Two new smut fungi (Ustilaginomycetes) on *Pennisetum* (Poaceae) from Ethiopia

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Abstract. Two new species of smut fungi, *Macalpinomyces tilletioides* and *Sporisorium penniseticola,* are described and illustrated, both on *Pennisetum sphacelatum* from Ethiopia.

Key words: Ethiopia, *Macalpinomyces tilletioides,* new species, *Pennisetum,* smut fungi, *Sporisorium penniseticola,* taxonomy

Introduction

I revised the smut fungi of *Pennisetum* (Vánky 2003: 8-20) and recognised 12 species: one *Moesziomyces,* two *Ustilago,* and nine *Sporisorium* species. Recently, two new species were collected in Ethiopia, both on *Pennisetum sphacelatum.* One is a *Macalpinomyces,* the other belongs to the genus *Sporisorium.*

Materials and Methods

Pressed and dried specimens of the types of *Macalpinomyces tilletioides* and *Sporisorium sphacelatum* (see below) were studied. For light microscopical (LM) studies, dried teliospores were rehydrated in a droplet of lactophenol or in lactophenol with cotton blue, on a microscope slide, by gently heating to boiling point under a cover glass. For scanning electron microscopical (SEM) studies, dried teliospores were dusted on double-sided adhesive tape, mounted on a specimen stub, sputter coated with gold-palladium *ca* 20 nm, and examined in a scanning electron microscope at 10 kV.

Herbaria are abbreviated according to Holmgren *et al.* (1990). H.U.V. is the author's private herbarium.

Results

Isolated tussocks of the unpalatable *Pennisetum sphacelatum* were the sole flowering plants in a large, overgrazed pasture. In some spikelets of these plants a smut fungus with *Tilletia*-like sori was collected. Studies revealed that it represents a new species of *Macalpinomyces:*

Macalpinomyces tilletioides Vánky, **sp. nov.**

Typi *in matrice Pennisetum sphacelatum, Ethiopia, Arsi Reg., 11 km S urbe Asela, 7°52'15.0" N, 39°07'39.4" E, alt. 2630 m.s.m., 4.XI.2004, leg. T. & K. Vánky.* ***Holotypus*** *in Herbario Ustil. Vánky, H.U.V. 20 828, isotypi in BPI 863 738, BRIP, S et in Vánky, Ust. exs. no. 1253.* ***Paratypus*** *in matrice P. sphacelatum, Ethiopia, Gondar Reg., 20 km NE urbe Gondar, 12°40'26.5" N, 37°30'1.6" E, alt. 2780 m.s.m., 24.X.2004, leg. T. & K. Vánky, H.U.V. 20 829.*

Macalpinomyces tilletioides distinctus a species Sporisorium tothii Vánky (Mycotaxon ***85****: 14, 2003; typus: Pennisetum glaucum (L.) R. Br., Sierra Leone) ei ficte simili, propter soros compactos, persistentes, integre a matrice decidentes, propter absentiam glomerulorum sporarum, praesentiam cellularum sterilium et teliosporas ornatas, non leves.*

Sori (Fig. 1) in some spikelets of an inflorescence comprising the ovaries, more or less hidden by the floral envelopes, ovoid, ellipsoidal or slightly irregular, compact, 1-1.5 × 2-3 mm, often with a short acute tip bearing remnants of the stigma, covered by a first green later brown, rather thick, persistent peridium. Sori fall off the plants in one piece, together with the spikelet and involucral bristles, similarly to the deciduous healthy spikelets. Spore mass dark brown, agglutinated, composed of irregular groups of tightly packed spores (pseudo spore balls) mixed with sterile cells. **Teliospores** (Figs 3-4) globoid, ellipsoidal, usually rounded

Fig. 1. Sori of *Macalpinomyces tilletioides* on *Pennisetum sphacelatum* (type). Habit, and enlarged two sori in the ovaries, and a healthy spikelet. Bars = 1 cm for habit, and 2 mm for enlargement

Fig. 2. Two sori of *Sporisorium penniseticola* on *Pennisetum sphacelatum* (type). Habit. Bar = 1 cm

subpolyhedrally or polyhedrally irregular, 9-10.5 × 9.5-12 (–13) µm, yellowish brown; wall even or slightly unevenly thick, *ca* 0.5 µm wide, finely, densely verrucose-echinulate, spore profile smooth, finely wavy to minutely serrulate. **Sterile cells** (Figs 3-4) in small groups or single. Single cells variable in shape and size, subglobose, ovoid, ellipsoidal or irregular, 6.5-12 × 7-16 µm, subhyaline with a pale yellowish-brown tint; wall 1-2 (–2.5) µm thick, homogenous, smooth.

On *Pennisetum sphacelatum* (Nees) Th. Dur. & Schinz; E Africa (Ethiopia). Known only from the type collections.

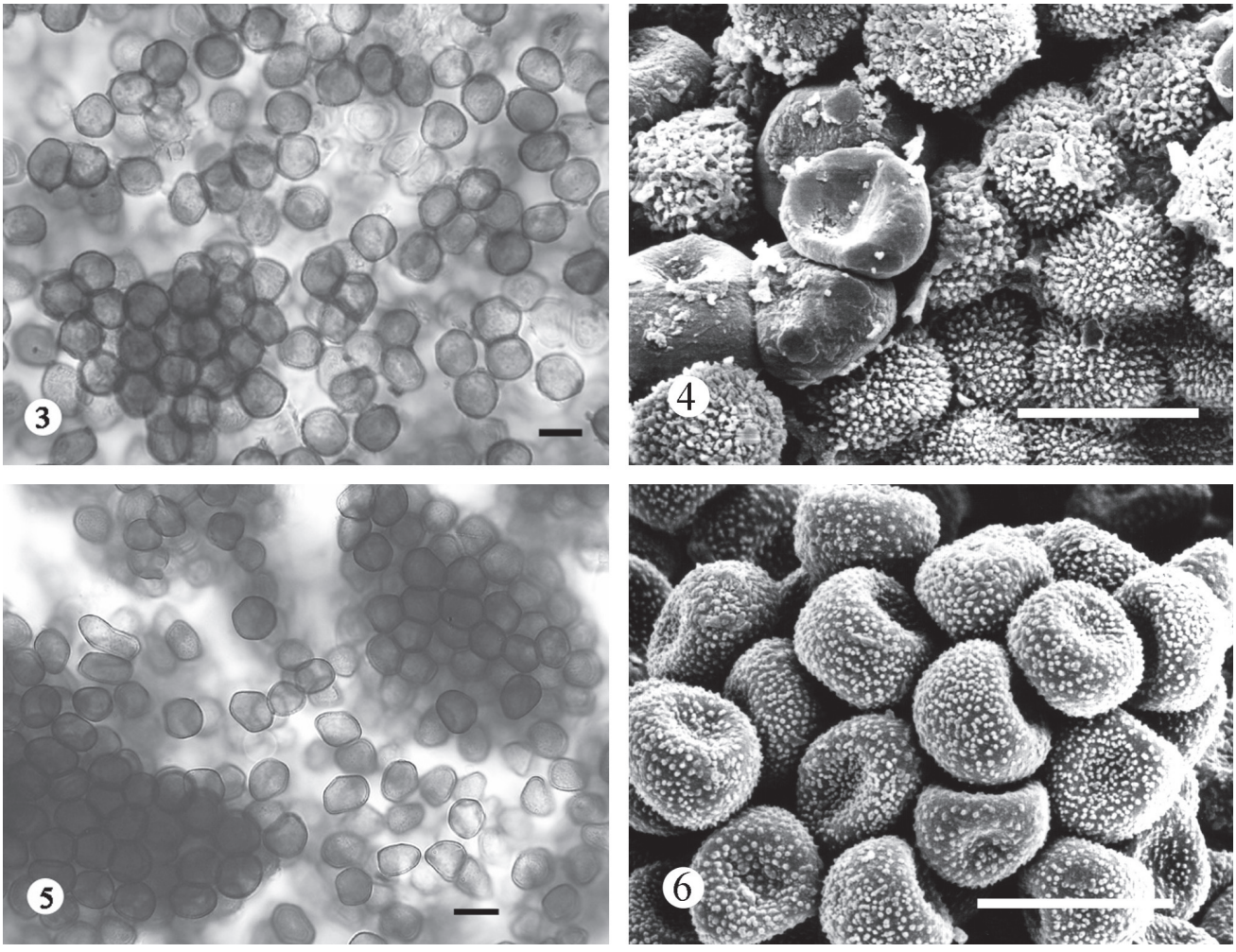
Teliospore formation was observed in a young sorus mounted in lactophenol with cotton blue. The spores (and sterile cells) develop within a mass of hyaline, septate, elongated, thin-walled sporogenous hyphae filling the sorus. The cells gradually increase in size, become rounded, then polyangular due to mutual pressure, and the spore wall becomes thicker, pigmented and finally ornamented.

The compact sori of *Macalpinomyces tilletioides,* which fall off the plants in one piece, is interpreted as an adaptation to keep the teliospores as close as possible to the host plant on which they were produced. Within the smut fungi it is uncommon that instead of adaptation to one of several kinds of spore dispersal, there is an adaptation to the contrary. Such a phenomenon was observed and discussed by Vánky (2004: 172) in the case of *Pilocintractia fibristylidicola* (Pavgi & Mundk.) Vánky on *Fimbristylis* spp. Such an adaptation is advantageous in the case of perennial host plants growing in isolated patches. In the case of *Pennisetum sphacelatum* infection is apparently a local, floral event. For such an infection pattern, basidiospores, the products of teliospore germination, are needed in possibly large numbers, at the right place, in the right time, i.e., when the new shoots of the host plants are flowering in the next season.

A second smut fungus, collected in Ethiopia in six localities, and observed in many more places is:

Sporisorium penniseticola Vánky, **sp. nov.**

Typi *in matrice Pennisetum sphacelatum, Ethiopia, Shewa Reg., 129 km N urbe Addis Abeba, 9°49'22" N, 38°35'19" E,*



Figs 3-4. Spores and sterile cells of *Macalpinomyces tilletioides* on *Pennisetum sphacelatum* in LM and in SEM (type). Bars = 10 µm. **Figs 5-6.** Spore balls and spores of *Sporisorium penniseticola* on *Pennisetum sphacelatum* in LM and in SEM (type). Bars = 10 µm

alt. 3007 m.s.m., 20.X.2004, leg. T. & K. Vánky. ***Holotypus*** *in Herbario Ustil. Vánky, H.U.V. 20 862, isotypi in BPI 863 736, S et in Vánky, Ust. exs. no. 1261.* ***Paratypi*** *in matrice P. sphacelatum, Ethiopia, Gondar Reg., 20 km NE urbe Gondar, 12°40'26.5" N, 37°30'1.6" E, alt. 2780 m.s.m., 24.X.2004, leg. T. & K. Vánky, H.U.V. 20 863, BPI 863 737, S; Arsi Reg., 11 km S urbe Asela, 7°52'15.0" N, 39°7'39.4" E, alt. 2630 m.s.m., 4 Nov 2004, leg. T. & K. Vánky, H.U.V. 20 864, BRIP, S.*

Sporisorium penniseticola specie Sporisorium sphacelatum Vánky (Mycotaxon ***85****: 13, 2003, typus in matrice Pennisetum sphacelatum, South Africa) simile, a quo imprimis propter morphologiam teliosporae distinctum. S. penniseticola cum teliosporis saepe irregularibus, magnitudine (6,5–) 7-9,5 × (7,5–) 8-11 (–13) µm, pariete qequali, cca. 0,5 µm crasso. Teliosporae speciei S. sphacelatum saepe regulares, magnitudine 5-6,5 × 5,5-7,5 µm, pariete inaequali (0,5-0,8 µm), ad latus unum crassiore et hic etiam obscuriore.*

Sori (Fig. 2) on the top of sterile shoots comprising the whole inflorescence and its stem, forming long, cylindrical, bent, greyish brown bodies, 1-3 mm wide, 5-18 cm long, partly enclosed by the uppermost leaf sheath. At maturity, the distal part of the sori splits longitudinally in several places, the blackish-brown, first agglutinated, later powdery mass of teliospore balls is gradually dispersed leaving behind several vascular fascicles as long, slender columellae, whereas the proximal part of the sori is still entire containing sporogenous hyphae with immature spore balls. Rarely, the sori are restricted to the inflorescence or to its stem or its axis only, bearing remnants of more or less aborted spikelets or distorted floral envelopes and bristles. **Spore balls** (Figs 5-6) variable in shape and size, globose, ovoid, ellipsoidal, elongated or irregular, 25-80 × 30-130 (–150) µm, dark yellowish or olivaceous brown to subopaque, composed of ten to tens or hundreds of spores which separate easily by pressure. **Teliospores** (Figs 5-6) variable in shape and size, subglobose, ovoid, ellipsoidal, usually rounded subpolyhedrally irregular, occasionally bent or with a subacute tip, (6.5–) 7-9.5 × (7.5–) 8-11 (–13) µm, yellowish brown; wall even, *ca* 0.5 µm thick, finely, densely punctate-verruculose, spore profile smooth. **Sterile cells** absent.

On *Pennisetum sphacelatum* (Nees) Th. Dur. & Schinz; E Africa. Known only from Ethiopia, where it is common.

Sporisorium penniseticola is similar to *S. sphacelatum* Vánky (type on *Pennisetum sphacelatum*, South Africa) from which it differs especially by teliospore morphology. In *S. penniseticola* the spores are mainly irregular, (7.5–) 8-11 (–13) µm long, the spore wall is even, *ca* 0.5 µm thick. The spores of *S. sphacelatum* are mainly regular, 5.5-7.5 µm long, the spore wall is uneven, 0.5-0.8 µm, and thicker on one side, where the spores are also darker.

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