum* Vánky (2003: 23). Type on *C. nardus*, Zimbabwe.

Distribution: on *Cymbopogon nardus* (*C. validus*, *C. afronardus*), *C. plurinodis*; Africa (South Africa, Uganda, Zimbabwe).

6. *Sporisorium cymbopogonis* (Mundk.) Vánky (2003: 25). Type on *C. citratus*, India.

= *Tolyposporium christensenii* Raghunath (as 'Ragunath'). Type on *C. flexuosus*, India.

Distribution: on *Cymbopogon citratus*, *C. coloratus*, *C. flexuosus*; Asia (India, Indonesia – Bali).

7. *Sporisorium cymbopogonis-distantis* (L. Ling) L. Guo (1998: 1). Type on *C. distans*, China.

Distribution: on *Cymbopogon distans*; E. Asia (China).

8. *Sporisorium densiflorum* (L. Ling) Vánky (2003: 27). Type on *C. densiflorus*, Congo.

Distribution: on *Cymbopogon densiflorus*, *C. dieterlenii*; Africa (Congo, South Africa).

9. *Sporisorium lanigeri* (Magnus) Vánky (2003: 27). Type on *C. schoenanthus*, Iran.

= *Ustilago furcata* Pat. & Har. Type on *Cymbopogon* sp., Mali.

= *Ustilago schoenanthi* Syd., P. Syd. & E.J. Butler. Type on *C. schoenanthus*, India.

= *Sphacelotheca moggii* Zundel. Type on *C. plurinodis*, South Africa.

= *Sphacelotheca concentrica* Zundel. Type on *C. plurinodis*, South Africa.

= *Sphacelotheca natalensis* Zundel. Type on *C. excavatus*, South Africa.

= *Sorosporium pretoriense* Zundel. Type on *C. plurinodis*, South Africa.

= *Sphacelotheca columellifera* "(Tul.) Yen", not (L.-R. & C. Tul.) Ciferri. ≡ *Sphacelotheca yenii* Zundel. Type on *C. schoenanthus*, Morocco.

= *Sphacelotheca cymbopogonis* W.Y. Yen. Type on *C. proximus*, Chad.

= *Sphacelotheca consueta* Syd. Type on *C. parkeri*, Pakistan.

= *Sorosporium ladharensis* Syd. Type on *C. jwarancusa*, India.

= *Sphacelotheca cymbopogonis-colorati* Mundk. & Thirum. Type on *C. coloratus*, India.

= *Sphacelotheca mutila* Mundk. & Thirum. Type on *C. caesius*, India.

= *Sporisorium martinii* Bag & D.K. Agarwal (as 'martinae'). Type on *C. martinii*, India.

Distribution: on *Cymbopogon ambiguus*, *C. bombycinus*, *C. caesius*, *C. coloratus*, *C. commutatus*, *C. distans*, *C. elegans*, *C. excavatus*, *C. flexuosus*, *C. jwarancusa*, *C. marginatus*, *C. martinii*, *C. nardus* (*C. validus*), *C. nardus* var. *confertiflorus* (*C. confertiflorus*), *C. obtectus*, *C. parkeri*, *C. plurinodis* (*Andropogon plurinodis*), *C. procerus* (*C. exaltatus*), *C. proximus*, *C. refractus*, *C. schoenanthus* (*Andropogon schoenanthus*, *A. laniger*); Africa

(Chad, Morocco, South Africa, Sudan, Zimbabwe), Asia (India, Iran, Iraq, Pakistan), Australia.

10. *Sporisorium mildbraedii* (Syd. & P. Syd.) Vánky (2003: 29). Type on *C. schoenanthus*, Rwanda.

= *Sphacelotheca cymbopogonis-afronardi* L. Ling, *nom. herb.*, on *C. afronardus* (q.e. *C. nardus*), Uganda.

Distribution: on *Cymbopogon schoenanthus* (*Andropogon schoenanthus*), *C. nardus* (*C. afronardus*); E. Africa (Tanzania, Uganda).

11. *Sporisorium mutabile* (Syd.) Vánky (2003: 29). Type on *C. refractus*, Australia.

= *Sorosporium cantonense* Zundel. Type on *C. hamatulus* (as 'hematatus'), China.

= *Sorosporium terrareginalense* Zundel. Type on *C. refractus*, Australia.

Distribution: on *Cymbopogon bombycinus*, *C. coloratus*, *C. densiflorus*, *C. distans*, *C. hamatulus*, *C. nardus*, *C. refractus*; Africa (Malawi, Zimbabwe), Asia (China, India, Pakistan), Australia.

12. *Sporisorium nardi* (Syd. & P. Syd.) Vánky (2003: 30). Type on *C. nardus*, India.

Distribution: on *Cymbopogon nardus* (*Andropogon nardus*); S. Asia (India).

13. *Sporisorium panamense* (Zundel & Dunlap) M. Piepenbr. (2001: 427, as 'panamensis'). Type on *C. citratus*, Panama.

Distribution: on *Cymbopogon citratus*; C. America (Panama).

14. *Sporisorium spermoideum* (Berk. & Broome) Vánky (2003: 31). Type on *C. martinii*, Sri Lanka.

Distribution: on *Cymbopogon martinii*, *C. nardus*, *C. nardus* var. *confertiflorus*, ? *Capillipedium venustum* (*Andropogon venustum*); S. Asia (Sri Lanka).

Host plant — smut fungus list

(S. = *Sporisorium*)

Andropogon laniger Desf. = *Cymbopogon schoenanthus*

A. nardus L. = *Cymbopogon nardus*

A. plurinodis Stapf = *Cymbopogon plurinodis*

A. schoenanthus L. = *Cymbopogon schoenanthus*

A. venustum Thw. = *Capillipedium venustum*

? *Capillipedium venustum* (Thw.) Bor — *S. spermoideum*

Cymbopogon afronardus Stapf = *C. nardus*

C. ambiguus A. Camus — *S. lanigeri*

C. bombycinus (R. Br.) Domin — *S. cymbopogonis-bombycini*, *S. lanigeri*,

S. mutabile

C. caesius (Nees) Stapf — *S. lanigeri*

C. citratus (DC.) Stapf — *S. cymbopogonis*, *S. panamense*

C. coloratus (Nees) Stapf — *S. barberi*, *S. cymbopogonis*, *S. lanigeri*, *S. mutabile*

C. commutatus (Steud.) Stapf — *S. lanigeri*

C. confertiflorus (Steud.) Stapf = *C. nardus* var. *confertiflorus*

C. densiflorus (Steud.) Stapf — *S. densiflorum*, *S. mutabile*

- C. dieterlenii* Stapf ex Phill. — *S. densiflorum*
C. distans (Nees ex Steud.) Watson — *S. cymbopogonis-distantis*, *S. lanigeri*,
S. mutabile
C. elegans Spreng. — *S. lanigeri*
C. exaltatus (R. Br.) Domin = *C. procerus*
C. excavatus (Hochst.) Stapf ex Burtt Davy — *S. lanigeri*
C. flexuosus (Nees ex Steud.) Watson — *S. barberi*, *S. cymbopogonis*, *S.*
lanigeri
C. giganteus Chiov. — *S. compactum*
C. hamatulus (Nees) A. Camus — *S. mutabile*
C. jwarancusa (Jones) Schult. — *S. lanigeri*
C. marginatus (Steud.) Stapf ex Burtt Davy — *S. lanigeri*
C. martinii (Roxb.) Watson — *S. lanigeri*, *S. spermoideum*
- C. nardus* (L.) Rendle — *S. cymbicum*, *S. lanigeri*, *S. mildbraedii*, *S. mutabile*,
S. nardi, *S. spermoideum*
C. nardus var. *confertiflorus* (Steud.) Stapf ex Bor — *S. barberi*, *S. lanigeri*,
S. spermoideum
C. obtectus S.T. Blake — *S. lanigeri*
C. parkeri Stapf — *S. lanigeri*
C. pendulus (Nees ex Steud.) Watson — *S. bengalense*
C. plurinodis (Stapf) Stapf ex Burtt Davy — *S. cymbicum*, *S. lanigeri*
C. procerus (R. Br.) Domin — *S. lanigeri*
C. proximus Stapf — *S. lanigeri*
C. refractus (R. Br.) A. Camus — *S. lanigeri*, *S. mutabile*
C. schoenanthus (L.) Spreng. — *S. lanigeri*, *S. mildbraedii*
C. validus (Stapf) Stapf ex Burtt Davy = *C. nardus*

Key to the smut fungi (*Sporisorium*) of *Cymbopogon*

- 1 Sori horn-shaped, forming witches' brooms in the inflorescence 2
1* Sori not so 3
2 Spore balls easily disintegrating; spores tuberculate *S. barberi*
2* Spore balls compact, permanent; outer spores echinulate *S. compactum*
3 Spores (12–) 13-17 (–20) μm long 4
3* Spores smaller 6
4 Columella one, simple; sterile cells present *S. panamense*
4* Columella 1-several, filiform; sterile cells absent 5
5 Spore wall c. 1 μm thick; outer spores apparently smooth to finely punctate-verruculose *S. cymbopogonis-distanti*
5* Spore wall 0.5-1.5 (–2) μm thick; outer spores verrucose *S. mutabile*
6 Spores between 10-15 μm long 7
6* Spores smaller 10
7 Sterile cells small, 5-8 μm *S. bengalense*
7* Sterile cells 11-17 μm or absent 8
8 Sori in the ovaries, ellipsoidal, 2-4 mm long; columella 1, flagelliform; sterile cells present *S. cymbicum*
8* Sori in the spikelets or in the racemes, columellae 2-7, filiform; sterile cells absent 9
9 Sori in the spikelets, up to 15 mm long; spores dimorphic *S. cymbopogonis-bombycini*
9* Sori in the racemes, 15-20 mm long; spores not dimorphic *S. densiflorum*
10 Spores 9-11 (–12.5) μm long, lighter on one side *S. spermoideum*
10* Spores smaller, not lighter on one side 11
11 Columella one, stout, rarely flagelliform; sterile cells present 12
11* Columella 1-several, filiform; sterile cells absent 13
12 Columella with short branches; peridium absent; sterile cells 7-12 μm long; spores 5.5-7 μm long *S. mildbraedii*
12* Columella simple or bifurcate; peridium present; sterile cells 10-20 μm long; spores 6-9 μm long *S. lanigeri*
13 Spores 7-13 μm long, free surface verrucose-echinulate *S. cymbopogonis*
13* Spores 6-9.5 μm long, free surface finely punctate-verruculose *S. nardi*

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