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## The smut fungi (Ustilaginomycetes) of *Hyparrhenia* (Poaceae)

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Twelve species of smut fungi are recognised on the grass genus *Hyparrhenia*. Detailed descriptions and synonyms with authors and place of publication are given for all recognised species. Each species is illustrated by line drawings of the habit and by LM and SEM pictures of the spores. New species described: *Sporisorium niariense* Vánky. New name proposed: *Sporisorium leelingianum* Vánky, replacing *Ustilago tumefaciens* Henn. New combinations proposed: *Sporisorium congense* (Syd. & P. Syd.) Vánky, based on *Ustilago congensis*; *S. dembianense* (Bacc.) Vánky, based on *Sorosporium dembianense*; *S. ischaemoides* (Henn.) Vánky, based on *Ustilago ischaemoides*; *S. maranguense* (Henn.) Vánky, based on *Sorosporium maranguense*. The following names are considered to be synonyms: *Sorosporium tembuti* Henn. & Pole-Evans is *Sporisorium leelingianum* Vánky; *Ustilago nyassae* Syd. & P. Syd. is *Sporisorium transfissum* (Tul. & C. Tul.) G. Deml; *Ustilago puellaris* Syd. is *Sporisorium vanderystii* (Henn.) Vánky. A further ten synonymies, established by L. Ling, are confirmed. Lectotypes are designated for *Ustilago congensis* Syd. & P. Syd. [= *Sporisorium congense* (Syd. & P. Syd.) Vánky], *Ustilago tumefaciens* Henn. (= *Sporisorium leelingianum* Vánky), and *Sphacelotheca ruprechtii* Syd. [= *Sporisorium vanderystii* (Henn.) Langdon & Full.]. A key to the species and a host-parasite list are provided to facilitate the identification of the smut fungi of *Hyparrhenia*.

**Key words:** lectotypes, new combinations, new species, synonyms.

### Introduction

*Hyparrhenia* Fourn., in the subfamily Panicoideae, tribe Andropogoneae, subtribe Anthistiriinae, has 55 species, mainly in Africa, with a few species extending to other tropical regions, and one to the Mediterranean area (Clayton and Renvoize, 1986: 354). At least 27 smut fungi have been described on *Hyparrhenia*, often as on *Andropogon*. Study of type specimens revealed that several of them are synonyms, and as a result, twelve species of smut fungi are recognised on *Hyparrhenia*. A key to the smut fungi of *Hyparrhenia*, a host-parasite list, and a list of fungus names are provided.

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## Materials and methods

Sorus and spore characteristics were studied using either freshly collected specimens or dried herbarium specimens, preserved mainly in Herbarium Ustilaginales Vánky (HUV). Herbarium names are abbreviated according to Index Herbariorum (Holmgren *et al.*, 1990).

For light microscopy (LM), dried spores were rehydrated in lactophenol by gently heating to boiling point. For scanning electron microscopy (SEM), dried spores were dusted on double-sided adhesive tape, mounted on a specimen stub, sputter-coated with gold-palladium, *ca.* 20 nm, and examined in a SEM at 10 kV.

## Taxonomy

Study of many smut fungi on *Hyparrhenia*, both old collections, including almost all type specimens, and also recent collections by the author, has resulted in the recognition of twelve species, including one new species. Ten earlier established synonymies were confirmed to which three new ones are added.

The study revealed that the smut fungi of *Hyparrhenia* are not strictly host specific. Most of them occur on several host plant species, including the closely related *Hyperthelia* and *Exothea*, and two smuts occur also on *Dichanthium* and *Euclasta*, in the subtribe Sorghinae. For example, *Sporisorium ischaemoides* is known on ten host plant species. The same plant species may be host to several smut fungi, e.g. five different smut fungi are known on *Hyparrhenia filipendula* and six on *H. rufa*.

It was observed that large variations in spore measurements may occur within the same smut species, not only between different collections but sometimes even within the same sorus. At the same time, other characters, such as soral features or spore wall ornamentation are fairly constant. Thus, species delimitation based only on spore measurements is not always adequate. For example, spore measurements alone are insufficient to recognise *Sporisorium barcinonense* and *S. transfissum*. However, differences in spore germination allow separation of these two species.

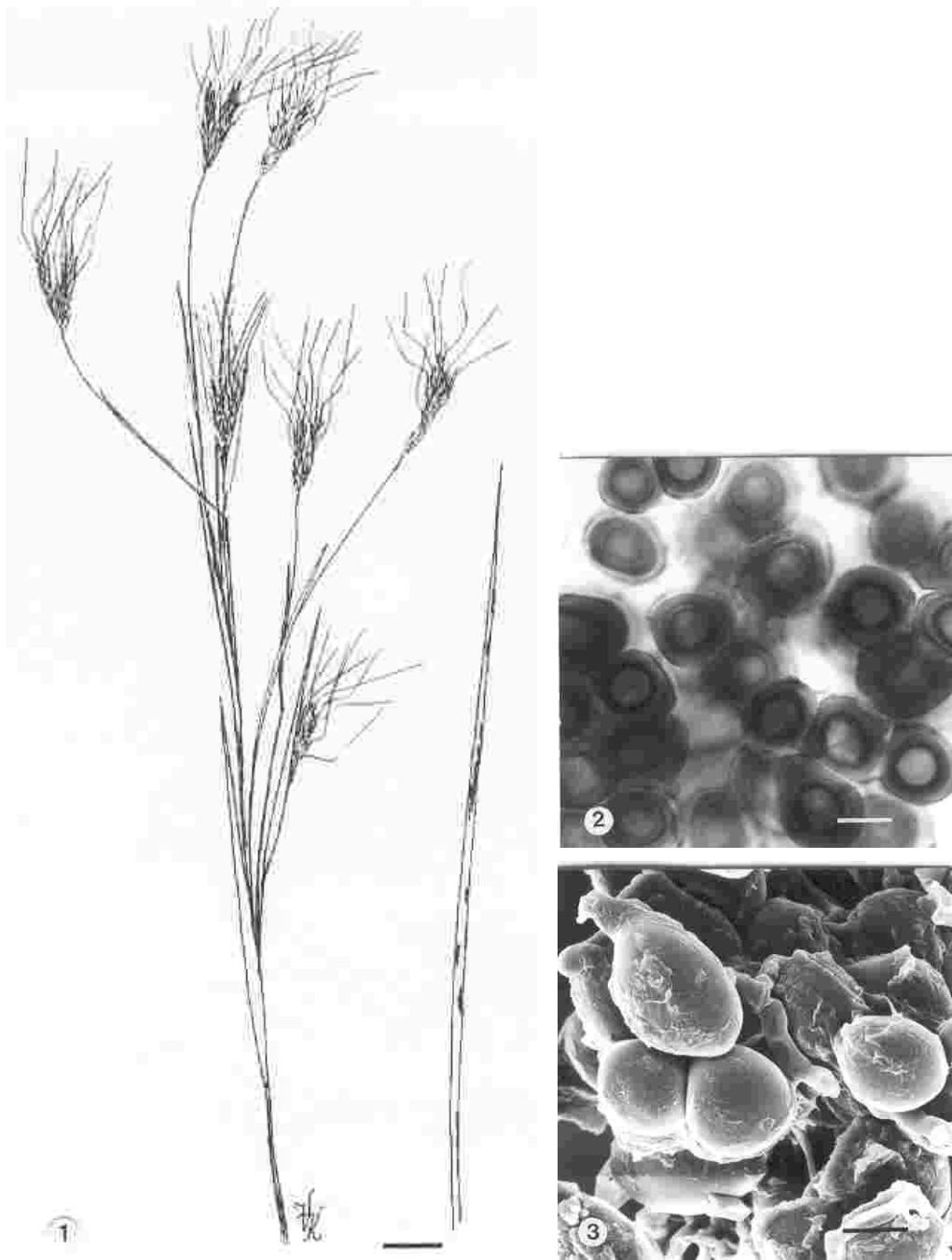
The twelve recognised smut fungi of *Hyparrhenia* are:

**1. *Jamesdicksonia obesa*** (Syd. & P. Syd.) Thirum., Pavgi & Payak, 1961 (1960): 478. (Figs. 1-3)

≡ *Entyloma obesum* Syd. & P. Syd., 1911: 145.

≡ *Tolyposporella obesa* (Syd. & P. Syd.) G.P. Clinton & Zundel, in Zundel, 1930: 157.

— Type on *Andropogon annulatus* Forsk. [= *Dichanthium annulatum* (Forsk.) Stapf], India, Nagpur, 21 October 1907, P.A. Pundit (BPI 17615, BPI 195050).



**Figs. 1-3.** *Jamesdicksonia obesa*. **1.** Sori on a leaf of *Hyparrhenia rufa* (Colombia, 19 February 1976, HUV 8881). To the left a healthy inflorescence. **2, 3.** Spores on *Hyparrhenia rufa*, in LM and in SEM (HUV 8881). Bars: 1 = 1 cm; 2 = 10  $\mu$ m; 3 = 5  $\mu$ m.

*Sori* (Fig. 1) in the leaves as fusiform pustules, 0.3-1 × 1-10 mm, or larger by confluence, first covered by the epidermis which later ruptures longitudinally exposing the black, agglutinated mass of spores. *Spores* (Figs. 2, 3) variable in shape and size, globose, ovoid, ellipsoidal, elongate, pyriform, often subpolyhedrally irregular, 8-20 × 10-28 µm, light olivaceous- to dark reddish-brown; wall 3-12(-16) µm thick, composed of a homogenous, thin (0.5-1 µm), uniform endospore and a multilayered, smooth exospore of variable thickness. Spores mature in a basipetal succession in the sorus. *Spore germination*, without dormancy, results in holobasidium bearing apically a whorl of 2-4, monocarotic, haploid basidiospores which conjugate in pairs in situ, and successively bud off dikaryotic, either short, allantoid, crescent-shaped ballistospores or long, tubular, secondary and tertiary sporidia (Raghunath, 1969: 760).

*Hosts*: *Dichanthium annulatum* (Forsk.) Stapf (*Andropogon annulatus* Forssk.), *Hyparrhenia rufa*.

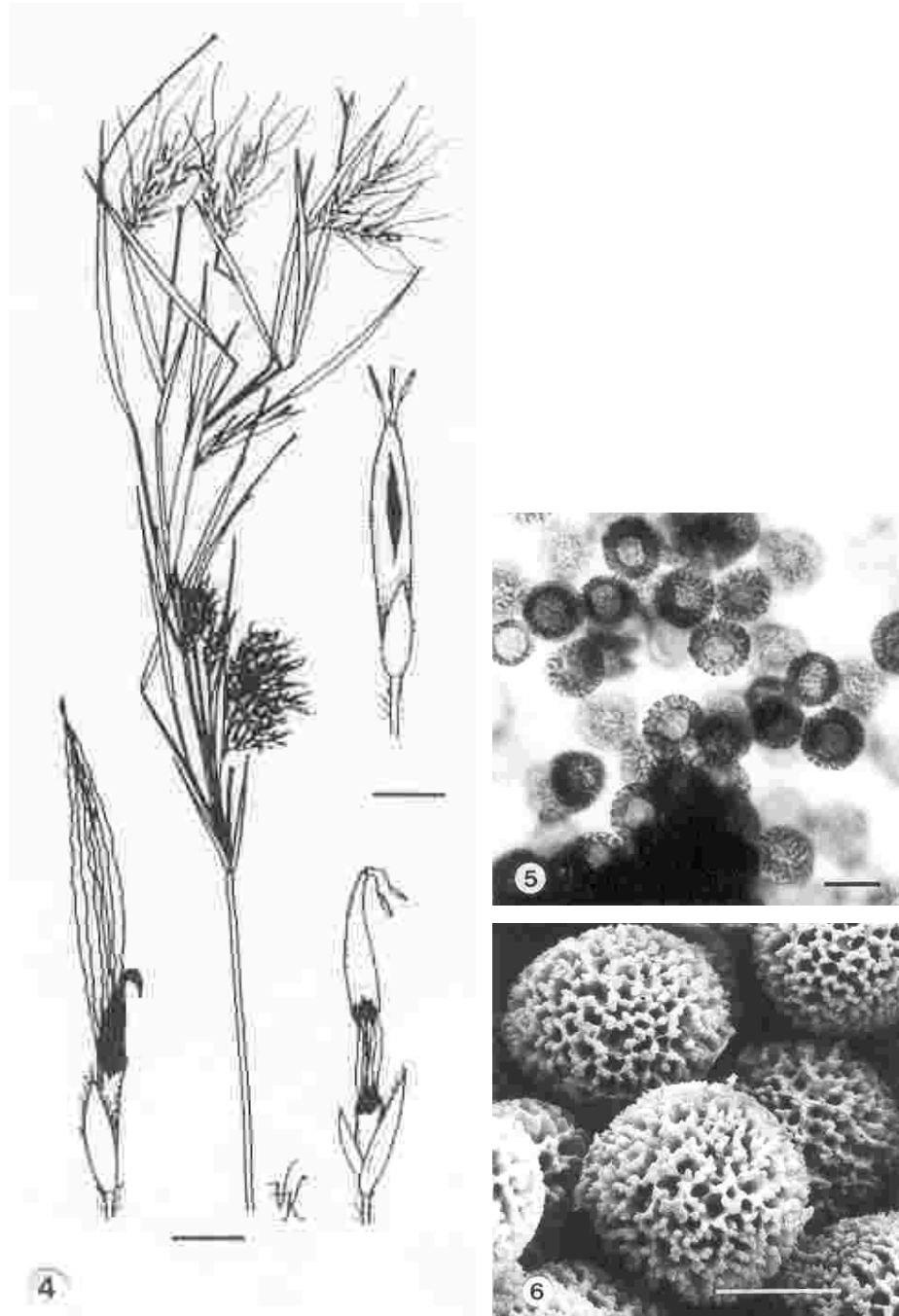
*Known distribution*: S. Asia (India), S. America (Colombia).

In the literature, there is a great variation regarding spore measurements and wall thickness of *Jamesdicksonia obesa*. According to Sydow and Sydow (1911: 145), the spores measure 8-11 × 24-35 µm, and the wall is 3-14 µm thick. Zundel (1953: 126) gave 13-29 µm for the spore diam., and a wall thickness of 8-19 µm. Walker and Shivas (1998: 1209) gave 12-24 × 12-30 µm for the spore measurements, and 4-10(-12) µm for the wall thickness. The reason for this variation lies in the property of the spore wall to swell considerably in water or in heated lactophenol. Spore measurements, made in unheated lactophenol, resulted in smaller values: 8-11 × 9-13(-15) µm for the spores and 2.5-6.5 µm for the wall thickness.

*Jamesdicksonia obesa* is not rare on *Dichanthium annulatum* in India. The occurrence of this smut on *Hyparrhenia rufa*, known from a single collection in Columbia (L.A. Molina and E. Orjuela, 19 February 1976, HUV 8881) is unexpected. The host plant identity of the Columbian specimen seems to be correct. Another species, *J. brunckii* (Ellis & Galloway) J. Walker & R.G. Shivas, on different *Andropogon* species, also on *Bothriochloa* and *Schizachyrium* from North-, Central- and South America, and on *Dichanthium sericeum* (R. Br.) A. Camus from Australia, differs from *J. obesa* especially by rounded, thick-walled spores (comp. also Walker and Shivas, 1998).

## **2. *Sporisorium andropogonis-finitimi* (Maubl.) Vánky & Mouch., 2000: 382. (Figs. 4-6)**

≡ *Ustilago andropogonis-finitimi* Maubl., 1906: 74. — Lectotype (designated by Vánky and Mouch., 2000: 382) on *Hyparrhenia finitima* (Hochst.) Stapf, Mozambique, 1905, G. Letestu, PC! ex Herbier de la Station Centrale de Pathologie Végétale, Versailles (no. 4132; isolectotype in HUV 18828!).



**Figs. 4-6.** *Sporisorium andropogonis-finitimi*. **4.** Sori in all flowers of some raceme pairs of *Hyparrhenia finitima* (type). Enlarged three sori at different stages of maturity. **5, 6.** Spores on *Hyparrhenia finitima*, in LM and in SEM (type). Bars: 4 = 1 cm for habit, 2 mm for the detail pictures; 5 = 10  $\mu\text{m}$ ; 6 = 5  $\mu\text{m}$ .

*Sori* (Fig. 4) destroying the innermost floral organs, often affecting all flowers of some raceme pairs of an inflorescence, appearing as witches' brooms, filiform, 1-2 × 5-20 mm, first covered by a thin, dark greyish peridium which ruptures irregularly disclosing the blackish-brown, semi-agglutinated to powdery mass of spore balls and spores surrounding up to 8, long, slender, wavy columellae. Sori may even comprise the whole raceme, then much thicker. *Spore balls* globose, ellipsoidal to irregular, 30-140 × 40-180 μm, reddish-brown, opaque, composed of (20-)25 to tens or a hundred(?) of easily separating spores. *Spores* (Figs. 5, 6) globose, subglobose, rarely broadly ellipsoidal, 9-12(-13) × 9-13(-14) μm, yellowish-brown; wall in LM two-layered, inner layer even, thin (*ca.* 0.5 μm), outer layer thick (2-3 μm), even or slightly uneven in thickness, spore surface irregularly, incompletely verrucose-reticulate, 6-10 complete or incomplete meshes per spore diam., in SEM the edge of the muri is irregularly verruculose.

*Hosts:* *Hyparrhenia filipendula* (Hochst.) Stapf, and *H. finitima* (Hochst.) Stapf (*Andropogon finitimus* Hochst.).

*Known distribution:* C. and SE. Africa (Mozambique, Zambia, Zimbabwe).

Variations of 1-3 μm in the spore measurements between different collections are not unusual.

### 3. *Sporisorium barcinonense* (Riofrio) Vánky, in Vánky *et al.*, 1988: 188. (Figs. 7-9)

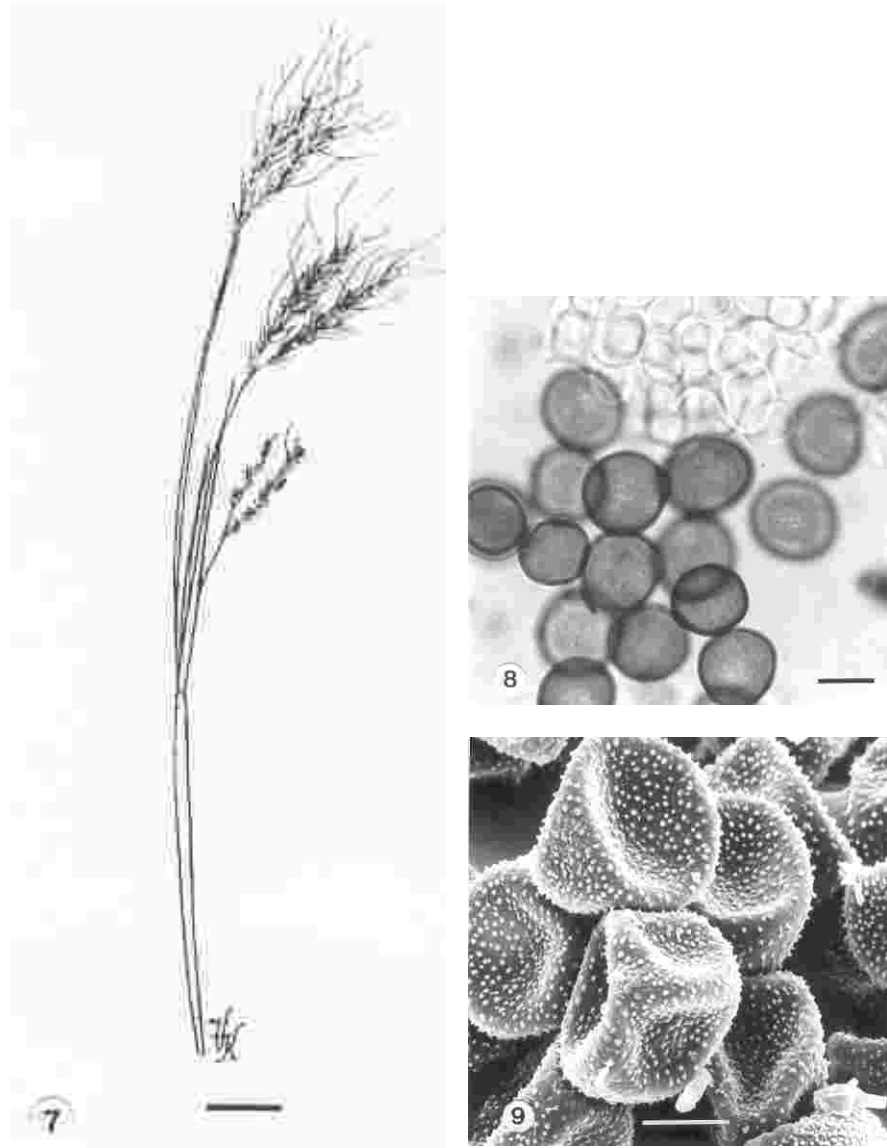
≡ *Sphacelotheca barcinonensis* Riofrio, 1923: 193. — Type on *Andropogon hirtus* L. var. *longearistata* [= *Hyparrhenia hirta* (L.) Stapf], Spain, Mt. Tibidabo near Barcelona, B.F. Riofrio (MPU, Herb. Maire 1616!).

*Sori* (Fig. 7) in all flowers of an inflorescence destroying the inner floral organs, ellipsoidal or cylindrical, 0.5-1 × 3-6 mm, partly hidden by the glumes, first covered by a greyish-brown peridium which ruptures irregularly disclosing the dark brown, semipowdery mass of spores surrounding a simple, flagelliform, central columella of the length of the sorus. *Spores* (Figs. 8, 9) when mature single, globose, subglobose to slightly ovoid, 13-16 × 13-18(-20) μm, yellowish-brown; wall even, 0.7-1 μm thick, finely, densely echinulate; spore profile finely serrulate. *Spore germination* results in a septate basidium with terminal and lateral basidiospores (Riofrio, 1923: 193). *Sterile cells* (Fig. 9) in irregular groups, globose to irregularly angular, smaller than the spores, mostly 9-14 μm, rarely up to 20 μm long, thin-walled, hyaline, often with a few oil droplets.

*Host:* *Hyparrhenia hirta* (L.) Stapf (*Andropogon hirtus* L.).

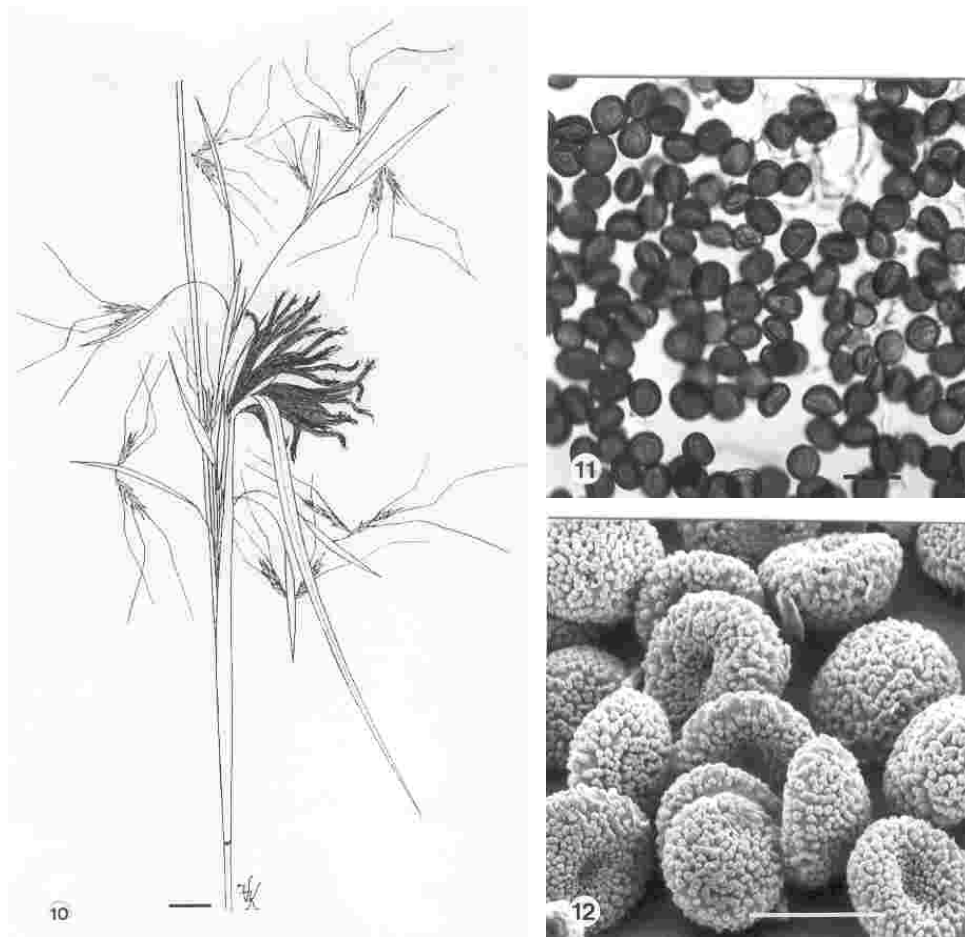
*Known distribution:* S. Europe (Italy, Spain), N. Africa (Canary Islands, Spain).

*Sporisorium barcinonense* is close to *S. transfissum*, from which it differs by somewhat larger spores and possibly also by the type of spore germination,



**Figs. 7-9.** *Sporisorium barcinonense*. 7. Sori in all flowers of an inflorescence of *Hyparrhenia hirta* (Italy, 1 June 1979, Pl. graec. Fungi no. 21, HUV 10962). 8, 9. Spores and sterile cells on *Hyparrhenia hirta*, in LM and in SEM (type). Bars: 7 = 1 cm; 8 = 10  $\mu$ m; 9 = 5  $\mu$ m.

of which little information is published. Due to variations in the spore measurements, some specimens are difficult to assign to one or the other of these two species, based on spore morphology only. Synonymising these two species may be necessary when more data about their germination is known.



**Figs. 10-12.** *Sporisorium congense*. **10.** Sori in the flowers of a raceme pair of *Hyparrhenia diplandra*, appearing as a small witches' broom (Vánky, Ust. exs. no. 1179). **11, 12.** Spores on *Hyparrhenia diplandra*, in LM and in SEM (type). Bars: 10 = 1 cm; 11 = 10  $\mu$ m; 12 = 5  $\mu$ m.

**4. *Sporisorium congense* (Syd. & P. Syd.) Vánky, *comb. nov.*** (Figs. 10-12)

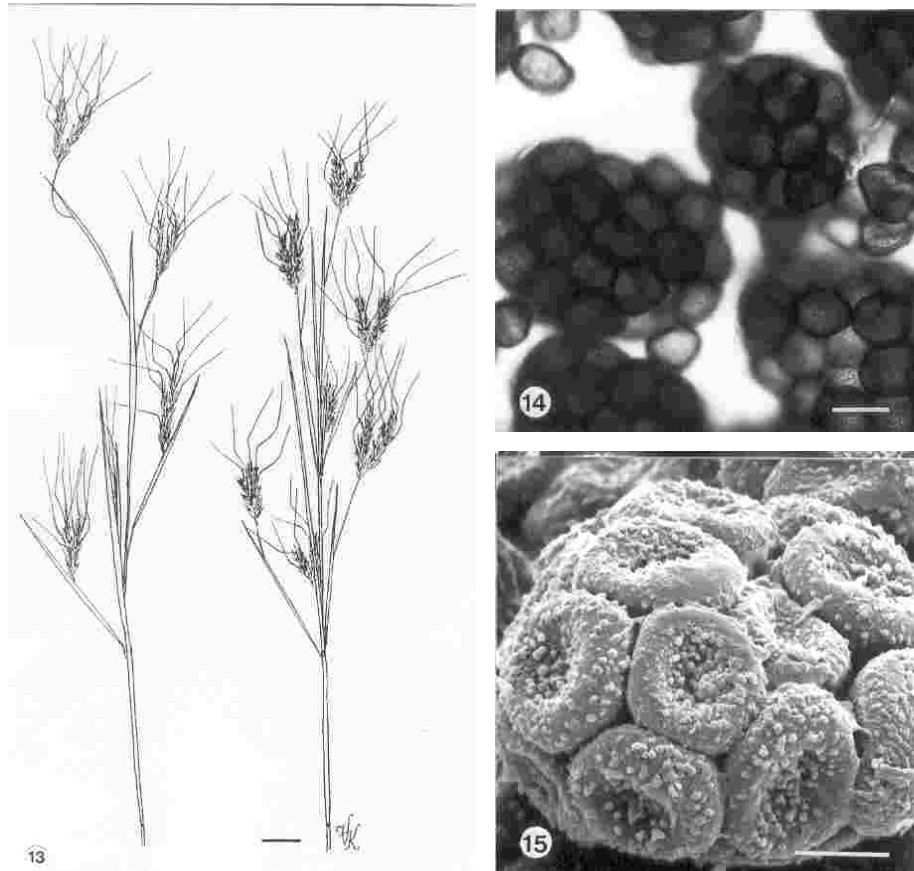
$\equiv$  *Ustilago congensis* Syd. & P. Syd., in Wildeman, *Études sur la flore du Bas- et Moyen-Congo* 3: 9, 1909.

$\equiv$  *Sphacelotheca congensis* (Syd. & P. Syd.) Wakef., in Zundel, 1930: 140. —

**Lectotype (designated here)** on *Andropogon* sp. [= *Hyparrhenia diplandra* (Hack.) Stapf, det. J. Bosser, BR], Belgian Congo (= Democratic Rep. of Congo), Leopoldville Prov., Kisantu, 13 September 1908, H. Vanderyst (712 BR 374!).

*Sori* (Fig. 10) destroying the inner floral organs of some raceme-pairs of an inflorescence, appearing as small witches' brooms. Either the single floral organs or a group of organs are transformed into cylindrical bodies with one or several acute tips, often bearing anthers and tips of destroyed floral envelopes. Sori 0.4-1.5  $\times$  8-15 mm, partly enclosed by spathae and intact glumes, first





**Figs. 13-15.** *Sporisorium dembianense*. **13.** Sori in all flowers of an inflorescence of *Hyparrhenia rufa* (Zambia, 25 April 2001, HUV 19951). To the left a healthy inflorescence. **14, 15.** Spore balls and spores on *Hyparrhenia rufa*, in LM and in SEM (type). Bars: 13 = 1 cm; 14 = 10 µm; 15 = 5 µm.

covered by a thin, grey peridium which ruptures longitudinally disclosing the dark brown, semiagglutinated to powdery mass of spores and several filiform columellae. *Spores* (Figs. 11, 12) when mature single, globose, subglobose to usually broadly ellipsoidal,  $5-7 \times 5.5-8$  µm, pale olivaceous-brown; wall 0.5-1 µm thick, moderately densely verrucose; spore profile wavy. *Sterile cells* between the spores not seen.

*Host:* *Hyparrhenia diplandra* (Hack.) Stapf.

*Known distribution:* C. Africa (Congo, Uganda).

In old specimens, the spores are yellowish-brown and collapsed on one side, looking like coffee beans.

**5. *Sporisorium dembianense* (Bacc.) Vánky, *comb. nov.*** (Figs. 13-15)

= *Sorosporium dembianense* Bacc., *Annali di Botanica* (Rome) 14: 132, 1917. — Lectotype (designated by Ling, 1953a: 188) on *Andropogon papillipes* A. Rich. [= misnamed

*Hyparrhenia rufa* (Nees) Stapf, det. L. Ling, conf. K. Vánky], Ethiopia, Amhara-Dembia, Asoso, 27 October 1909, E. Chiovenda (2671, FT! Isolectotype in BPI 179725!). Syntype on *Andropogon arrhenobasis* Hochst. ex Steud. [= *Hyparrhenia arrhenobasis* (Hochst. ex Steud.) Stapf], Ethiopia, Amhara-Dembia, Gondar, in the valley of Cahà, 2 October 1909, E. Chiovenda (2281, FT! Isosyntype in BPI 179721).

*Sori* (Fig. 13) in all flowers of an inflorescence, destroying the inner floral organs, cylindrical, tapering at both ends, 0.5-1 × 3-9(-15) mm, partly hidden by the spreading glumes, first covered by a pale brown peridium which shreds from the apex disclosing the black, granular-powdery mass of spore balls and a flagelliform central columella, often with a shortly bi- or trifurcate apex. *Spore balls* (Figs. 14, 15) rather permanent, subglobose, ovoid, ellipsoidal, or somewhat irregular, rarely elongated, (15-)20-40(-45) × (20-)25-60 µm, yellowish to dark reddish-brown, composed of (6-)10-50? spores which separate by pressure. *Spores* (Figs. 14, 15) dimorphic, outer spores rather variable in shape and size, subpolyhedrally irregular, more rarely subglobose, ellipsoidal or oblong, 7-11 × 9-13(-15) µm, medium reddish-brown; wall slightly unevenly thick, 0.5-1 µm, sparsely to moderately densely, prominently verrucose on the free surface, punctate or apparently smooth on the contact sides; spore profile smooth to serrulate; inner spores of the large spore balls subpolyhedrally irregular, 7-10.5 × 8-12 µm, subhyaline to pale yellowish-brown; wall thin, 0.3-0.5 µm, apparently smooth. *Sterile cells* absent.

*Hosts*: *Hyparrhenia arrhenobasis* (Hochst. ex Steud.) Stapf (*Andropogon arrhenobasis* Hochst. ex Steud.), *H. filipendula* (Hochst.) Stapf, *H. rufa* (Nees) Stapf, *H. tamba* (Steud.) Stapf.

*Known distribution*: Africa (Ethiopia, Malawi, South Africa, Tanzania, Zambia, Zimbabwe).

Variations in the size of the spore balls and spores of different collections are given by Ling, 1953a: 188.

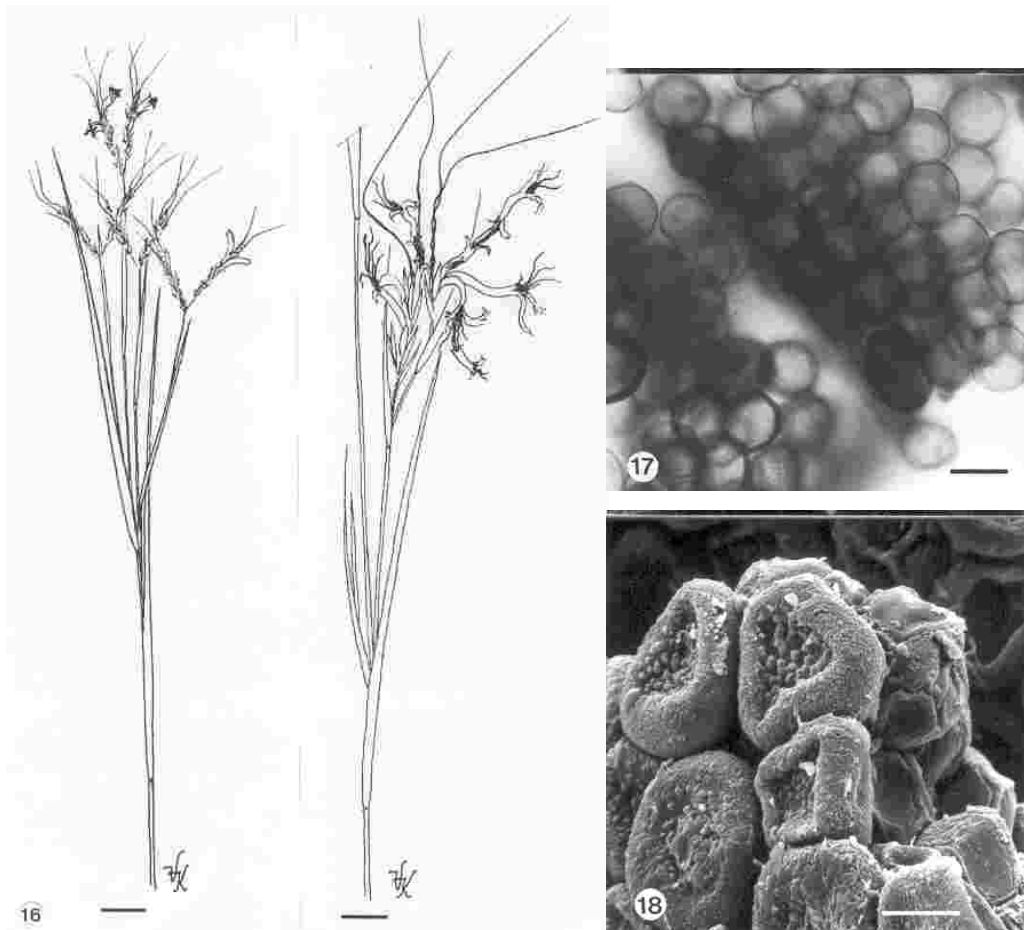
## 6. *Sporisorium ischaemoides* (Henn.) Vánky, **comb. nov.** (Figs. 16-18)

≡ *Ustilago ischaemoides* Henn., in Wildeman, 1907: 86.

≡ *Sorosporium ischaemoides* (Henn.) Zundel, 1937: 587. — Type on *Andropogon* sp. [= *Hyparrhenia diplandra* (Hack.) Stapf, det. J. Bosser, BR], Belgian Congo (= Democratic Rep. of Congo), Leopoldville, 18 May 1906, H. Vanderyst (121 BR 393! **Lectotype designated here**).

= *Sorosporium wildemanianum* Henn., in Wildeman, 1907: 87. — Type on *Andropogon* sp. [= *Hyparrhenia rufa* (Nees) Stapf], Belgian Congo (= Democratic Rep. of Congo), Mbele, 10 May 1906, H. Vanderyst (150 BR!) (syn. by Ling 1951: 105, confirmed).

= *Sorosporium austro-africanum* Zundel, 1930: 147. — Type on *Andropogon cymbarius* L. [*Hyparrhenia cymbaria* (L.) Stapf = misnamed *H. tamba* (Steud.) Stapf, comp. Doidge, 1950: 378; or *H. hirta* (L.) Stapf, comp. Ling, 1951: 106], South Africa, Natal, Tugela River, May 1920, E.M. Doidge (PREM 14168). Isotypes BPI 179490, 195136, HUV 17985! (syn. by Ling, 1951: 106, confirmed).



**Figs. 16-18.** *Sorosporium ischaemoides*. **16.** Sori in some flowers of *Hyparrhenia anamesa* (to the left; South Africa, 29 November 1996, HUV 19896) and of *Hyperthelia dissoluta* (Nees ex Steud.) Clayton (to the right; Zimbabwe, 19 March 1999, HUV 18970). **17, 18.** Spore balls and spores on *Hyparrhenia anamesa*, in LM and in SEM (Vánky, Ust. exs. no. 1162). Note the dimorphism of the outer, darker, ornamented spores and inner, paler, smooth spores of partly ruptured spore balls. Bars: 16 = 1 cm; 17 = 10  $\mu$ m; 18 = 5  $\mu$ m.

= *Sorosporium hansfordii* Ainsw., 1941: 93. — Type on *Hyparrhenia pilgeriana* C.E. Hubb., Uganda, Elgon, Kabaroni, December 1933, C.G. Hansford (U1721, IMI 38989). Isotypes BPI 180016, HUV 17361! (syn. by Ling, 1951: 106, confirmed).

*Sori* (Fig. 16) destroying the inner floral organs of some flowers of an inflorescence, cylindrical, tapering at both ends, 1-1.5  $\times$  8-15 mm, partially concealed by the glumes, covered by a pale yellowish-brown, thick peridium which dehisces from the apex disclosing the black, semiagglutinated to granular-powdery mass of spore balls and several filiform columellae. Rarely, all of the flowers of a raceme pair may be infected, looking like a small

witches' broom. *Spore balls* (Figs. 17, 18) permanent, variable in shape and size, subglobose, ovoid, oblong or irregular, 30-90(-140) × 40-150 µm (in some collections up to 280 µm long), dark yellowish- or reddish-brown to subopaque, composed of tens to hundreds of spores which separate by pressure. *Spores* (Figs. 17, 18) dimorphic, outer spores globose, ellipsoidal, ovoid to subpolyangular, 7-10.5(-12) × 7.5-12(-13.5) µm, medium to deep yellowish-brown; wall even to uneven, 0.8-1.5 µm thick, prominently verrucose on the free surface, smooth on the contact side, spore profile wavy to serrulate on the free surface; inner spores about the same shape and size as the outer spores but subhyaline or pale yellowish-brown; wall thin (0.3-0.5 µm), smooth.

*Hosts*: *Euclasta condylotricha* (Steud.) Stapf, *Hyparrhenia anamesa* Clayton, *H. anthistirioides* (A. Rich.) Stapf, *H. cymbaria* (L.) Stapf, *H. filipendula* (Hochst.) Stapf, *H. hirta* (L.) Stapf, *H. pilgeriana* C.E. Hubb., *H. rufa* (Nees) Stapf, *H. tamba* (Steud.) Stapf, *Hyperthelia dissoluta* (Nees ex Steud.) Clayton [*Hyparrhenia dissoluta* (Nees ex Steud.) C.E. Hubb.].

*Known distribution*: C. & S. Africa (Congo, South Africa, Uganda, Zambia, Zimbabwe).

There are some variations in the size and colour of the spore balls and spores between different collections.

The smut fungus in the flowers of *Euclasta condylotricha* (subtribe Sorghinae) is morphologically indistinguishable from *Sporisorium ischaemoides* on different *Hyparrhenia* (subtribe Anthistiriinae), having the same sorus, spore ball and spore characteristics. If they represent the same species of smut fungus, it may mean that *Euclasta* and *Hyparrhenia* are more closely related than it is thought and expressed by their placement in different subtribes (parasites as "plant taxonomists"! ). Indeed, regarding Sorghinae, Clayton and Renvoize (1986: 339) wrote: "There is some parallelism between the *Dichanthium* group (of Sorghinae) and certain Anthistiriinae, but no convincing evidence for a direct relationship".

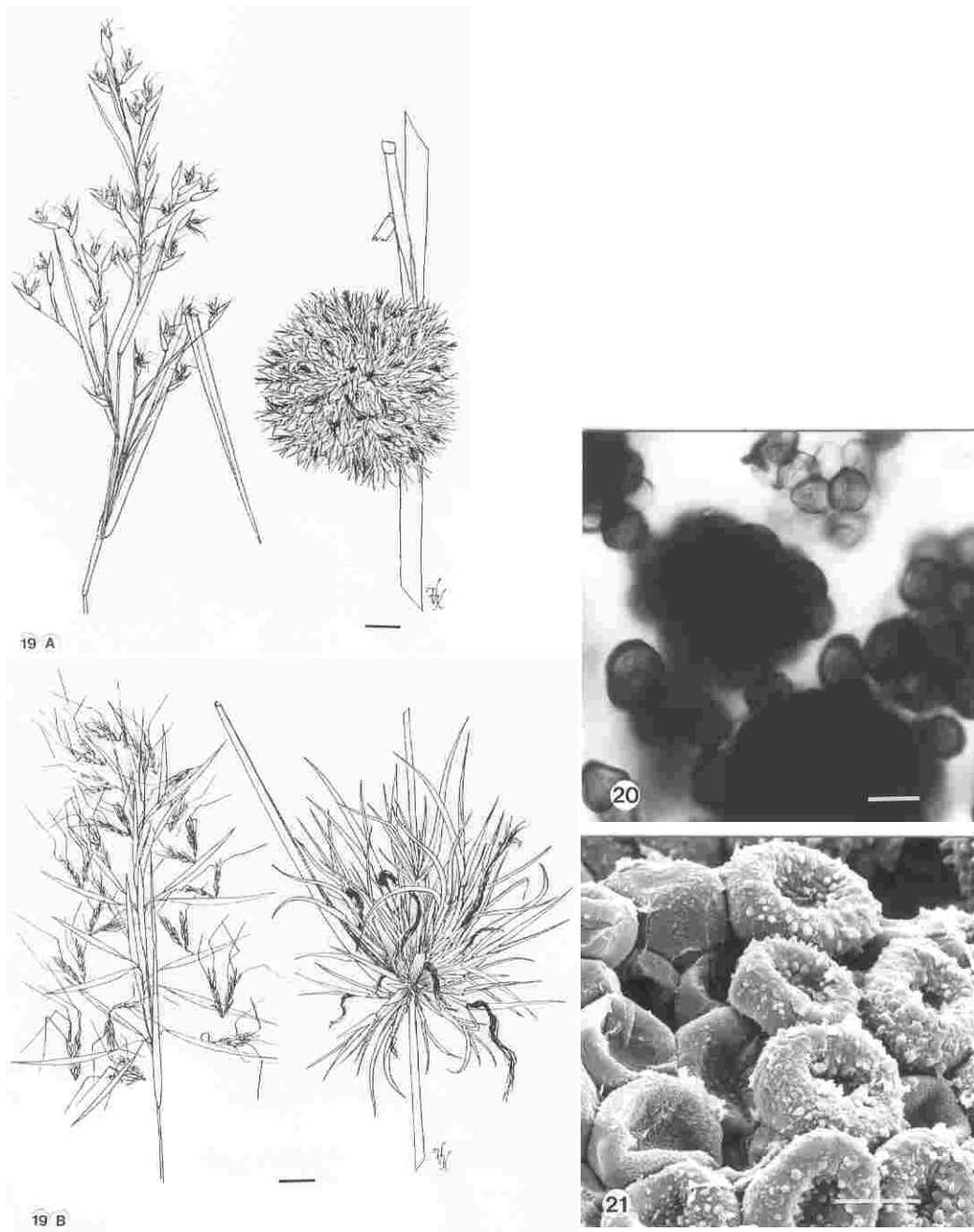
### 7. *Sporisorium leelingianum* Vánky, **nom. nov.** (Figs. 19-21)

Based on ≡ *Ustilago tumefaciens* Henn., in Engler, Pflanzenwelt Ost-Afrikas, etc., C, p. 48, 1895.

≡ *Sorosporium tumefaciens* (Henn.) Zundel, 1930: 149, not McAlpine, 1910 (not *Sporisorium tumefaciens* (McAlpine) Vánky, 1983: 328).

≡ *Sorosporium zundelianum* Cif., 1933: 268, **nom. nov.** (not *Sporisorium zundelianum* Vánky, 1995: 207, type on *Trachypogon plumosus* (H. and B. ex Willd.) Nees). — **Lectotype (designated here)** on *Andropogon rufus* (Nees) Kunth (= *Hyparrhenia rufa* (Nees) Stapf), Tanzania, Kilimandscharo, Rombo Mku, alt. 1450 m, June 1893, S. Volkens (397 K!) (The type in Berlin, B, was lost during World-War II).

= *Sorosporium tembuti* Henn. & Pole-Evans, in Hennings, Botanische Jahrbücher für Systematik 41: 270, 1908. — Type on *Andropogon ?cymbarius* L. [= misnamed *Hyparrhenia tamba* (Steud.) Stapf; comp. Doidge, 1950: 380], South Africa, Transvaal, Weterval Onder, 17 June 1905, J. Burt Davy (PREM 169; isotype HUV 17991!) (**syn. here**).



**Figs. 19-21.** *Sporisorium leelingianum*. **19.** Sori forming witches' broom at the internode of **A.** *Hyparrhenia cymbaria* (Vánky, Ust. exs. no. 1180); **B.** *Hyparrhenia tamba* (South Africa, 30 December 1996, HUV 19870). To the left a healthy inflorescence. **20, 21.** Spore balls and the dimorphic spores on *Hyparrhenia tamba*, in LM and in SEM (lectotype). 19 = 1 cm; 20 = 10  $\mu$ m; 21 = 5  $\mu$ m.

= *Sorosporium clintonii* Zundel, 1930: 153. — Type on *Andropogon cymbarius* L. [= misnamed *Hyparrhenia* cf. *tamba* (Steud.) Stapf, det. L. C. in PREM; comp. also Doidge, 1950: 378], South Africa, Pretoria, Waterkloof, 14 April 1916, I.B. Pole-Evans (PREM 9693; isotype HUV 1652!) (syn. by Ling, 1951: 108, as *Sorosporium tembuti*, confirmed).

= *Sorosporium healdii* Zundel, 1930: 147. — Type on *Andropogon cymbarius* L. (= *Hyparrhenia* sp.; comp. Doidge, 1950: 379), South Africa, Transvaal, Pretoria, 7 May 1916, I.B. Pole-Evans (PREM 9732; isotype HUV 17997!) (syn. by Ling, 1951: 108, as *Sorosporium tembuti*, confirmed).

= *Sorosporium proliferatum* Zundel, 1930: 150. — Type on *Andropogon hirtus* L. [= misnamed *Hyparrhenia aucta* (Stapf) Stapf ex Stent; comp. Doidge, 1950: 380; and/or *H. tamba* (Steud.) Stapf, teste K. Vánky], South Africa, Transvaal, Waterval Boven, 29 November 1918, I.B. Pole-Evans (PREM 11336; isotype HUV 18006!) (syn. by Ling, 1951: 108, as *Sorosporium tembuti*, confirmed).

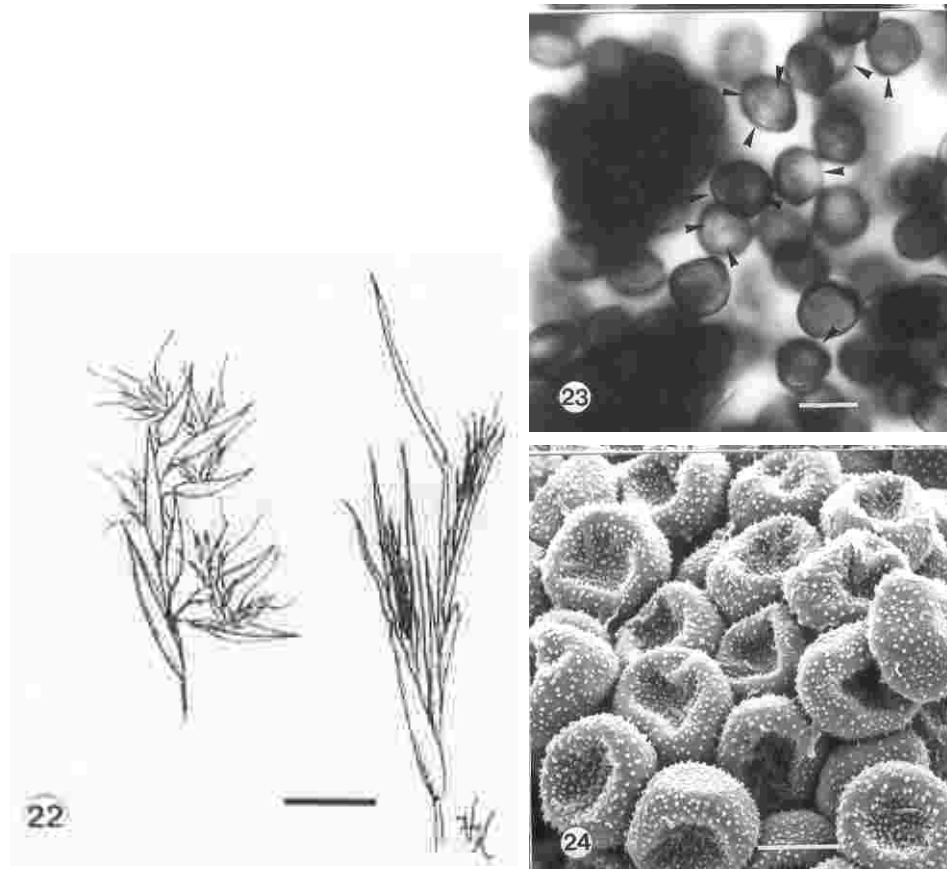
*Sori* (Fig. 19) as witches' brooms at the internode, probably developing from a strongly deformed and congested inflorescence, 2-7 cm diam., composed of several to usually numerous, short, congested "shoots", partly enclosing the long-cylindrical sori measuring 1-2.5 × 15-30(-40) mm. Each sorus first covered by a pale to dark brown, thick peridium which ruptures longitudinally disclosing the black, granular-powdery mass of spore balls and several (3-25), long, filiform columellae. *Spore balls* (Figs. 20, 21) rather permanent, globose, ovoid, ellipsoidal, oblong or irregular, 25-70(-100) × 30-130(-150) μm, dark reddish-brown to opaque, composed of tens to hundreds of spores which separate by pressure. *Spores* (Figs. 20, 21) dimorphic, outer spores subglobose, ovoid, ellipsoidal to subpolyhedrally irregular, 7-11(-12) × 8-13.5(-14) μm, deep reddish-brown; wall uneven, (0.5-)1-2.5(-3) μm thick, sparsely to moderately densely, evidently, low verrucose-echinulate on the free surface, finely verruculose to apparently smooth on the contact sides; spore profile smooth, wavy to serrulate on the free surface; inner spores rounded subpolyhedrally irregular, 7-10(-12) × 7.5-12(-14.5) μm, subhyaline to pale olivaceous-brown; wall even or slightly uneven, 0.5-0.8 μm, smooth.

*Hosts*: *Hyparrhenia collina* (Pilger) Stapf [*H. scabrimarginata* (de Wild.) Robyns], *H. cymbaria* (L.) Stapf (*Andropogon cymbarius* L.), *H. dregeana* (Nees) Stapf [*H. aucta* (Stapf) Stapf ex Stent], *H. filipendula* (Hochst.) Stapf, *H. rufa* (Nees) Stapf [*Andropogon rufus* (Nees) Kunth], *H. tamba* (Steud.) Stapf, *H. variabilis* Stapf, *Hyperthelia dissoluta* (Nees ex Steud.) Clayton [*Hyparrhenia dissoluta* (Nees ex Steud.) C.E. Hubb., *H. ruprechtii* (Hack.) Fourn.].

*Known distribution*: C., E. and S. Africa (Malawi, South Africa, Tanzania, Uganda, Zambia).

Variations in the size of the spore balls and ± 1(-2) μm in the size of the spores between different collections are not unusual.

*Etymology*: This species is named in honour of Lee Ling, Chinese mycologist, author of *The Ustilaginales of China* (1953c), and several excellent taxonomic papers treating smut fungi, including also the smut fungi of *Hyparrhenia*.

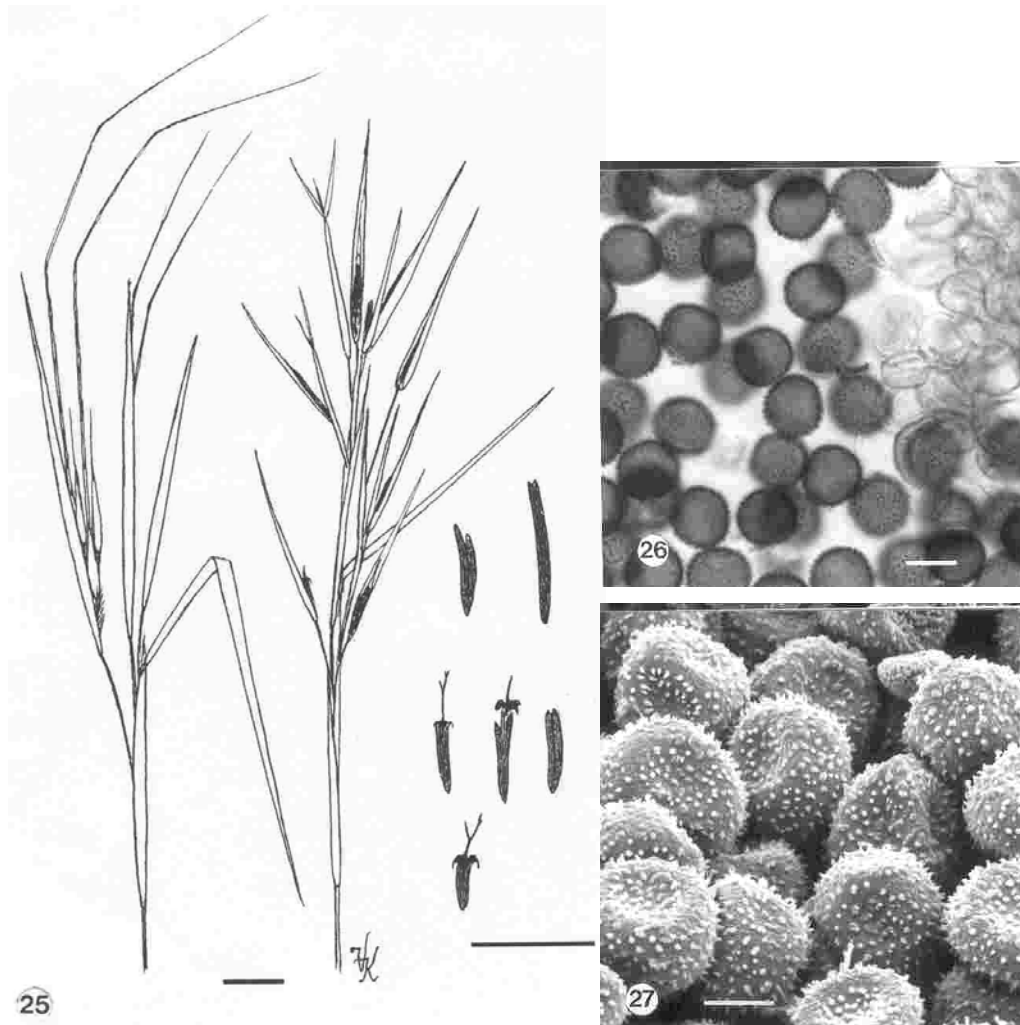


**Figs. 22-24.** *Sporisorium maranguense*. **22.** Sori on *Hyparrhenia cymbaria* (Congo, 19 December 1914, BR). To the left some healthy spikelets. **23, 24.** Spore balls and spores on *Hyparrhenia cymbaria*, in LM and in SEM (HUV 18114). Note the lighter spots on the spores in the LM picture (arrowheads). Bars: 22 = 1 cm; 23 = 10 µm; 24 = 5 µm.

**8. *Sporisorium maranguense* (Henn.) Vánky, *comb. nov.*** (Figs. 22-24)

≡ *Sorosporium maranguense* Henn., in Engler, Pflanzenwelt Ost-Afrikas, etc., C, p. 49, 1895 (as "*maranguensis*"). — Type on *Andropogon lepidus* Nees (= *Hyparrhenia cymbaria* (L.) Stapf), Tanzania, Marangu, coll. Volkens (689; **lectotype designated here**).

*Sori* (Fig. 22) destroying the whole inflorescence, 3-6 cm long, more or less hidden by leaf sheaths, first covered by a brownish peridium which flakes away disclosing the dark brown, powdery mass of spore balls, spores and several, long, filiform columellae. *Spore balls* (Figs. 23, 24) loose, subglobose, ovoid, ellipsoidal to irregular, 30-50 × 40-70 µm, dark reddish-brown, composed of tens of spores which separate easily. *Spores* (Figs. 23, 24) subglobose, ovoid, ellipsoidal to commonly subpolyhedrally slightly irregular, 9-11 × 9-12(-14) µm, yellowish-brown; wall alternatively thick and thin,



**Figs. 25-27.** *Sporisorium niariense*. **25.** Sori in the racemes or raceme pairs of *Hyparrhenia niariensis* (type). Habit, and enlarged six sori. To the left part of a healthy inflorescence. **26,** **27.** Spores and sterile cells of *Sporisorium niariense* on *Hyparrhenia niariensis*, in LM and in SEM (type). Bars: 25 = 1 cm; 26 = 10  $\mu\text{m}$ ; 27 = 5  $\mu\text{m}$ .

ca. 0.3-1(-1.5)  $\mu\text{m}$ , causing not sharply delimited, irregular, slightly darker and lighter spots on the spores; spore surface moderately densely, finely verrucose; spore profile smooth to finely wavy.

*Host:* *Hyparrhenia cymbaria* (L.) Stapf (*Andropogon lepidus* Nees).

*Known distribution:* C. Africa (Congo, Malawi, Tanzania).

A difference of  $\pm 1-1.5 \mu\text{m}$  in the spore length between different collections of *S. maranguense* is considered to be variation within the same species.



**9. *Sporisorium niariense* Vánky, sp. nov.** (Figs. 25-27)

*Sori* racemos omnes vel paria omnia racemorum eiusdem inflorescentiae destruentes, ea in corpora brevia, cylindrica, V- vel Y-formia transformantes, spatheolis occulti, 1-1.5 × 5-10 mm, peridio crasso, brunneo cooperti, quo irregulariter rupto massam sporarum atrobrunneam, semiagglutinam usque pulveream, cellulas steriles et columellas 1-2, centrales, 5-10 mm longas, attenuatas, simplices vel furcatas, saepe ramulis brevibus, lateralibus instructas ostendentes. *Sporae* maturae singulae, globosae, ovoideae, late ellipsoidales, 10-13 × 11-13.5 µm, flavidobrunneae; pariete aequali, ca. 1 µm crasso, mediocriter dense echinulato, imago obliqua spora serrulata. *Cellulae steriles* in catervis irregularibus, cellulae singulae subglobosae, ellipsoidales vel plus-minus irregulares, 8-15 µm longae, subhyalinae usque pallide flavidobrunneae; pariete tenui, ca. 0.5 µm, levi.

Typus in matrice *Hyparrhenia niariensis* (Franch.) Clayton, Tanzania, Kigoma Distr., Kakombe, 14 April 1964, leg. K. Pirozynski (M. 1087). **Holotypus** in IMI 107465. **Isotypus** in Herbario Ustil. Vánky, HUV 18982!

*Sori* (Fig. 25) destroying all racemes or raceme-pairs in the inflorescence, transforming them into a short, cylindrical, V- or Y-shaped body, hidden by the spatheolae, 1-1.5 × 5-10 mm, covered by a thick, brown peridium which ruptures irregularly, disclosing the dark brown, semiagglutinated to powdery mass of spores, sterile cells and 1-2 central, 5-10 mm long, narrowing, simple or forked columellae, often with short, lateral branches. *Spores* (Figs. 26, 27) when mature single, globose, ovoid, broadly ellipsoidal, 10-13 × 11-13.5 µm, yellowish-brown; wall even, ca. 1 µm thick, moderately densely echinulate, spore profile serrulate. *Sterile cells* in irregular groups, single cells subglobose, ellipsoidal or more or less irregular, 8-15 µm long, subhyaline to pale yellowish-brown; wall thin, ca. 0.5 µm, smooth.

*Host*: *Hyparrhenia niariensis* (Franch.) Clayton.

*Known distribution*: C. Africa (Tanzania). Known only from the type collection.

**10. *Sporisorium transfissum* (Tul. & C. Tul.) G. Deml, 1983: 174.**

(Figs. 28-30)

≡ *Ustilago carbo* (DC.) Tul. & C. Tul. γ *columellifera* a. *transfissa* Tul. & C. Tul., 1847: 81.

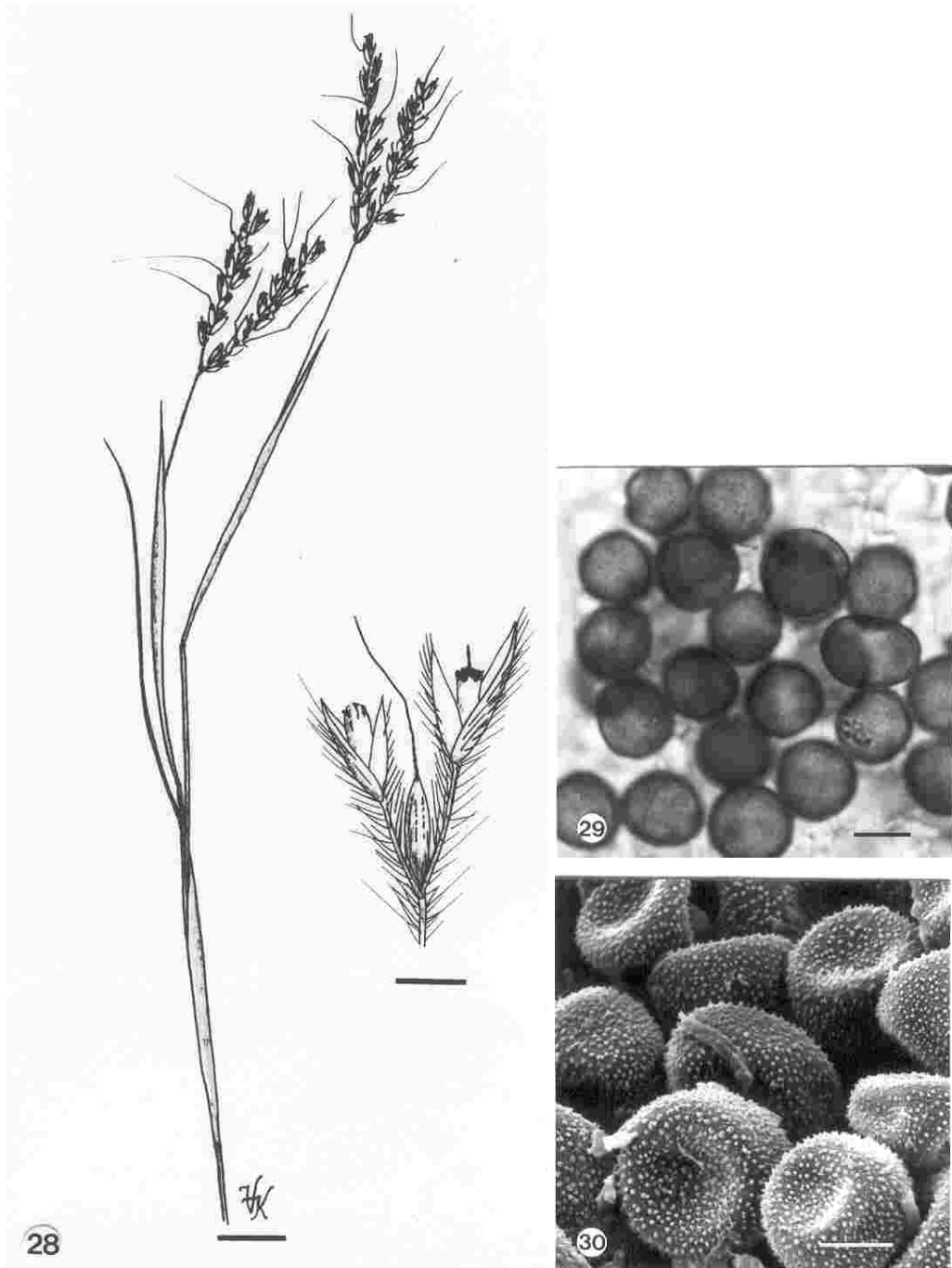
≡ *Sphacelotheca columellifera* (Tul. & C. Tul.) Cif., 1928: 32.

≡ *Sphacelotheca transfissa* (Tul. & C. Tul.) Zundel, 1939: 582. — Type on *Andropogon hirtus* L. [= *Hyparrhenia hirta* (L.) Stapf], Algeria, La Calle, V.1841, L. Motelay 1878, PC!

= *Ustilago nyassae* Syd. & P. Syd., 1920: 156.

≡ *Sphacelotheca nyassae* (Syd. & P. Syd.) Zundel, 1930: 133. — Type on *Andropogon* sp. (= *Hyparrhenia* sp., det. H. Scholz, B), Nyasaland, "Nyassa-Hochland", Station Kymbila, alt. 1600 m, 15 May 1912, A. Stolz (1262, B; isotype HUV 5219!) (**syn. here**).

*Sori* (Fig. 28) in all flowers of an inflorescence, rather inconspicuous, ovoid to long ellipsoidal, 0.8-1 × 3-8 mm, concealed by the spreading glumes, first covered by a delicate, greyish-brown peridium which flakes away revealing the dark brown, first agglutinated, later powdery mass of spores and sterile cells surrounding a simple, narrowing, central columella. *Spores*



**Figs. 28.** *Sporisorium transfissum*. **28.** Sori in all flowers of an inflorescence of *Hypparrhenia hirta* (Vánky, Ust. exs. no. 580). Habit, and enlarged some sori. **29, 30.** Spores on *Hypparrhenia hirta*, in LM and in SEM (type). Bars: 28 = 1 cm for habit, 3 mm for the detail picture; 29 = 10  $\mu$ m; 30 = 5  $\mu$ m.

(Figs. 29, 30) when mature single, globose, subglobose, occasionally slightly irregular, 9-13(-14) × 10-15(-16) μm, light olivaceous-brown; wall evenly thick, *ca.* 0.5 μm, in LM densely, finely punctate-verruculose which just affects the spore profile, in SEM finely echinulate, between the spines very finely, densely verruculose. *Spore germination* results in a two-celled basidium producing lateral and terminal basidiospores (Deml, 1983: 178). *Sterile cells* (Figs. 29, 30) in irregular groups or chains, single cells globose to irregular, variable in size, usually smaller or about the size of the spores, sometimes larger, 8-15(-21) μm long, hyaline, thin-walled.

*Hosts:* *Hyparrhenia anamesa* Clayton, *H. diplandra* (Hack.) Stapf, *H. hirta* (L.) Stapf (*Andropogon hirtus* L.), *H. hirta* (L.) Stapf var. *longearistata* (Willk. & Lange) Rothm. & Silva, *H. quarrei* Robyns, *H. rufa* (Nees) Stapf, *H. tamba* (Steud.) Stapf, *Hyperthelia dissoluta* (Nees ex Steud.) Clayton.

*Known distribution:* S. Europe (Portugal, Spain), Africa (Algeria, Chad, Congo, Madagascar, Malawi, South Africa, Zimbabwe).

*Sporisorium transfissum* is close to *S. barcinonense*, from which it differs especially in the smaller size of the spores and the 2-celled basidium.

In several collections the spores of *S. transfissum* are 10-14.5 μm long. Comparison of the type of *Ustilago nyassae* with that of *S. transfissum* revealed more homogeneous and smaller spores (9.5-12 × 10.5-13 μm) in *U. nyassae*. In other characters they are identical. I consider them to represent the same fungus.

### 11. *Sporisorium vanderystii* (Henn.) Langdon & Full., 1978: 451.

(Figs. 31-33)

≡ *Ustilago vanderystii* Henn., in Wildeman, 1907: 86 (as "*vanderysti*").

≡ *Cintractia vanderystii* (Henn.) Zundel, 1930: 128.

≡ *Sphacelotheca vanderystii* (Henn.) L. Ling, 1951: 104. — Lectotype (designated by Ling, 1951: 105) on *Andropogon* sp. [= *Hyparrhenia rufa* (Nees) Stapf], Belgian Congo (= Democratic Rep. of Congo), Leopoldville, Dembo, June 1906, H. Vanderyst (BR 334!).

= *Ustilago hyparrheniae* Beeli, 1922: 6.

≡ *Sphacelotheca hyparrheniae* (Beeli) Zambett., 1979 (1980): 414. — Type on *Hyparrhenia diplandra* (Hack.) Stapf, Belgian Congo (= Democratic Rep. of Congo), Kimpese, June 1914, H. Vanderyst (4404, BR!) (syn. by Ling, 1951: 104, confirmed).

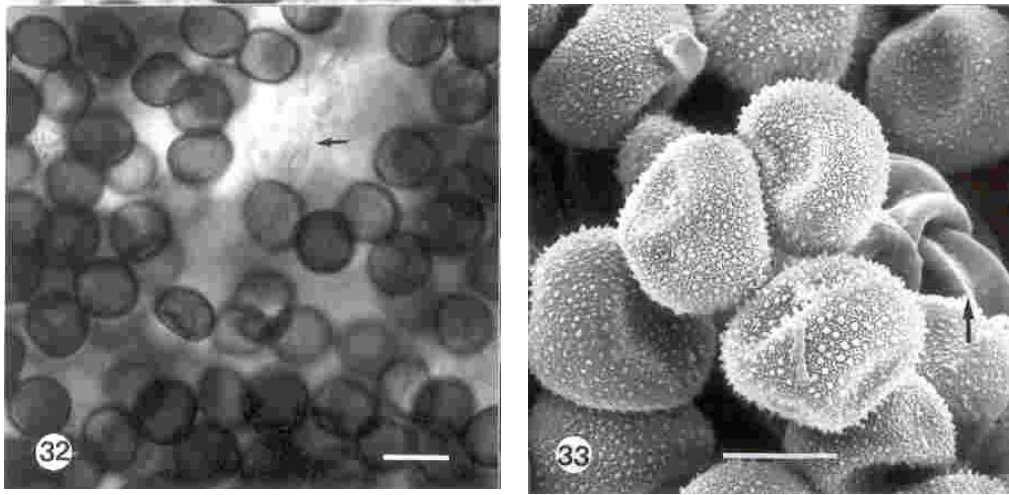
= *Sphacelotheca evansii* Zundel, 1930: 133. — Type on *Andropogon* sp. [= *Hyparrhenia dissoluta* (Nees ex Steud.) C.E. Hubb.; comp. Doidge, 1950: 382], South Africa, Transvaal, Olifants River, 4 January 1918, I.B. Pole-Evans (PREM 14174; isotypes BPI 195092, BPI 195108, HUV 18068!) (syn. by Ling, 1951: 104. However, the HUV copy represents *Sporisorium ischaemoides*; mixed collection?).

= *Sphacelotheca ritchiei* Zundel, 1930: 138. — Type on *Hyparrhenia cymbaria* (L.) Stapf, Tanganyika (= Tanzania), Morogoro, January 1926, A.H.R. Ritchie (PREM 20650; isotypes BPI 113653, 195085, 195091, HUV 18177!) (syn. by Ling, 1951: 104, confirmed).

= *Ustilago puellaris* Syd., 1935: 231.



**Fig. 31.** *Sporisorium vanderystii*. **A.** Sori in all raceme pairs of an inflorescence of *Hyparrhenia bracteata* (Vánky, Ust. exs. no. 1169). To the left a healthy inflorescence. **B.** Sori in all raceme pairs of an inflorescence of *Hyperthelia dissoluta* (to the left; Vánky, Ust. exs. No. 1157). To the right sori of *Sporisorium ischaemoides* in some flowers of *Hyperthelia dissoluta* (Vánky, Ust. exs. no. 1158). Bars = 1 cm.



**Figs. 32, 33.** Spores and sterile cells (arrows) of *Sporisorium vanderystii* on *Hyperthelia dissoluta*, in LM and in SEM (lectotype). Bars: 32 = 10  $\mu\text{m}$ ; 33 = 5  $\mu\text{m}$ .

= *Sporisorium puellare* (Syd.) G. Deml, in Vánky *et al.*, 1988: 185. — Type on *Hyparrhenia hirta* (L.) Stapf, South Africa, E. Transvaal, Nelspruit, Research Station, March 1931, L.C.C. Liebenberg (PREM 26646; isotype HUV 12250!) (**syn. here**).

= *Sphacelotheca ruprechtii* Syd., 1935: 232. — **Lectotype (designated here)** on *Hyparrhenia ruprechtii* (Hack.) Fourn. [= *Hyperthelia dissoluta* (Nees ex Steud.) Clayton], South Africa, Transvaal Prov., Pretoria, Commando Nek, 19 February 1919, I.B. Pole-Evans (PREM 12224, isoelectotype HUV 1995!) Syntypes on *Hyparrhenia ruprechtii*, Transvaal Prov., Rustenburg Distr., Marikana, 10 March 1934, T. Pallister (PREM 27377, isosyntytype HUV 18174!), and Nelspruit Research Station, March 1931, L.C.C. Liebenberg (PREM 26647, 25905, isosyntytype HUV 18175!) (syn. by Ling, 1951: 104, confirmed).

= *Sphacelotheca kenya* Zundel, 1937: 586. — Type on *Hyparrhenia* sp., Kenya, Eldoret, 20 September 1929, A.S. Hitchcock (25028, BPI 178048). (syn. by Ling, 1951: 104).

= *Ustilago hyparrheniae* J.C.F. Hopkins, 1938: 109 and 126 (later homonym, not Beeli, 1922). — Type on *Hyparrhenia filipendula* (Hochst.) Stapf, S. Rhodesia (= Zimbabwe), Charter, 28 February 1933, J.M. Rattray (BPI 161634; isotypes in BPI 195258, HUV 15927!, IMI 44465, PREM 30371). (syn. by Ling, 1951: 104, confirmed).

*Sori* (Fig. 31) comprising all raceme-pairs or racemes of an inflorescence, cylindrical, usually forked, Y- or V-shaped, 1-2(-2.5)  $\times$  4-8 mm, partly concealed by the spathae, first covered by a thick, brown peridium which ruptures irregularly disclosing the semiagglutinated to powdery mass of spores and sterile cells surrounding a stout, bifurcate or a simple columella of the length of the sorus, often with short branches. Rarely, the sori are restricted to the spikelet-pairs only. *Spores* (Figs. 32, 33) when mature single, globose, ovoid, ellipsoidal to rarely elongate or slightly irregular, 7-10  $\times$  (7.5-)8-11(-12)  $\mu\text{m}$ , yellowish-brown; wall evenly thick, 0.5-0.8  $\mu\text{m}$ , finely, densely punctate-verruculose; spore profile smooth; in SEM spore surface finely, densely echinulate, between the spines finely, densely verruculose. *Spore germination*

(Deml no. 1674, in Vánky *et al.*, 1988: 186-187) resulted in a ramifying, multicellular, mononuclear mycelium. *Sterile cells* (Figs. 32, 33) in small, irregular groups, single cells globose, ellipsoidal or irregularly polyangular with flattened side(s), 9-24(-30)  $\mu\text{m}$  long, hyaline or subhyaline; wall 0.5-1.5  $\mu\text{m}$  thick, smooth.

*Hosts*: *Exothea abyssinica* (A. Rich.) Anderss. [*Hyparrhenia abyssinica* (A. Rich.) Roberty], *Hyparrhenia anamesa* Clayton, *H. anthistirioides* (A. Rich.) Stapf, *H. bracteata* (H. & B. ex Willd.) Stapf, *H. cymbaria* (L.) Stapf, *H. diplandra* (Hack.) Stapf, *H. filipendula* (Hochst.) Stapf, *H. hirta* (L.) Stapf, *H. nyassae* (Rendle) Stapf (*H. vulpina* Stapf), *H. rufa* (Nees) Stapf, *Hyperthelia dissoluta* (Nees ex Steud.) Clayton [*Hyparrhenia dissoluta* (Nees ex Steud.) C.E. Hubb., *H. ruprechtii* (Hack.) Fourn.].

*Known distribution*: S. Europe (Balearic Is., France, Greece, Italy, Portugal, Spain), Africa (Algeria, Canary Islands, Cape Verde Island, Congo, Kenya, Madagascar, Malawi, Morocco, South Africa, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe), S. America (Venezuela), Australasia (Australia, Papua New Guinea).

Comparison of the types and other specimens of *Ustilago puellaris* Syd., and *S. vanderystii* could not reveal any essential difference, hence they are treated as synonyms. Possible synonymy with the similar *S. andropogonis* (Opiz) Vánky {type on *Andropogon angustifolium* Sib. & Sm. [= *Dichanthium ischaemum* (L.) Roberty]} is discussed by Vánky, 1994: 198-199.

## 12. *Tilletia hyparrheniae* L. Ling, 1953b: 151.

*Sori* in ovaries, oblong, with tapering ends, *ca.* 1.5-2  $\times$  10 mm, covered by a rather thick, brownish, persistent membrane of host origin, which later dehisces at the apex and the spores and sterile cells are scattered. *Spores* globose, subglobose, ovoid or broadly ellipsoidal, 19.5-31.5  $\mu\text{m}$  diam., from pale to dark olive-brown or opaque when mature, densely ornamented with truncate projections, 2.5-4  $\mu\text{m}$  long, *ca.* 0.8  $\mu\text{m}$  wide. *Sterile cells* globose, ellipsoidal or ovoid, 13.5-45  $\mu\text{m}$  diam., hyaline; wall 3-4.5  $\mu\text{m}$  thick.

*Material examined*: SIERRA LEONE, Musaia, on *Hyparrhenia subplumosa* Stapf, 15 December 1946, F.C. Deighton (M2553, IMI 11370, slide, holotype).

*Host*: *Hyparrhenia subplumosa* Stapf.

*Known distribution*: W. Africa (Sierra Leone). Known only from the type locality.

The type specimen in IMI, of which I have seen only a slide, is scanty. In this slide the spores were (22-)26-32(-36)  $\mu\text{m}$  long.

*Sphacelotheca hyparrheniae* (Beeli) Zambett. f. *major* Zambett., Bull. Soc. Mycol. France 95: 412, 1979 (1980), on *Hyparrhenia* sp., is an invalid name (no Latin diagnosis).

Reports of *Sphacelotheca tenuis* (Syd. & P. Syd.) Zundel [type on *Bothriochloa pertusa* (L.) A. Camus, India], and of *Sorosporium everhartii* Ellis & Galloway (type on *Andropogon virginicus* L., USA), on *Hyparrhenia*

sp. and *Hyperthelia dissoluta*, most probably refer to other smut fungi or other host plants.

### Key to the smut fungi of *Hyparrhenia*

(*S.* = *Sporisorium*)

1. Sori in the ovaries; spores 20-30  $\mu\text{m}$  long ..... *Tilletia hyparrheniae*
1. Sori elsewhere; spores smaller.....2
2. Sori in the leaves; spore wall 3-6.5  $\mu\text{m}$  thick, multilayered ..... *Jamesdicksonia obesa*
2. Sori not in the leaves; spore wall thinner, not multilayered.....3
3. Sori producing witches' brooms.....4
3. Sori not producing witches' brooms.....6
4. Witches' brooms on the stems; spore balls rather permanent; outer spores prominently, low verrucose-echinulate, inner spores smooth.....*S. leelingianum*
4. Witches' brooms in the racemes; spore balls ephemeral or easily separating into spores; all spores ornamented .....5
5. Spores 5.5-8  $\mu\text{m}$  long; spore wall 0.5-1  $\mu\text{m}$  thick, moderately densely verrucose.....*S. congense*
5. Spores 9-13(-14)  $\mu\text{m}$  long; spore wall 2.5-3.5  $\mu\text{m}$  thick, irregularly verrucose-reticulate ....  
.....*S. andropogonis-finitimi*
- 6(3). Sori comprise the whole inflorescence; spores with inconspicuous, darker and lighter spots.....*S. maranguense*
6. Sori do not comprise the whole inflorescence; spores without spots.....7
7. Sori comprise the racemes or raceme-pairs.....8
7. Sori in the flowers; columella filiform or flagelliform .....9
8. Columella stout, one, simple or bifurcate; spores (7.5-)8-11(-12)  $\mu\text{m}$  long, finely punctate-verruculose; spore profile smooth.....*S. vanderystii*
8. Columella narrowing, 1-2, simple or forked; spores 11-13.5  $\mu\text{m}$  long, echinulate; spore profile serrulate.....*S. niariense*
- 9(7). Sori in some flowers of an inflorescence (rarely in all flowers of a raceme-pair); columellae several, filiform .....*S. ischaemoides*
9. Sori in all flowers of an inflorescence; columella single, flagelliform.....10
10. Spore balls rather permanent; no sterile cells .....*S. dembianense*
10. Spore balls apparently absent; sterile cells present.....11
11. Spores 13-18(-20)  $\mu\text{m}$  long.....*S. barcinonense*
11. Spores 10-15(-16)  $\mu\text{m}$  long.....*S. transfissum*

## HOST – PARASITE LIST

*A.* = *Andropogon*; *H.* = *Hyparrhenia*; *S.* = *Sporisorium*

- A. annulatus* = *Dichanthium annulatum*  
*A. arrhenobasis* = *H. arrhenobasis*  
*A. cymbarius* = *H. cymbaria*  
*A. finitimus* = *H. finitima*  
*A. hirtus* = *H. hirta*  
*A. lepidus* = *H. cymbaria*  
*A. rufus* = *H. rufa*  
*Dichanthium annulatum* — *Jamesdicksonia obesa*  
*Euclasta condylotricha* — *S. ischaemoides*  
*Exothea abyssinica* — *S. vanderystii*  
*H. abyssinica* = *Exothea abyssinica*  
*H. anamesa* — *S. ischaemoides*, *S. transfissum*, *S. vanderystii*  
*H. anthistirioides* — *S. ischaemoides*, *S. vanderystii*  
*H. arrhenobasis* — *S. dembianense*  
*H. aucta* = *H. dregeana*  
*H. bracteata* — *S. vanderystii*  
*H. collina* — *S. leelingianum*  
*H. cymbaria* — *S. ischaemoides*, *S. leelingianum*, *S. maranguense*, *S. vanderystii*  
*H. diplandra* — *S. congensis*, *S. transfissum*, *S. vanderystii*  
*H. dissoluta* = *Hyperthelia dissoluta*  
*H. dregeana* — *S. leelingianum*  
*H. filipendula* — *S. andropogonis-finitimi*, *S. dembianense*, *S. ischaemoides*, *S. leelingianum*,  
*S. vanderystii*  
*H. finitima* — *S. andropogonis-finitimi*  
*H. hirta* — *S. barcinonense*, *S. ischaemoides*, *S. transfissum*, *S. vanderystii*  
*H. hirta* var. *longearistata* — *S. transfissum*  
*H. niariensis* — *S. niariense*  
*H. nyassae* — *S. vanderystii*  
*H. pilgeriana* — *S. ischaemoides*  
*H. quarrei* — *S. transfissum*  
*H. rufa* — *Jamesdicksonia obesa*, *S. dembianense*, *S. ischaemoides*, *S. leelingianum*, *S.*  
*transfissum*, *S. vanderystii*  
*H. ruprechtii* = *Hyperthelia dissoluta*  
*H. scabrimarginata* = *H. collina*  
*H. subplumosa* — *Tilletia hyparrheniae*  
*H. tamba* — *S. dembianense*, *S. ischaemoides*, *S. leelingianum*, *S. transfissum*  
*H. variabilis* — *S. leelingianum*  
*H. vulpina* = *H. nyassae*  
*Hyperthelia dissoluta* — *S. ischaemoides*, *S. leelingianum*, *S. transfissum*, *S. vanderystii*



**FUNGUS NAMES**

(valid names in bold face)

***andropogonis-finitimi* Sporisorium***andropogonis-finitimi* Ustilago = ***Sporisorium andropogonis-finitimi****austro-africanum* Sorosporium = ***Sporisorium ischaemoides******barcinonense* Sporisorium***barcinonensis* Sphacelotheca = ***Sporisorium barcinonense****carbo* γ *columellifera* a. *transfissa* Ustilago = ***Sporisorium transfissum****clintonii* Sorosporium = ***Sporisorium leelingianum****columellifera* Sphacelotheca = ***Sporisorium transfissum******congense* Sporisorium***congensis* Sphacelotheca = ***Sporisorium congense****congensis* Ustilago = ***Sporisorium congense****dembianense* Sorosporium = ***Sporisorium dembianense******dembianense* Sporisorium***evansii* Sphacelotheca = ***Sporisorium vanderystii******everhartii* Sorosporium***hansfordii* Sorosporium = ***Sporisorium ischaemoides****healdii* Sorosporium = ***Sporisorium leelingianum****hyparrheniae* Sphacelotheca = ***Sporisorium vanderystii****hyparrheniae* Sphacelotheca f. *major*, invalid name.***hyparrheniae* Tilletia***hyparrheniae* Beeli, Ustilago = ***Sporisorium vanderystii****hyparrheniae* J.C.F. Hopkins, Ustilago = ***Sporisorium vanderystii****ischaemoides* Sorosporium = ***Sporisorium ischaemoides******ischaemoides* Sporisorium***ischaemoides* Ustilago = ***Sporisorium ischaemoides****kenyae* Sphacelotheca = ***Sporisorium vanderystii******leelingianum* Sporisorium***maranguense* Sorosporium = ***Sporisorium maranguense******maranguense* Sporisorium*****niariense* Sporisorium***nyassae* Sphacelotheca = ***Sporisorium transfissum****nyassae* Ustilago = ***Sporisorium transfissum******obesa* Jamesdicksonia***obesa* Tolyposporella = ***Jamesdicksonia obesa****obesum* Entyloma = ***Jamesdicksonia obesa****proliferatum* Sorosporium = ***Sporisorium leelingianum****puellare* Sporisorium = ***Sporisorium vanderystii****puellaris* Ustilago = ***Sporisorium vanderystii****ritchiei* Sphacelotheca = ***Sporisorium vanderystii****ruprechtii* Sphacelotheca = ***Sporisorium vanderystii****tembuti* Sorosporium = ***Sporisorium leelingianum******tenuis* Sphacelotheca***transfissa* Sphacelotheca = ***Sporisorium transfissum******transfissum* Sporisorium***tumefaciens* Sorosporium = ***Sporisorium leelingianum***

*tumefaciens* *Ustilago* = *Sporisorium leelingianum*  
*vanderystii* *Cintractia* = *Sporisorium vanderystii*  
*vanderystii* *Sphacelotheca* = *Sporisorium vanderystii*  
*vanderystii* *Sporisorium*  
*vanderystii* *Ustilago* = *Sporisorium vanderystii*  
*wildemanianum* *Sorosporium* = *Sporisorium ischaemoides*  
*zundelianum* *Sorosporium* = *Sporisorium leelingianum*

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