
The smut fungi (*Ustilaginomycetes*) of *Chrysopogon* (*Poaceae*)

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Description of the ten recognised species of smut fungi of *Chrysopogon* is given. A host-parasite list and a key facilitate the identification of these species. One new species is proposed: *Sporisorium tumiforme* Vánky & R.G. Shivas (type on *Chrysopogon pallidus*, Australia). Two new combinations are: *Sporisorium azmatii* (Mundk.) Vánky (based on *Sorosporium azmatii*, type on *Chrysopogon coeruleus*, India), and *Sporisorium chrysopogonis-grylli* (Thirum. & Pavgi) Vánky (based on *Sphacelotheca chrysopogonis-grylli*, type on *Chrysopogon gryllus*, India). A lectotype is designated for *Sorosporium tumefaciens* McAlpine (= *Sporisorium tumefaciens*).

Key words: lectotype, new combinations, new species, *Sporisorium tumiforme*, taxonomy.**Introduction**

This paper is part of a series in which the smut fungi of various grass genera are revised, to pave the way towards a world monograph (comp. Vánky, 2000a,b, 2001, 2002, 2003a,b,c, 2004a,b,c,d; Vánky and Shivas, 2001; Shivas and Vánky, 2001).

Chrysopogon Trin., with 26 species in tropical and warm temperate regions of the Old World, principally in Asia and Australia, and one species in Florida and West Indies, belongs to the subfamily Panicoideae, tribe Andropogoneae, subtribe Sorghinae. It is closely related and intergrades with *Vetiveria* Bory, with 10 species in the Old World tropics (Clayton and Renvoize, 1986: 342). Therefore, it is expected, that some smut fungi may occur on members of both genera. On *Vetiveria* six smut fungi are recognised (Vánky, 1997b: 142-145), while on *Chrysopogon* at least 14 smut fungi have been described. Of these some are synonyms. Both *Sphacelotheca chrysopogonis* G.P. Clinton and *Tolyposporella chrysopogonis* Atkinson have been described on *Chrysopogon nutans* (L.) Benth., which is *Sorghastrum nutans* (L.) Nash. The host plant of *Sorosporium assamicum* A.K. Roy (= *Sporisorium assamicum* (A.K. Roy) Vánky) is not *Andropogon aciculatus*

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Retz. (= *Chrysopogon aciculatus* (Retz.) Trin.) as originally given but *Imperata cylindrica* (L.) Beauv. (teste A.K. Roy). The ten recognised smut fungi of *Chrysopogon*, including a new species, are:

Macalpinomyces chrysopogonicola (Mundk. & Thirum.) Vánky, 2001: 320.

≡ *Sphacelotheca chrysopogonicola* Mundk. & Thirum., in Thirumalachar & Mundkur, 1951: 2. — **Type** on *Chrysopogon* sp., India, Mysore, Bangalore, Uttarahalli, 2 September 1943, M.J. Thirumalachar, HClO 10781!

= *Ustilago chrysopogonis* S. Ahmad, 1956: 2.

≡ *Macalpinomyces chrysopogonis* (S. Ahmad) Vánky, 1997a: 129. — **Type** on *Chrysopogon gryllus* (L.) Trin., Pakistan, Swat State, Kulali-Kalam, 19 August 1958, S. Ahmad; isotype HUV 8999! (syn. by Vánky, 2001: 320).

= *Sorosporium capillipedii* Mishra, 1957: 257.

≡ *Endosporisorium capillipedii* (Mishra) Vánky, 1995a: 228. — **Type** on *Capillipedium parviflorum* (R. Br.) Stapf, India, Bihar, Hazaribagh, 10 October 1955, J.N. Mishra, BPI 179479! (syn. by Vánky, 2001: 320).

Sori comprise the distal part of the stems transforming them into 3-16 cm long, ca. 1 mm wide, whitish, straight or whip-like, twisted, sometimes looped tubes filled with agglutinated spore masses intermixed with groups of sterile cells. At maturity, the sori split longitudinally liberating the blackish-brown, granular-powdery mass of groups of spores, spores and sterile cells. Usually all shoots of a plant are transformed into sori and infected plants do not flower. Peridium and columella lacking. *Spores* when mature single, subpolyhedrally globose, ovoid or irregular, 8-10.5 × 8-11 µm, medium reddish-brown; wall thin (0.5-0.8 µm), densely echinulate, spines short (0.3-0.4 µm) just affecting the spore profile which appears undulate or serrulate; in SEM the spore surface is provided with short, conical spines. *Sterile cells* variable in form and size, subglobose, ellipsoidal or subpolyhedrally irregular, 4-9(-13) × 5-11(-15) µm, hyaline, usually forming irregular groups; wall thin (c. 0.5 µm), smooth. *Spore germination* results in phragmobasidia, the cells of which may or may not conjugate, giving rise to basidiospores on long sterigmata, or to hyphae (Vánky, 1995a: 228-231, figs. 20 and 23).

Hosts: *Capillipedium parviflorum* (R. Br.) Stapf, *Chrysopogon echinulatus* (Nees) W. Wats, *Ch. fulvus* (Spreng.) Chiov., *Ch. gryllus* (L.) Trin.

Known distribution: S. Asia (India, Pakistan).

Macalpinomyces effusus (H. & P. Sydow) Vánky, 1997a: 129.

≡ *Ustilago effusa* H. & P. Sydow, in H. & P. Sydow & Butler, 1906: 425.

≡ *Endosporisorium effusum* (H. & P. Sydow) Vánky, 1995b: 212. — **Type** on *Andropogon muricatus* Retz. (= *Vetiveria zizanioides* (L.) Nash), India, Assam, Sylhet Distr., Kanaighat, 21 May 1905, E.J. Butler, HClO 450!; isotypes BPI 160327, BPI 160328, BPI 188930, HUV 16416!

Sori in the interior of yellowish-white culms which split longitudinally disclosing the dark brown, semi-powdery mass of loose groups of spores intermixed with sterile cells. *Spores* globose, subglobose to broadly ellipsoidal, $3.5-5.5 \times 4-6(-6.5)$ μm , reddish-brown; wall thin, verrucose. *Sterile cells* few, in groups or single, globose to ovoid, larger than the spores (5.5-8 μm long), collapsed in old specimens.

Hosts: ? *Arundinella bengalensis* (Spreng.) Druce (*Arundinella wallichii* Trin.), ? *Chrysopogon aciculatus* (Retz.) Trin., *Vetiveria zizanioides* (L.) Nash (*Andropogon muricatus* Retz.).

Known distribution: S. Asia (India).

Macalpinomyces tubiformis R.G. Shivas & Vánky, in Shivas, Cunnington & Vánky, 2004: 152.

Type on *Chrysopogon fallax* S.T. Blake, Australia, Queensland, ca. 20 km N of Gingin, alt. ca. 108 m., 25 April 2003, M.D.E. & R.G. Shivas, BRIP 39858; isotype HUV 20303!

Sori in some sessile and pedicelled spikelets of an inflorescence destroying the innermost floral organs, much hypertrophied, long tubiform, often bent or twisted, $2-3 \times 25-50$ mm, covered by a grey peridium of host and fungal origin which ruptures longitudinally disclosing the dark brown, powdery mass of spores intermixed with groups of sterile cells. *Spores* globose, subglobose, usually ellipsoidal, $8-11 \times 9-13.5$ μm , olivaceous-brown; wall even, 1.5-2.5 μm thick including the densely situated, acute, pyramidal warts. *Sterile cells* in irregular groups, single cells globose, subglobose, ellipsoidal, $5-8(-10) \times 5-9.5(-12)$ μm , hyaline; wall thin, ca. 0.5 μm , smooth.

Host: *Chrysopogon fallax* S.T. Blake.

Known distribution: Australia. Known only from the type collection.

Sporisorium andropogonis-aciculati (Petch) Vánky, 1983: 328.

≡ *Ustilago andropogonis-aciculati* Petch, 1909: 303.

≡ *Sorosporium andropogonis-aciculati* (Petch) Petch, 1912: 227. — **Type** on *Andropogon aciculatus* Retz. (= *Chrysopogon aciculatus* (Retz.) Trin.), Ceylon (= Sri Lanka), Peradeniya.

Sori destroying the whole inflorescence, long cylindrical, $1-2 \times 20-40(-50)$ mm, more or less hidden by the uppermost leaf-sheath, at first covered by a pale brown peridium which ruptures irregularly from its apex disclosing the blackish-brown, granular-powdery mass of spore balls and several long, filiform columellae. *Spore balls* subglobose, ellipsoidal to slightly irregular, $20-50 \times 20-60$ μm , dark reddish-brown to opaque, composed of tens or hundreds of spores which separate by pressure. *Spores* globose, subglobose, ellipsoidal to slightly irregular, $4-5 \times 5-6.5$ μm , yellowish-brown, somewhat lighter on one side; wall uneven, 0.5-1 μm thick, apparently smooth to very

finely punctate, in SEM finely, moderately densely verruculose. *Sterile cells* absent.

Host: Chrysopogon aciculatus (Retz.) Trin. (*Andropogon aciculatus* Retz.).

Known distribution: S. and E. Asia, Philippines, Indonesia, Papua New Guinea, Australia.

***Sporisorium azmatii* (Mundk.) Vánky, comb. nov.**

Basionym: \equiv *Sorosporium azmatii* Mundkur, Trans. Brit. Mycol. Soc. 23: 115, 1939. —

Type on *Chrysopogon caeruleus* (Steudel) Watson, India, Mysore, Bilikere, 19 September 1903, C.A. Barber, HClO 7734; isotypes IMI, HUV 17270!

Sori destroying the whole inflorescence, long cylindrical, 0.5-1 \times 20-40 mm, completely hidden by the uppermost leaf sheaths, from which only the long, filiform columella is protruding. *Sori* covered also by a yellowish-brown peridium which later ruptures disclosing the blackish-brown, granular-powdery mass of spore balls surrounding a long, filiform columella. *Spore balls* semi-permanent, variable in shape and size, ovoid, ellipsoidal, elongated or irregular, 25-60(-70) \times 30-100(-120) μ m, reddish-brown to subopaque, composed of tens to hundred of spores which separate by pressure. *Spores* globose, subglobose, ellipsoidal to subpolyhedrally irregular, 6.5-9.5 \times 7-10.5 μ m, dimorphic; outer spores reddish-brown; wall uneven, 0.5-1.5 μ m thick, densely, finely verrucose-echinulate on the free surface, spore profile wavy to finely serrulate; inner spores pale yellowish-brown; wall even or nearly so, ca. 0.5 μ m thick, smooth. *Sterile cells* between the spore balls not seen.

Host: Chrysopogon caeruleus (Steudel) Watson.

Known distribution: S. Asia (India). Known only from the type locality.

Herbert and Langdon (1941: 2) considered *Sorosporium azmatii* to be a synonym of *S. tumefaciens* McAlpine, which is a different species.

***Sporisorium chrysopogonis* Vánky, 1983: 327.**

Type on *Chrysopogon montanus* Trin. (= *C. fulvus* (Sprengel) Choiv.), Sri Lanka (Ceylon), North Central Province, Polonnaruwa Distr., Habarane, alt. 250 m, 18 March 1974, K. Vánky, HUV 6685!; isotypes in Vánky, Ust. exs. no. 407.

Sori destroying the whole inflorescence, partially concealed by the leaf sheath, elongated, cylindrical, 1-2 mm wide, 1-4 cm long, *sori* exceptionally confined to the spikelets only, at first covered by a thick, yellowish-brown, fungal peridium, composed of long chains of hyaline, elongated cells, 4-9 \times 4-22 μ m. The peridium ruptures from its apex, disclosing the black, granular-powdery mass of spore balls and numerous filiform columellae of host origin. *Spore balls* globose, ovoid to slightly irregular, 32-56 \times 36-80(-88) μ m, reddish-brown, composed of (6-)10-75? spores which separate by hard

pressure. *Spores* 8-13 × 9-14(-16) µm, dimorphic; outer spores globose, subglobose, ovoid to slightly irregular, reddish-brown; wall uneven, 0.8-1.5 µm, verrucose-echinulate on the free surface, smooth on the contact sides, spore profile wavy to finely serrulate; inner spores subpolyhedrally irregular, subhyaline to pale yellowish-brown; wall even, *ca.* 0.5 µm, smooth.

Hosts: *Chrysopogon fulvus* (Sprengel) Choiv. (*C. montanus* Trin.), *Chrysopogon* sp.

Known distribution: S. Asia (Pakistan, Sri Lanka).

Sporisorium chrysopogonis-grylli (Thirum. & Pavgi) Vánky, **comb. nov.**

Basionym: ≡ *Sphacelotheca chrysopogonis-grylli* Thirumalachar & Pavgi, Sydowia 20: 23, 1967(1968). — **Type** on *Chrysopogon gryllus* (L.) Trin., India, Kashmir, at Trehgaum, 15 June 1953, M.S. Pavgi 1238.

‘*Sori* in the inflorescence destroying it completely, long, cylindrical, 2 to 3 cm long and 1.5 to 2.5 mm broad, covered at first by a pinkish false membrane which soon ruptures exposing the dark spore mass and a long, simple columella. Mature *spores* reddish-brown, globose to subglobose, oval and measuring 10 to 15 µm in diameter with a mean of 11.5 µm. Epispore thick and minutely echinulate. *Sterile cells* of the membrane hyaline, irregularly globoid, thick walled, smooth and measuring 8.75 to 11.25 µm in diameter.’

Host: *Chrysopogon gryllus* (L.) Trin.

Known distribution: S. Asia (India). Known only from the type collection.

It is not known where the type specimen is deposited (Dr. M.S. Pavgi, pers. comm.). It is not in HClO or in IMI. The description above is taken from the original. The fungus belongs to the genus *Sporisorium*. It is different from all known *Sporisorium* species on *Chrysopogon*.

Sporisorium fallax R.G. Shivas & J.H. Cunnington, in Shivas, Cunnington & Vánky, 2004: 149.

Type on *Chrysopogon fallax* S.T. Blake, Australia, Northern Territory, 268 km SE of Katherine, alt. 250 m, 15 March 2000, R.G. Shivas, I.T. Riley, C. & K. Vánky. **Holotype** in BRIP 27687; **isotypes** in HUV 18119 and VPRI 31661; **paratypes** on *C. fallax*, Stuart Highway, near ‘Todd’s Monument’, 16 March 2000, R.G. Shivas, I.T. Riley, C. & K. Vánky, BRIP 27031, HUV 20374 and VPRI 31526; 349 km N of Alice Springs, near ‘Devil’s Marbles’, alt. 460 m., 15 March 2000, R.G. Shivas, I.T. Riley, C. & K. Vánky, BRIP 27690, HUV 20375; on *C. latifolius* S.T. Blake, Northern Territory, Litchfield National Park, near Lake Rum Jungle, alt. 140 m., 13 March 2000, R.G. Shivas, I.T. Riley, C. & K. Vánky, BRIP 27685, HUV 20376.

Sori destroying the entire inflorescence, elongated cylindrical, *ca.* 0.5 × 5 cm, partly concealed by leaf sheath, at first covered by a thick, greyish

peridium which ruptures and flakes away at maturity exposing the black, powdery mass of loose spore balls and several, long, filiform columellae. *Spore balls* globose, subglobose to ovoid, 30-65 × 30-85 µm, dark reddish-brown, semipermanent. *Spores* dimorphic; outer spores globose, subglobose to subpolyhedrally irregular, 6-8 × 6-10 µm, dark reddish-brown; wall 1-3 µm thick, densely verruculose on the free surface; inner spores globose, subglobose to subpolyhedrally irregular, often angular, 7-10 × 8-12 µm, pale yellowish-brown to medium reddish-brown; wall 0.5-1 µm thick, densely punctate-verruculose. *Sterile cells* not seen.

Host: Chrysopogon fallax S.T. Blake, *C. latifolius* S.T. Blake.

Known distribution: Australia.

***Sporisorium tumefaciens* (McAlpine) Vánky, 1983: 328**

≡ *Sorosporium tumefaciens* McAlpine, 1910: 184. — **Lectotype (designated here)** on *Stipa pubescens* R. Br. (= misnamed *Chrysopogon* sp., S.T. Blake in Herbert & Langdon, 1941: 2, confirmed), Australia, Queensland, near Cloncurry, 10 May 1909, G.H. Robinson, VPRI 2978!

Sori destroying the whole inflorescence, swollen, elongated, narrow ovoid, broadly fusiform or long cylindrical, 0.2-0.8(-1) × 0.5-5 cm, partly hidden by the uppermost leaf sheath, at first covered by a whitish to yellowish-brown, tough peridium which ruptures irregularly, often in several places, to disclose the blackish-brown, granular-powdery mass of spore balls and numerous filiform columellae. *Spore balls* subglobose, ellipsoidal, irregular, 30-70 × 30-80(-100) µm, dark reddish-brown, composed of tens to hundreds of easily separating spores. *Spores* subellipsoidal, ovoid, oblong to slightly irregular, (6-)6.5-8 × 7-10.5(-11) µm, yellowish-brown; wall even to slightly uneven, 0.5-1 µm thick, from apparently smooth to finely, densely punctate or verruculose; spore profile smooth. *Sterile cells* in irregular groups, collapsed in old specimens, hyaline to yellowish tinted.

Hosts: On *Chrysopogon aciculatus* (Retz.) Trin., *C. caeruleus* (Steudel) Watson, *C. fallax* S.T. Blake, *C. latifolius* S.T. Blake, *C. pallidus* (R. Br.) Trin. ex Steudel, *Chrysopogon* sp.

Known distribution: S. Asia (India, Sri Lanka), Australia.

McAlpine (1910: 184) when describing *Sorosporium tumefaciens*, mentioned two syntypes both collected by Robinson from the same place on the same date. One was on ‘*Stipa* sp.’ (no. 202/09), the other on ‘*Stipa pubescens*’ (no. 200/09). Later, both collections have been divided into two envelopes. No. 202/09 was filed as VPRI 2975 and VPRI 2976, no. 200/09 as VPRI 2977 and VPRI 2978.

R.F. Langdon studied these specimens and in 1976 noted inside the envelope that no. 202/09 on ‘*Stipa* sp.’ represents *Heteropogon contortus*

infected by *Sorosporium caledonicum* Pat. (= *Sporisorium caledonicum* (Pat.) Vánky, confirmed). The host plant of no. 200/09 is *Chrysopogon* sp., infected by *S. tumefaciens* (Herbert and Langdon, 1941: 2). Of the syntypes, the richer sample of *S. tumefaciens*, that of VPRI 2978 is designated as lectotype, VPRI 2977 being isolectotype.

***Sporisorium tumiforme* Vánky & R.G. Shivas, sp. nov.** (Figs. 1-3)

Typus in matrice *Chrysopogon latifolius* S.T. Blake, Australia, Western Australia, Kimberley region, pr. Kalumburu, 14°17' S, 126°39' E, alt. cca. 30 m.s.m., 21 February 1996, leg. A.A. Mitchell, C. & K. Vánky. **Holotypus** in Herbario Ustil. Vánky, HUV 17791; **isotypi** in BRIP 26384, et in Vánky, Ust. exs. no. 974, ut *Sporisorium tumefaciens*. **Paratypus** in matrice *Chrysopogon pallidus* Trin. ex Steudel, Australia, Western Australia, cca. 150 km SE urbe Broome, Shamrock Station, 18°46'01" S, 122°05'34" E, 26 March 1996, leg. A.A. Mitchell 4302. **Paratypi** in PERTH 4176235 et in HUV 18803!

Sori inflorescentiam totam destruentes, tumefacti, elongatocylindrici, 0.5-0.8 × 5-10 cm, vagina folii supremi partim obtecti, primo peridio crasso, albido usque flavidobrunneo cooperti, quo irregulariter rupto massam nigrobrunneam, granulosopulveream glomerulorum sporarum et columellarum multarum, filiformium ostendentes. *Glomeruli sporarum* subglobosi usque late ellipsoidales, 30-60(-70) × 40-70(-80) μm, rubrobrunnei, e pluribus decem sporis, pressu faciliter separabilibus compositi. *Sporae* globosae, ellipsoidales usque subpolyedrice parum irregulares, (7-)8-10.5 × 8-13 μm, flavidobrunneae; pariete aequali, vel parum inaequali, 0.5-0.8 μm crasso, leniter, dense verruculoso usque verruculoso-echinulato, in SEM dense, uniforme verrucoso; imago obliqua sporarum undulata usque leniter serrulata. *Cellulae steriles* paucae, in catervis irregularibus, cellulae singulares earum globosae, ellipsoidales usque parum irregulares, magnitudine variae, 9-23 μm longae, hyalinae; pariete 0.5-1 μm crasso, levi.

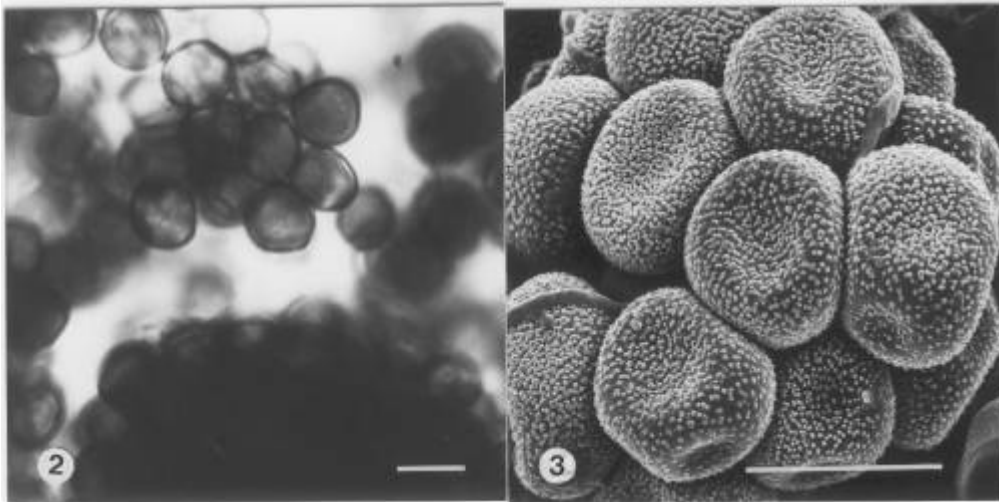
Sori (Fig. 1) destroying the whole inflorescence, swollen, long cylindrical, 0.5-0.8 × 5-10 cm, partly hidden by the uppermost leaf sheath, at first covered by a whitish to yellowish-brown, thick peridium which ruptures irregularly disclosing the blackish-brown, granular-powdery mass of spore balls and numerous filiform columellae. *Spore balls* (Figs. 2, 3) subglobose to broadly ellipsoidal, 30-60(-70) × 40-70(-80) μm, reddish-brown, composed of tens of spores which separate easily by pressure. *Spores* (Figs. 2, 3) globose, ellipsoidal to subpolyhedrally slightly irregular, (7-)8-10.5 × 8-13 μm, yellowish-brown; wall even or slightly uneven, 0.5-0.8 μm thick, finely, densely verruculose to verruculose-echinulate, in SEM densely, uniformly verrucose; spore profile wavy to finely serrulate. *Sterile cells* few, in irregular groups, single cells globose, ellipsoidal to slightly irregular, variable in size, 9-23 μm long, hyaline; wall 0.5-1 μm thick, smooth.

Hosts: *Chrysopogon fallax* S.T. Blake, *C. latifolius* S.T. Blake, and *C. pallidus* (R. Br.) Trin. ex Steudel.

Known distribution: Australia.



Fig. 1. A sorus of *Sporisorium tumiforme* Vánky & R.G. Shivas on *Chrysopogon latifolius* S.T. Blake (from holotype). To the left a healthy inflorescence. Bar = 1 cm.



Figs. 2, 3. Spore balls and spores of *Sporisorium tumiforme* Vánky & R.G. Shivas on *Chrysopogon latifolius* S.T. Blake, in LM and in SEM (from holotype). Bars = 10 µm.

Sporisorium tumiforme differs from *S. tumefaciens* by the larger, more evidently ornamented spores and also in having more regular spore balls and spores.

Small variations in the spore measurements ($\pm 1 \mu\text{m}$) and in the spore wall thickness ($\pm 0.2 \mu\text{m}$) may occur between different collections of *S. tumiforme*.

Key to the smut fungi of *Chrysopogon*

M = *Macalpinomyces*; *S* = *Sporisorium*

- | | | |
|----|---|----------------------------|
| 1. | Sori tubular, in the distal part of the stems | 2 |
| 1. | Sori not tubular, not in the distal part of the stems | 3 |
| 2. | Spores 8-11 µm long, densely echinulate | <i>M. chrysopogonicola</i> |
| 2. | Spores 4-6(-6.5) µm long, verrucose | <i>M. effusus</i> |
| 3. | Sori in hypertrophied spikelets. Spores with acute, pyramidal warts | <i>M. tubiformis</i> |
| 3. | Sori in the whole inflorescence. Spores otherwise ornamented..... | 4 |
| 4. | Spores dimorphic, i.e. outer and inner spores in a ball different | 5 |
| 4. | Spores not dimorphic..... | 7 |
| 5. | Spores 9-14(-16) µm long..... | <i>S. chrysopogonis</i> |
| 5. | Spores smaller | 6 |
| 6. | Spores 7-10.5 µm long. Columella one | <i>S. azmatii</i> |
| 6. | Spores 6-10 µm long. Columella several..... | <i>S. fallax</i> |

7. Spores 5-6.5 µm long.....*S. andropogonis-aciculati*
 7. Spores larger 8
8. Spores 10-15 µm long. Columella one *S. chrysopogonis-grylli*
 8. Spores smaller. Columella several 9
9. Spores 7-10.5(-11) µm long. Spore profile smooth *S. tumefaciens*
 9. Spores 8-13 µm long. Spore profile wavy to finely serrulate *S. tumiforme*

HOST-PARASITE LIST

Ch. = *Chrysopogon*; *M.* = *Macalpinomyces*; *S.* = *Sporisorium*

?*Arundinella bengalensis* – *M. effusus*
Capillipedium parviflorum – *M. chrysopogonicola*
Ch. aciculatus – ?*M. effusus*, *S. andropogonis-aciculati*, *S. tumefaciens*
Ch. caeruleus – *S. azmatii*, *S. tumefaciens*
Ch. echinulatus – *M. chrysopogonicola*
Ch. fallax – *M. tubiformis*, *S. fallax*, *S. tumefaciens*, *S. tumiforme*
Ch. fulvus – *M. chrysopogonicola*, *S. chrysopogonis*
Ch. gryllus – *M. chrysopogonicola*, *S. chrysopogonis-grylli*
Ch. latifolius – *S. fallax*, *S. tumefaciens*, *S. tumiforme*
Ch. pallidus – *S. tumefaciens*, *S. tumiforme*
Ch. sp. – *S. chrysopogonis*, *S. tumefaciens*
Vetiveria zizanioides – *M. effusus*

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