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A new smut fungus on a new grass: *Sporisorium capillipedii-alpini* (Ustilaginales) sp. nov. infecting *Capillipedium alpinum* (Poaceae) sp. nov., from Sichuan, China

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Abstract

A new smut fungus, *Sporisorium capillipedii-alpini* (Ustilaginales), and a new species of grass, *Capillipedium alpinum* (Poaceae), on which it is growing, are described and illustrated. The collections were made in western Sichuan, China. *Capillipedium alpinum* differs from other species of *Capillipedium* by its diminutive size and short, slender inflorescence. *Sporisorium capillipedii-alpini* is compared with the species of *Sporisorium* with similar symptoms (destroying all spikelets of an inflorescence) that infect *Capillipedium*, *Botriochloa*, and *Dichanthium*. The new smut fungus differs from these species as follows: from *Sporisorium taianum* by having larger spores with minutely echinulate spore walls, from *S. dichanthicola* by having larger spores, from *S. sahayae* by having lower spore wall ornamentation and thinner spore walls, from *S. andropogonis-annulati* by having larger spores, and smaller sterile cells with thinner walls, and from *S. mysorensis* by possessing minutely echinulate spore walls and differently colored spores and sterile cells. The types of *S. andropogonis-annulati*, *S. mysorensis*, and *S. sahayae* were re-examined and detailed descriptions of these species are given. A key to the smut fungi of *Sporisorium*, that infect *Capillipedium*, *Botriochloa*, and *Dichanthium* and destroy all spikelets of the inflorescence of an infected plant, is also provided.

Key words: Andropogoneae, *Anthracoystis*, Asia, *Capillipedium*, China, Hengduan Mountains, Poaceae, Sichuan, smut fungi, *Sporisorium*, taxonomy, Ustilaginaceae

Introduction

A revision of smut fungi on grasses kept in the herbaria of Harvard University yielded a new species of *Sporisorium* (Ustilaginales) on two gatherings of *Capillipedium* (Poaceae, Andropogoneae) collected in China by Boufford *et al.* (nos 28703 & 29019).

This grass species had been identified by Lang Liu [L. Liou] as *Capillipedium alpinum* L. Liou. It was distributed to other herbaria under that name. Liu apparently intended to publish *C. alpinum* as a new species, but passed away in 2001 before doing so. The species, using the name Liu proposed, is described and illustrated herein.

Capillipedium Stapf (Poaceae) is a small genus in the tribe Andropogoneae Dumort., subtribe Anthistiriinae J. Presl (including 244 species in 16 genera) (Soreng *et al.* 2015). *Capillipedium* comprises 17 species (Clayton *et al.* 2015) characterized by delicate panicles with subdivided branches bearing short racemes comprising 1–5(–8) units of paired spikelets, 1 sessile, the other pedicellate, with terminal spikelets in triplets. Spikelets in the unit are not homogamous (i.e. sexually alike), with sessile spikelets being fertile while pedicellate spikelets are sterile (Clayton & Renvoize 1999, Clayton *et al.* 2015). Five species of *Capillipedium* are reported from China (Chen & Phillips 2006).

According to Clayton & Renvoize (1999), the boundaries between *Botriochloa*, *Capillipedium*, and *Dichanthium* are somewhat blurred. Because of this, in the taxonomic treatments of Vánky (2004, 2011) the smut fungi on *Capillipedium* are considered together with the species on *Botriochloa* and *Dichanthium*.

Twenty species of smut fungi are recognized on *Capillipedium*, *Botriochloa*, and *Dichanthium*, as follows: two species of *Jamesdicksonia*, two of *Macalpinomyces*, three of *Anthracoystis*, and 13 of *Sporisorium* (Vánky 2011). The aforementioned unknown species on *Capillipedium* belongs to the genus *Sporisorium*.

A modern concept for the smut fungi of *Anthracoystis* and *Sporisorium* (Ustilaginaceae) was presented by McTaggart *et al.* (2012a, b), who distinguished these genera on the bases of morphological characters and molecular data. The following morphological features are characteristic of the members of *Sporisorium*: (i) presence of a stout, cylindrical or woody, branched or unbranched columella, (ii) absence of spore balls, and (iii) presence of sterile cells, formed from non-sporogenous hyphae (McTaggart *et al.* 2012b).

Seven of the thirteen known species of *Sporisorium* destroy the whole inflorescence. *Sporisorium doidgeae* possesses variable sori that destroy the entire inflorescence, only some branches of the inflorescence or some racemes or some spikelets of a raceme (Ling 1953, as *Sphacelotheca capillipedii*; Vánky 2011). The remaining six species (including the new, undescribed species) destroy all spikelets of an inflorescence, but not the entire inflorescence.

In the present article, a new smut fungus on *Capillipedium alpinum* is described and illustrated. A key to the species of *Sporisorium*, that infect *Capillipedium*, *Botriochloa*, and *Dichanthium*, and destroy all spikelets of the inflorescence, is also provided.

Material and methods

The morphological description and illustrations of *Capillipedium alpinum* are based on dried specimens collected from Sichuan Province, China. These specimens are kept at Harvard University, Cambridge (A), the Department of Botany, California Academy of Sciences, San Francisco (CAS), the Kunming Institute of Botany, Chinese Academy of Sciences, Kunming (KUN), and the Institute of Botany, Chinese Academy of Sciences, Xiangshan, Beijing (PE).

Dried specimens of smut fungi from the herbaria of Harvard University (A), the Royal Botanic Garden Edinburgh (E), the Queensland Department of Agriculture and Fisheries, Brisbane (BRIP), and the Herbarium Ustilaginales Vánky (H.U.V., kept at BRIP) were examined under light microscope (LM) and scanning electron microscope (SEM). For LM observations and measurements, spores were mounted in lactoglycerol solution (w : la : gl = 1 : 1 : 2) on glass slides, gently heated to the boiling point to rehydrate the spores, and then cooled. The measurements of spores are given as min–max (mean \pm 1 standard deviation). In the descriptions, the total number of spores (n) from all collections (x) measured are given in the form '(n/x)'. For SEM, the spores were attached to specimen holders by double-sided adhesive tape and coated with gold (JEOL JSM-5510) or platinum-palladium (JEOL JSM-7600F) in an ion sputter. The surface structure of the spores was observed and photographed at 10 kV accelerating voltage using JEOL JSM-5510 (Figs 15, 19, 24, 25) and JEOL JSM-7600F (Figs 8–11) scanning electron microscopes. The description of spore ornamentation is in accordance with Denchev *et al.* (2013). The height of the wall ornaments (warts and spines) was measured using SEM. The descriptions of smut fungi given below are based entirely on the specimens examined.

The map was generated with SimpleMappr (Shorthouse 2010).

A new species of *Capillipedium* from Sichuan Province

Capillipedium alpinum H. Sun & Boufford, *sp. nov.* (Figs 1–3)

[*Capillipedium alpinum* L. Liou, in sched. (nom. inval.)]

高山细柄草, gaoshan xibingcao

Type:—CHINA. Sichuan Province: Xiangcheng Xian, Siqu; meadow, 3500 m, 11 August 1981, leg. *Qinghai-Tibet Expedition Team 4564* (KUN, holotype; PE, isotype).

Diagnosis:—Differing from other species of *Capillipedium* (Poaceae) in its diminutive size, to 25 cm tall, short, narrow inflorescence, 1–5 \times 0.4–1 cm and sessile spikelet 3–3.2 mm long.

Etymology:—Epithet derived from the high elevation habitats (2700–3650 m) in the Hengduan Mountains, China, where it occurs.

Herbs, *perennial*. *Culms* tufted, 5.5–25 cm tall, unbranched; nodes bearded. *Leaf sheaths* spreading or slightly reflexed hispid, densely ciliate at mouth; *leaf blades* 1.5–12 \times 1.5–3.5 mm, scaberulous, with tubercle-based long hairs, trichomes more tufted at base of blade, becoming sparse apically, base merging smoothly with sheath, tapering smoothly to apex; *ligules* scarious 0.3–0.5 mm long. *Inflorescences* thyrsoid panicles, 1–5 \times 0.4–1 cm; branches erect or ascending, glabrous, green with purple streaks or wholly purple; nodes with few long hairs or glabrous; *racemes*

composed of 1 or 2 spikelet pairs below terminal triad, purple; rachis internodes and pedicels glabrous. *Sessile spikelets* 3–3.2 mm long; lower glume lanceolate, grayish purple, slightly glossy, dorsally 3- or faintly to conspicuously 5- or 7-veined, scarcely depressed along midline, glabrous or with ascending stiff trichomes, glabrous above middle, margins scarious, apex gradually tapering, acute; upper glume ciliate or glabrous along margins; awn of upper lemma 4–15 mm long, twisted, slightly to conspicuously scaberulous. *Pedicellate spikelets* equaling sessile spikelets, staminate or bisexual. *Chromosome number* unknown.

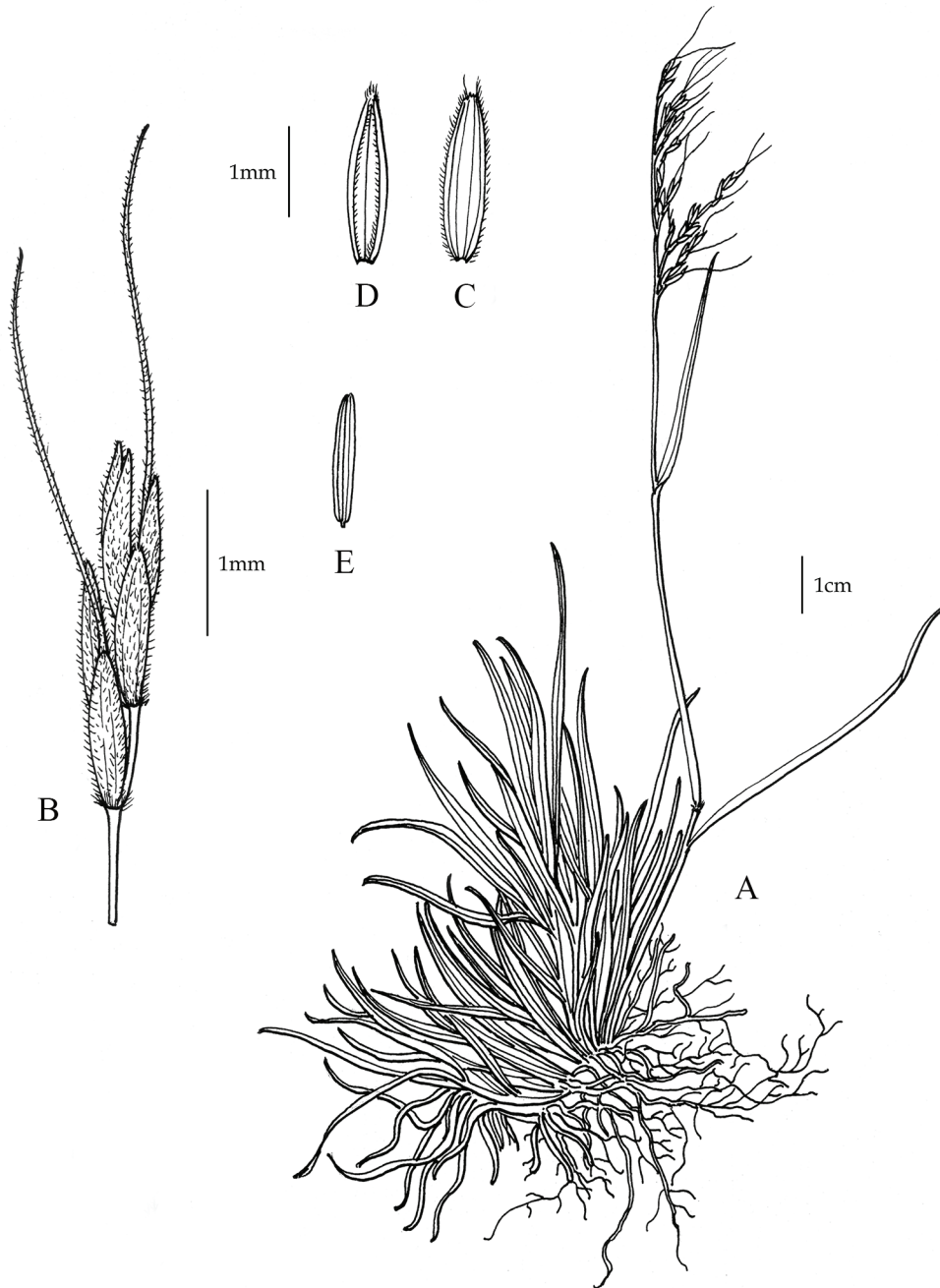


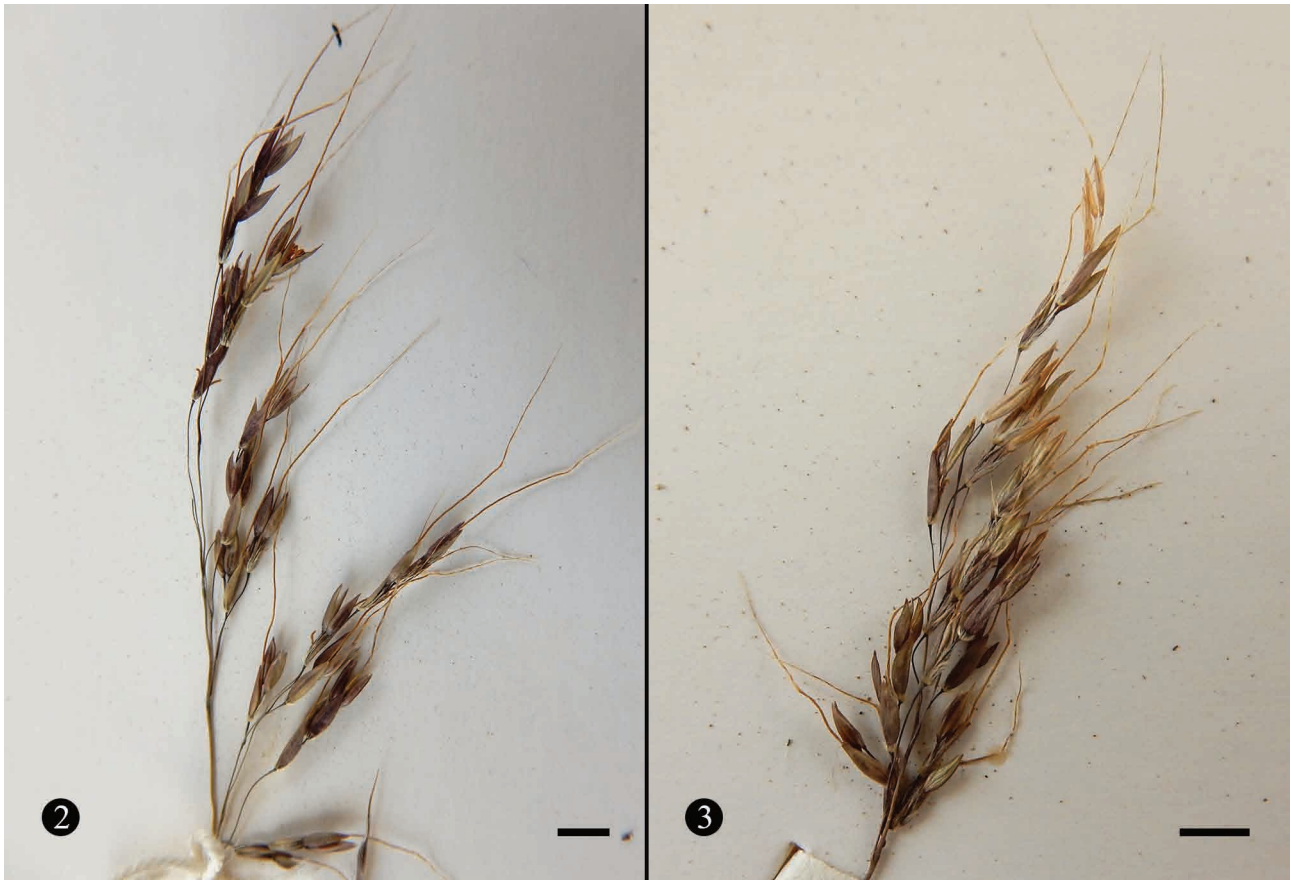
FIGURE 1. *Capillipedium alpinum* H. Sun & Boufford (holotype, KUN). A. Habit. B. Spikelet. C. Lower glume. D. Upper glume. E. Lemma. Scale bars: A = 1 cm, B–E = 1 mm. Drawn by Ling Wang.

Phenology:—Flowering and fruiting: summer.

Distribution and habitat:—China, Sichuan Province; dry, open slopes and meadows, 2700–3650 m (Fig. 26).

Additional specimens examined:—CHINA. Sichuan Province: Xiangcheng Xian, vicinity of the town of Reda, 29°6'11"N, 99°37'55"E, 3450–3650 m. Dry slopes with cut over *Quercus*, *Pinus*, *Berberis*, *Cotoneaster*. Open meadow, 15 July 1998, D.E. Boufford, B. Bartholomew, C.Y. Chen, M.J. Donoghue, R.H. Ree, H. Sun & S.K. Wu 28703 (A, CAS, KUN); Sichuan Province: Xiangcheng Xian, Xiarewu, on road between Xiangcheng and Daxue Shan

(road to Zhongdian from Xiangcheng), 28°47'32"N, 99°50'14"E, 2700 m. Spinescent shrub community on dry, stony slopes above Souqu River. Meadow near marshland, 22 July 1998, *D.E. Boufford, B. Bartholomew, W.Y. Chen, M.J. Donoghue, R.H. Ree, H. Sun & S.K. Wu 29019* (A, CAS, KUN).



FIGURES 2–3. Inflorescences of *Capillipedium alpinum* H. Sun & Boufford (holotype, KUN). Scale bars = 3 mm.

Comments:—*Capillipedium alpinum* is much smaller than its congeners in mainland China, which range from half a meter to over three meters tall. The closest in stature to *C. alpinum* in China is *C. kwashotense* (Hayata) C.C. Hsu, which is restricted to seaside habitats in eastern Taiwan and to Iriomote Island in southern Japan.

Sporisorium capillipedii-alpini* (Ustilaginales), a new smut fungus on *Capillipedium alpinum

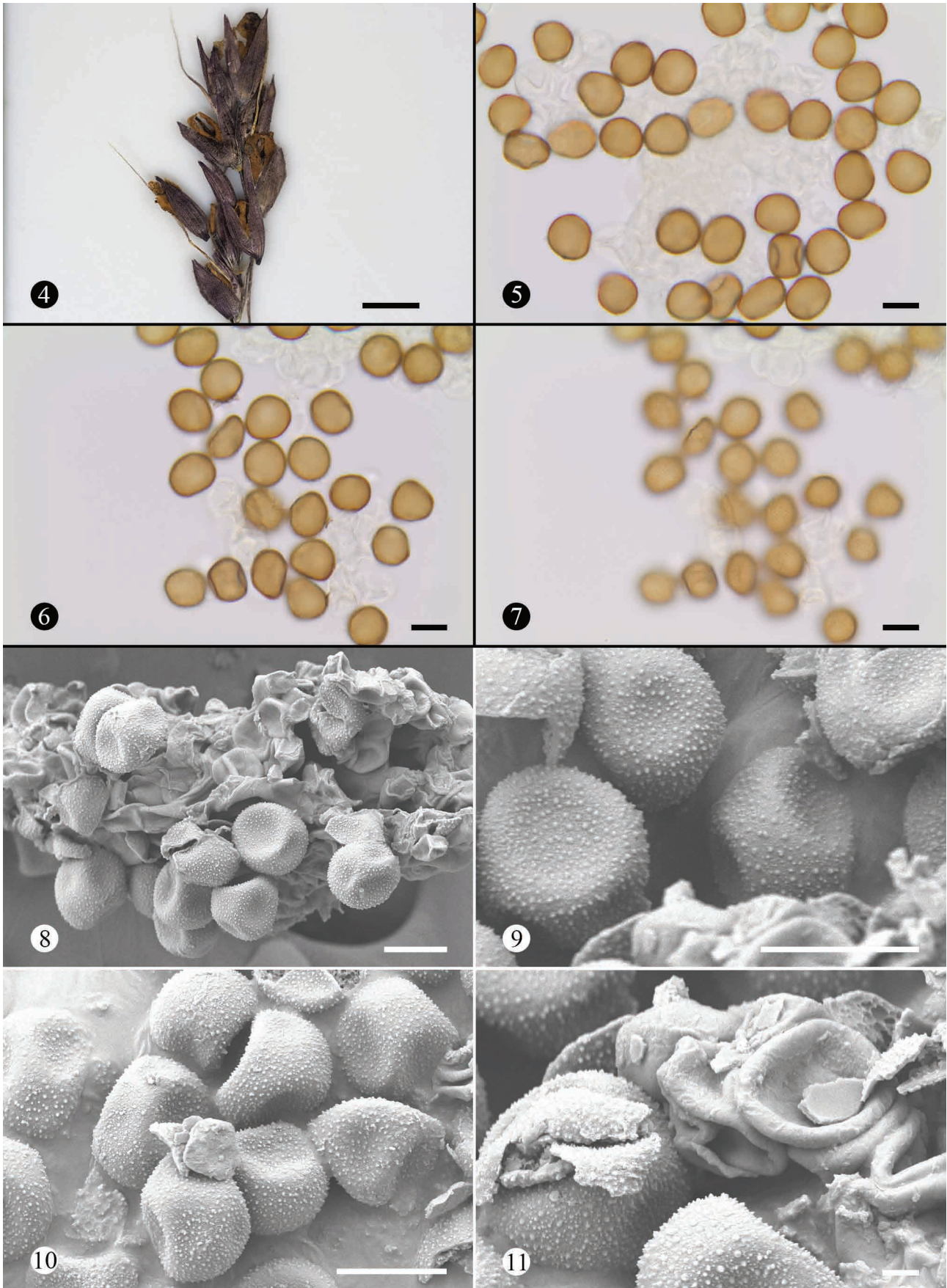
Sporisorium capillipedii-alpini T. Denchev & Denchev, *sp. nov.* (Figs 4–11)

Index Fungorum number: IF551695

Type:—On *Capillipedium alpinum* H. Sun & Boufford (Poaceae). CHINA. Sichuan Province: Xiangcheng Xian, Xiarewu, on road between Xiangcheng and Daxue Shan (road to Zhongdian from Xiangcheng), spinescent shrub community on dry, stony slopes above Souqu River, 28°47'32"N, 99°50'14"E, 2700 m, 22 July 1998, leg. *D.E. Boufford, B. Bartholomew, W.Y. Chen, M.J. Donoghue, R.H. Ree, H. Sun & S.K. Wu 29019* (BRIP 63 636, holotype).

Diagnosis:—*Sporisorium capillipedii-alpini* differs from the species of *Sporisorium* that infect *Capillipedium*, *Botriochloa*, and *Dichanthium* and destroy all spikelets of the inflorescence, as follows: from *Sporisorium taianum* by having larger spores with minutely echinulate spore walls, from *S. dichanthicola* by having larger spores, from *S. sahayae* by having lower spore wall ornamentation and thinner spore walls, from *S. andropogonis-annulati* by having larger spores and smaller sterile cells with thinner walls, and from *S. mysorensis* by possessing minutely echinulate spore walls and differently colored spores (medium yellow-brown with purplish tint) and sterile cells (hyaline).

Etymology:—Epithet derived from the host plant, *Capillipedium alpinum*.



FIGURES 4–11. *Sporisorium capillipedii-alpini* T. Denchev & Denchev on *Capillipedium alpinum* (holotype, BRIP 63 636). 4. Habit. 5–7. Spores in LM. 5, 6. In median view. 7. In surface view. 8–11. Spores in SEM. Scale bars: 4 = 0.2 cm, 5–8 = 10 µm, 9, 10 = 5 µm, 11 = 2 µm.

Sori in all spikelets (sterile and fertile) of the inflorescence, 1.2–2.5 × 0.4–0.8 mm, ellipsoidal or fusiform, partially visible between the spreading glumes; initially covered by a thick, yellow-brown peridium that soon ruptures irregularly, exposing a single, stout, tapering, sometimes with a few short branches, columella as long as the sorus and with shallow longitudinal furrows, surrounded by a powdery, blackish brown mass of spores and sterile cells. *Sterile cells* in irregular groups, single sterile cells uncommon; globose, subglobose, broadly ellipsoidal or irregular, often collapsed, (6–)7.5–12(–14.5) µm long, usually smaller than the spores, hyaline; wall 0.5–0.8 µm thick, smooth. *Spores* subglobose, broadly ellipsoidal, slightly irregular, globose, ovoid or sometimes ellipsoidal, (10.5–)11.5–14.5(–15.5) × (9.5–)10.5–13(–14) (12.7 ± 0.8 × 11.5 ± 0.7) µm (n/2 = 300), medium yellow-brown with purplish tint; wall more or less evenly thickened, 0.6–0.9 µm thick, in LM minutely verruculose, spore profile not affected or slightly affected. In SEM sparsely minutely echinulate, spinules up to 0.2 µm high, spore surface punctate between the spinules.

Known host and distribution:—On Poaceae: *Capillipedium alpinum*, Asia (China, Sichuan) (Fig. 26).

Additional specimen examined:—On *Capillipedium alpinum*. CHINA. Sichuan Province: Xiangcheng Xian, Reda, vicinity of the town of Reda, dry slopes with cut over forest of *Quercus*, *Pinus*, *Berberis*, *Cotoneaster*, 29°6'11"N, 99°37'55"E, 3450–3650 m, 15 July 1998, leg. D.E. Boufford, B. Bartholomew, W.Y. Chen, M.J. Donoghue, R.H. Ree, H. Sun & S.K. Wu 28703 (BRIP 63 637, paratype).

Comments:—*Sporisorium capillipedii-alpini* can be distinguished from the other species of *Sporisorium* that destroy all spikelets of the inflorescence of an infected plant of *Capillipedium*, *Botriochloa*, and *Dichanthium*. From *S. taianum* (Syd.) L. Guo, it differs by having larger spores, (10.5–)11.5–14.5(–15.5) µm long with minutely echinulate spore walls; *S. taianum* possesses smooth spores 6.5–8 µm long.

Sporisorium dichanthiicola (Mundk. & Thirum.) Vánky can also be differentiated by its smaller spores (5.5–9 µm long).

Sporisorium capillipedii-alpini differs from *S. sahayae* by having lower spore wall ornamentation (with spinules up to 0.2 µm high while the spines of *S. sahayae* are up to 0.4(–0.6) µm high) and thinner spore walls (0.6–0.9 µm thick versus 0.7–1.4(–1.7) µm thick for *S. sahayae*), and from *S. andropogonis-annulati* by having larger spores ((10.5–)11.5–14.5(–15.5) µm long versus (8.5–)9–12(–13) µm long for *S. andropogonis-annulati*) and smaller sterile cells with thinner walls (6–14.5 µm long, with walls 0.5–0.8 µm thick versus sterile cells 9–22 µm long, with walls 0.8–2.0(–2.5) µm thick).

Sporisorium capillipedii-alpini is distinguished from *S. mysorensis* by having a different type of spore wall ornamentation (minutely echinulate, with spinules up to 0.2 µm high; the spore walls of *S. mysorensis* are punctate, with projections up to 0.1 µm high) and differently colored spores (medium yellow-brown with purplish tint versus medium reddish brown) and sterile cells (hyaline versus subhyaline to light yellow-brown). Additionally, *S. capillipedii-alpini* possesses slightly larger spores, (10.5–)11.5–14.5(–15.5) (12.7 ± 0.8) µm long versus (9–)10–12.5(–13.5) (11.3 ± 0.7) µm long for *S. mysorensis*.

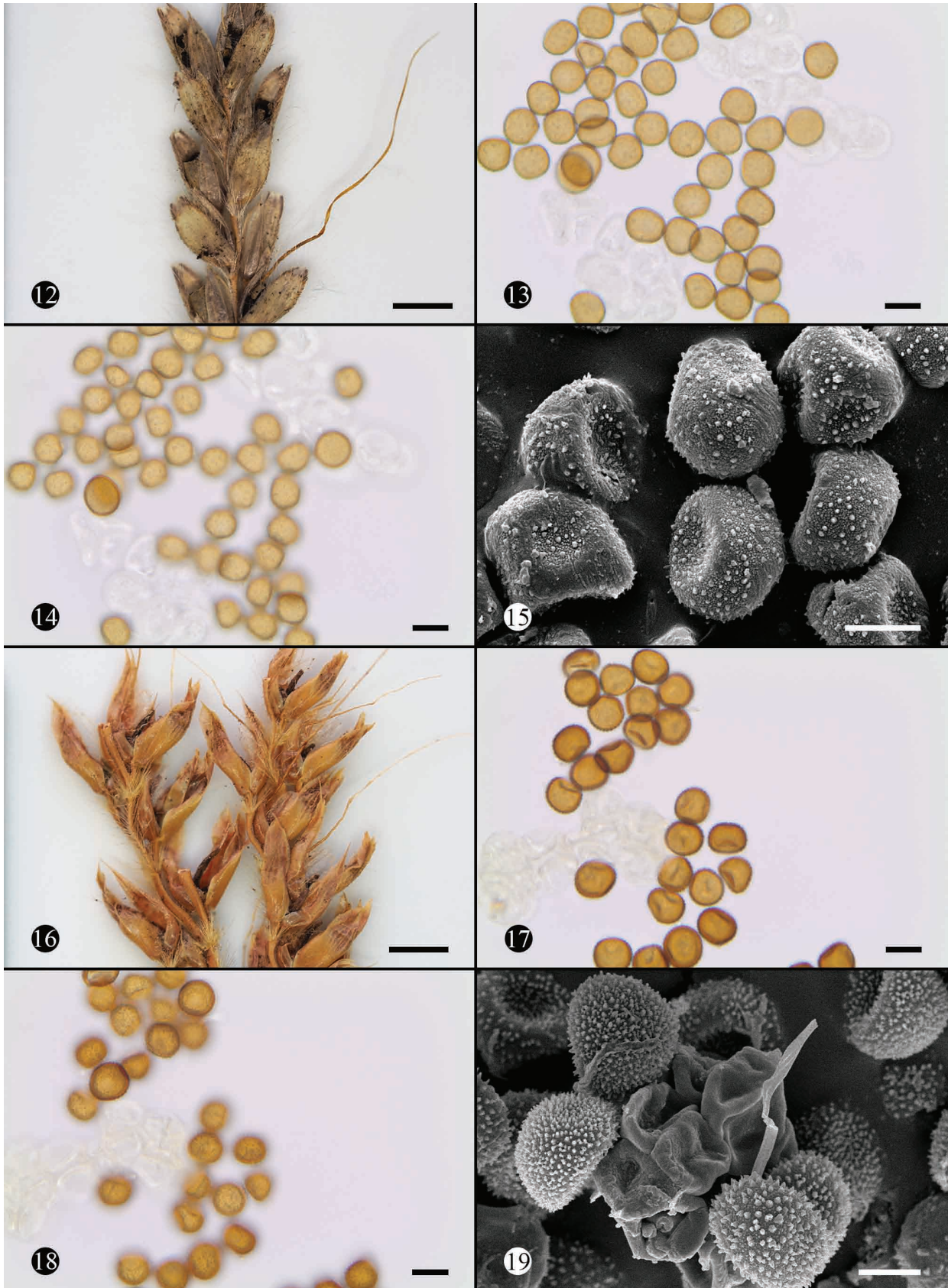
Six species of *Sporisorium* infecting *Capillipedium*, *Botriochloa*, and *Dichanthium* have been previously reported from China: *S. andropogonis*, *S. andropogonis-annulati*, *S. doidgeae*, *S. reticulatum*, *S. spinulosum*, and *S. taianum* (Sydow 1929, Ling 1945, 1953, Ling & Chen 1945, Wang 1963, Liu *et al.* 1979, Guo 1990, 2000, 2011, Wang & Piepenbring 2002, Vánky 2004, He & Guo 2009). *Sporisorium andropogonis*, *S. doidgeae*, *S. reticulatum*, and *S. spinulosum* destroy the whole inflorescence, and not just all spikelets within the inflorescence, and, as mentioned above, can easily be distinguished from *S. capillipedii-alpini*. The other two species, *S. capillipedii* (L. Ling) L. Guo and *S. andropogonis-micranthi* (L. Ling & T.L. Chen) Vánky—both on *Capillipedium parviflorum* (R. Br.) Stapf—were described from China (Ling 1945, Ling & Chen 1945) but were reduced to synonyms of *S. doidgeae* (Vánky 2004).

Sporisorium andropogonis-annulati (Bref.) S.R. Wang & M. Piepenbr., Mycol. Progress 1: 403, 2002. (Figs 12–15)

Ustilago andropogonis-annulati Bref., Unters. Gesamtgeb. Mykol. 12: 109, 1895.—*Sphacelotheca andropogonis-annulati* (Bref.) Zundel, Mycologia 22: 132, 1930.—Type: On *Dichanthium annulatum* (as *Andropogon annulatus* Forssk., Poaceae). INDIA. Uttar Pradesh: Dehra Dun, comm. D.D. Cunningham (type specimen lost in Berlin (B), during World War II).

Schroeteria annulata Ellis & Everh., J. Mykol. 6: 118, 1890.—*Sphacelotheca annulata* (Ellis & Everh.) Mundk., Trans. Brit. Mycol. Soc. 23: 92, 1939.—Type: On *Dichanthium annulatum* (as *Andropogon annulatus*, Poaceae). INDIA. Saharan Prov., 11 October 1888, leg. S.M. Tracy (holotype, BPI 192 888; isotypes, NY, H.U.V. 1858!).

For a complete list of synonyms, see Vánky (2011: 527).



FIGURES 12–15. *Sporisorium andropogonis-annulati* (Bref.) S.R. Wang & M. Piepenbr. on *Dichanthium annulatum* (isotype of *Schroeteria annulata*, H.U.V. 1858). 12. Habit. 13, 14. Spores in LM. 13. In median view. 14. In surface view. 15. Spores in SEM. Scale bars: 12 = 0.2 cm, 13, 14 = 10 μm , 15 = 5 μm . **FIGURES 16–19.** *Sporisorium sahayae* (Mundk.) Vánky on *Dichanthium annulatum* (isotype, H.U.V. 17 303). 16. Habit. 17, 18. Spores in LM. 17. In median view. 18. In surface view. 19. Spores in SEM. Scale bars: 16 = 0.2 cm, 17, 18 = 10 μm , 19 = 5 μm .

Sori in all spikelets (sterile and fertile) of the inflorescence, 2.0–3.0 × 0.7–1.2 mm, ovoid or ellipsoidal, at first concealed by the glumes, later partially visible between the spreading glumes; initially covered by a thin grayish brown peridium that soon ruptures irregularly exposing a single, stout, tapering, not branching columella with shallow longitudinal furrows, surrounded by a semi-agglutinated, at maturity pulverulent, blackish brown mass of spores and sterile cells. *Sterile cells* single or in small, irregular groups, globose, subglobose, broadly ellipsoidal or irregular, often collapsed, 9–20(–22) µm long, usually larger than the spores, hyaline; wall 0.8–2.0(–2.5) µm thick, smooth. *Spores* subglobose, slightly irregular, broadly ellipsoidal, globose or ovoid, (8.5–)9–12(–13) × (8–)8.5–10.5(–11.5) (10.3 ± 0.6 × 9.4 ± 0.7) µm ($n_1 = 100$), medium yellow-brown; wall more or less evenly thickened, 0.6–0.9 µm thick, minutely verruculose, spore profile not affected or slightly affected. In SEM minutely echinulate, spinules up to 0.3 µm high, spore surface densely punctate between the spinules.

Specimen examined:—Isotype of *Schroeteria annulata* (H.U.V. 1858).

Known host and distribution:—On Poaceae: *Dichanthium annulatum* (Forssk.) Stapf (incl. *D. annulatum* var. *bullisetosum* B.S. Sun & S. Wang), (?) *D. caricosum* (L.) A. Camus. Asia (China, Pakistan, India).

Sporisorium sahayae (Mundk.) Vánky, Fungal Diversity 15: 237, 2004 (as *S. sahayai*). (Figs 16–19)

Basionym: *Sphacelotheca sahayae* Mundk., Trans. Brit. Mycol. Soc. 23: 93, 1938 (as *S. sahayai*).

Type:—On *Dichanthium annulatum* (Poaceae). INDIA. Ganjam District: at Chatrapur, 30 August 1904, leg. *E.J. Butler* (holotype, HClO 7333; isotypes, IMI, H.U.V. 17 303!).

Sori in all spikelets (sterile and fertile) of the inflorescence, 1.5–2.5 mm long, ovoid or ellipsoidal, at first concealed by the glumes, later partially visible between the spreading glumes; initially covered by a thin, fragile, yellow-brown peridium that soon ruptures irregularly exposing a single, stout, slightly tapering, not branching columella, rarely with few shallow longitudinal furrows, surrounded by a semi agglutinated, pulverulent at maturity, blackish brown mass of spores and sterile cells. *Sterile cells* rather tightly packed in irregular groups or short rows, single sterile cells not seen, collapsed, 7–13(–16) µm long, hyaline; wall 0.6–1.2(–2.5) µm thick, smooth. *Spores* slightly irregular, subglobose, broadly ellipsoidal, globose, ovoid or sometimes ellipsoidal, (9.5–)10–13(–14) × (8.5–)9–11.5(–12.5) (11.4 ± 0.7 × 10.3 ± 0.7) µm ($n_1 = 100$), medium reddish brown; wall slightly uneven, 0.7–1.4(–1.7) µm thick, moderately echinulate, spore profile affected. In SEM spines up to 0.4(–0.6) µm high, densely packed, punctate between the spines.

Specimen examined:—Isotype (H.U.V. 17 303).

Known host and distribution:—On Poaceae: *Dichanthium annulatum* (Forssk.) Stapf, *Dichanthium sericeum* (R. Br.) A. Camus (incl. *Dichanthium affine* (R. Br.) A. Camus). Asia (India), Australia.

Sporisorium mysorensis (Pavgi & Thirum.) Vánky, Mycotaxon 54: 230, 1995. (Figs 20–25)

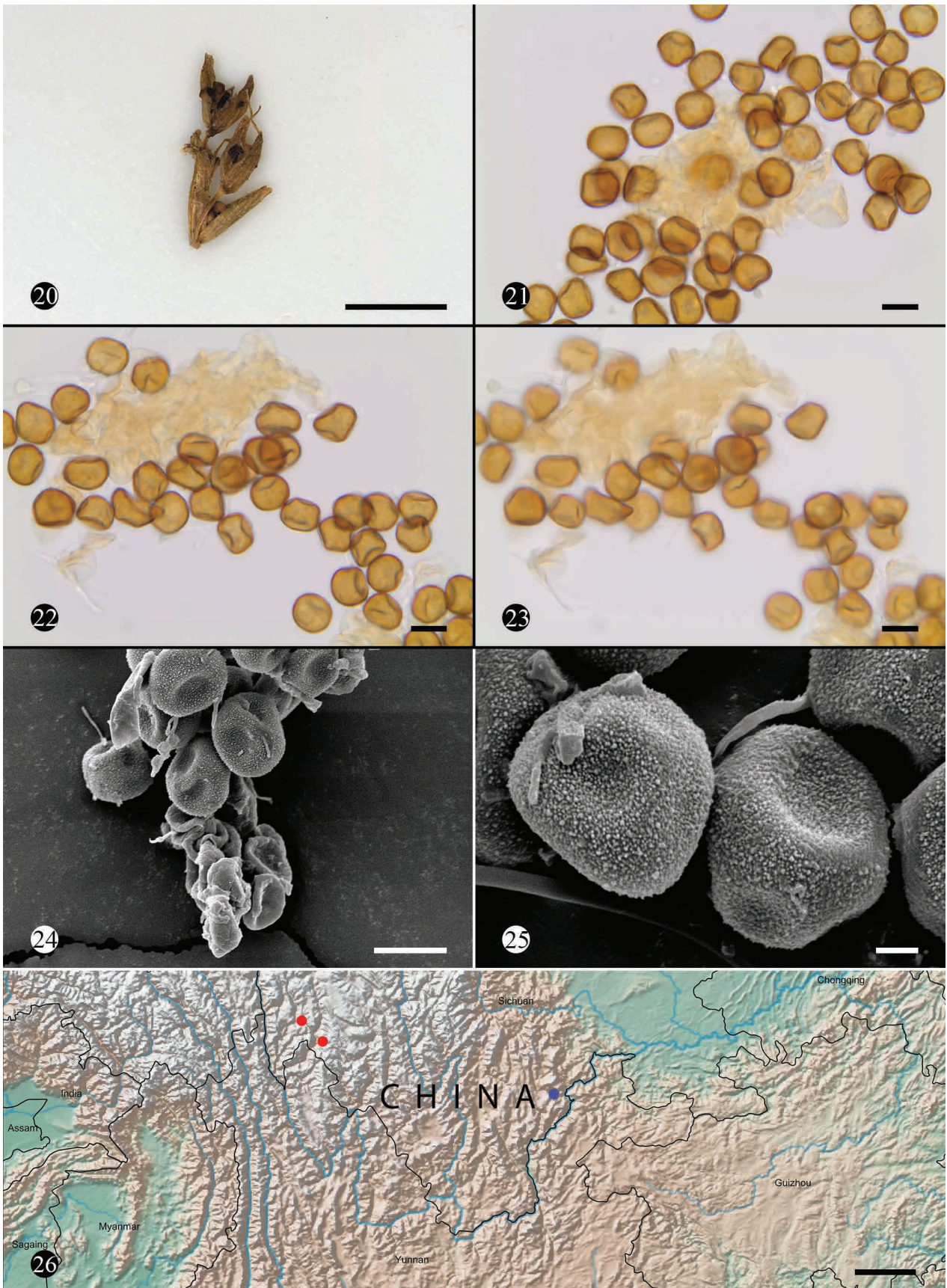
Basionym: *Sphacelotheca mysorensis* Pavgi & Thirum., in Thirumalachar & Pavgi, Sydowia 6: 394, 1952.

Type:—On *Capillipedium huegelii* (Poaceae). INDIA. Mysore, Shimoga District: at Bedur, May 1951, leg. *B.T. Lingappa* (holotype, HClO 20 130; isotypes BPI 190 144, IMI 52 805, H.U.V. 16 039!).

Sori in all spikelets of the inflorescence, single sterile spikelets may not be infected, 0.7–1.8 × 0.4–0.8 mm, ovoid, partly concealed by the glumes; initially covered by a thick yellow-brown to dark brown peridium that soon ruptures irregularly exposing a single, stout, tapering, unbranched columella as long as the sorus. Columella with shallow longitudinal furrows, surrounded by a semi agglutinated, blackish brown mass of spores and sterile cells. *Sterile cells* in irregular groups, single sterile cells uncommon, collapsed, (6.5–)7.5–13.5(–15) µm long, subhyaline to light yellow-brown; wall 0.5–0.7 µm thick, smooth. *Spores* subpolygonate, slightly irregular, subglobose or broadly ellipsoidal, (9–)10–12.5(–13.5) × (9–)9.5–11(–12) (11.3 ± 0.7 × 10.1 ± 0.6) µm ($n_1 = 100$), medium reddish brown; wall unevenly thickened, 0.7–1.0 µm thick, with a few thinner areas in which the wall is collapsed and often lighter, smooth, spore profile not affected. In SEM densely punctate, projections up to 0.1 µm high, often fused.

Specimen examined:—Isotype (H.U.V. 16 039).

Known host and distribution:—On Poaceae: *Capillipedium huegelii* (Hack.) A. Camus. Asia (India).



FIGURES 20–25. *Sporisorium mysorens* (Pavgi & Thirum.) Vánky on *Capillipedium huegelii* (isotype, H.U.V. 16 039). 20. Habit. 21–23. Spores in LM. 21, 22. In median view. 23. In surface view. 24, 25. Spores in SEM. Scale bars: 20 = 0.2 cm, 21–24 = 10 μ m, 25 = 2 μ m. **FIGURE 26.** Holotype locality of *Capillipedium alpinum* (blue circle) and localities of *Sporisorium capillipedii-alpini* on *Capillipedium alpinum* (red circles).

The species of *Sporisorium* that destroy all spikelets of the inflorescence of an infected plant in the genera *Capillipedium*, *Botriochloa*, and *Dichanthium* (but not the whole inflorescence), may be distinguished using the following key:

Key to the smut fungi on *Capillipedium*, *Botriochloa*, and *Dichanthium* with sori destroying all spikelets of the inflorescence of an infected plant

- 1 Spores up to 9 µm long 2
- 1* Spores larger, more than 9 µm long 3
- 2 Spores smooth, paler on one half *S. taianum*
- 2* Spores minutely echinulate, not paler on one half *S. dichanthiicola*
- 3 Spores moderately echinulate (spines up to 0.6 µm high), with spore walls 0.7–1.4(–1.7) µm thick *S. sahayae*
- 3* Spores with lower ornamentation (less than 0.3 µm high) and thinner walls (up to 1.0 µm thick) 4
- 4 Spores smooth in LM; densely punctate in SEM, with projections up to 0.1 µm high *S. mysorensis*
- 4* Spores minutely verruculose in LM; minutely echinulate in SEM, spinules more than 0.1 µm high, spore surface punctate between the spinules 5
- 5 Spores (10.5–)11.5–14.5(–15.5) µm long; sterile cells 6–14.5 µm long, with walls 0.5–0.8 µm thick *S. capillipedii-alpini*
- 5* Spores (8.5–)9–12(–13) µm long; sterile cells 9–22 µm long, with walls 0.8–2.0(–2.5) µm thick *S. andropogonis-annulati*

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