

SHORT RESEARCH NOTES

The smut fungi (Ustilaginomycetes) on *Triodia*, including *Ustilago lituana* sp. nov. from Australia

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Abstract. A new smut fungus, *Ustilago lituana*, is described and illustrated on the grass *Triodia epactia* from Western Australia. It is compared with the three known smut fungi on *Triodia* and a key for identifying these species is given.

The grass genus *Triodia* R. Br. ('spinifex'; subfam. Chloridoideae, tribe Triodieae) contains 65 species, all endemic to Australia (Lazarides *et al.* 2005). Three smut fungi are known on *Triodia*, namely *Ustilago altilis* H. Syd., *U. inaltilis* Vánky & A. A. Mitchell and *U. triodiae* Vánky. All of them have sori on the floral stems, often also on the destroyed inflorescences, which are at first covered by a thin peridium of host origin. The spores are relatively small (<12 µm long). The three species differ from each other by sorus and spore morphology (comp. Vánky 1997: 166–172, 1998: 327–329, and the key below). A similar smut fungus on *Triodia epactia* was collected in the Pilbara region of Western Australia in 2005. Its comparison with the types and other specimens of the three known *Ustilago* species on *Triodia* revealed that it is a different species, which is described as:

Ustilago lituana R. G. Shivas, Vánky & Cunnington sp. nov. (Fig. 1)

Typus in matrice *Triodia epactia* S.W.L. Jacobs., Australia, Western Australia, Port Hedland, Cooke Point, 20°17'S, 118°38'E, alt. 3 m.s.m., 12 Aug. 2005, leg. M. J. Ryley, T. S. Marney & R. G. Shivas. Holotypus in BRIP 46795!, isotypi in HUV 21105!, PERTH 07094574! et in Vánky, Ust. exs. no. 1293.

Ustilago lituana species nova similis speciei *Ustilago triodiae* Vánky (Mycotaxon 62: 167, 1997), sed distincta soris typice curvatis et sporis minoribus pallidioribusque,

magnitudinis 5–7 × 6–8 µm. Sporae *U. triodiae* 7–10.5 × (8–)9–12 µm magnae.

Sori surrounding the floral stems and also completely destroying the inflorescence, long-cylindrical, curved like a shepherd's crook, 1–2(–2.5) mm wide, 4–17 cm long, occasionally bearing remnants of small, deformed glumes on their distal part, first covered by the epidermis as a thin, greyish peridium which ruptures irregularly, disclosing the dark brown, semi-agglutinated to powdery mass of spores surrounding a long, simple, flagelliform columella. *Spores* globose, subglobose to broadly ellipsoidal, 5–7 × 6–8 µm, pale olivaceous-brown; wall even, c. 0.5 µm thick, rather sparsely, evidently low verruculose, spore profile smooth to very finely wavy. *Spore germination* of the *Ustilago*-type.

Etymology: adjectival form of *lituus* (Latin for a curved staff) referring to the shape of the sori.

U. lituana is close to *U. triodiae* from which it differs by the typically curved sori and much smaller and paler spores measuring 5–7 × 6–8 µm. The spores of *U. triodiae* measure 7–10.5 × (8–)9–12 µm. A key to the smut fungi (*Ustilago*) on *Triodia* follows.

1. Sori long (up to 30 cm), cylindrical 2
– Sori comparatively short (less than 10 cm) 3
2. Sori straight or only slightly bent. Spores (8–)9–12 µm long *U. triodiae*
– Sori typically curved. Spores 6–8 µm long *U. lituana*
3. Spores 7–12 µm long. Sori short, thick. No trace of an inflorescence
..... *U. altilis*
– Spores (5.5–)6–9.5(–10.5) µm long. Sori as blister-like swellings
several cm long. More or less aborted inflorescence present . . . *U. inaltilis*



Fig. 1. *Ustilago lituana* on *Triodia epactia*. (a) Sorus. Bar = 1 cm. (b) Healthy inflorescence of *Triodia epactia*. Bar = 1 cm. (c) Spores. Bar = 10 μ m. (d, e) Germinating spores after 12 h at room temperature on potato-dextrose agar. (f) Surface ornamentation of spores in scanning electron microscope.

As shown above, *U. lituana* infects a grass (Poaceae) and has sori on the surface of the floral stems and the destroyed inflorescence, and has relatively small spores (6–8 μ m long). The genus *Tranzscheliella* Lavrov, with its type *T. otophora* Lavrov (= *T. williamsii* (Griffiths) Dingley & Versluis), is

characterised by naked sori on the surface of the stems (and floral axes) of Poaceae, possessing relatively small spores (comp. Vánky 2002: 162–163). The fact that some *Ustilago* species have similar sori and spores can cause problems in the classification of smut fungi at the generic level, if the

assumption is made that all smut fungi on the surface of the stems (and floral axes) of Poaceae, and possessing small spores, belong to the genus *Tranzscheliella*. DNA analysis has the ability to show, on the one hand that *Tranzscheliella* is a good genus, and on the other hand whether our new species, and similar 'Tranzscheliella-like' smuts, belong to the genus *Ustilago* or to *Tranzscheliella*. Stoll *et al.* (2005), in their comprehensive phylogenetic analysis of *Ustilago*, *Sporisorium* and related taxa, included also *U. triodiae*, a *Tranzscheliella*-like smut, but no true *Tranzscheliella* species. From their analysis, it is clear that not all *Tranzscheliella*-like smuts belong to this genus.

To provide some insight into the relationship between these taxa, the ITS region was amplified and sequenced from the type specimen of *U. lituana* and a specimen of a true *Tranzscheliella*, *T. hypodytes* (BRIP 28937, ex *Stipa papposa* Nees), according to Cunningham *et al.* (2005). These two sequences have been deposited in GenBank under accessions DQ307754 and DQ307753, respectively. Due to sequencing difficulties, sequence data for the ITS 2 region of *U. lituana* could not be obtained. A Blast2 (Altschul *et al.* 1997) comparison with GenBank sequences revealed that the ITS 1 region of *U. lituana* differs from *U. triodiae* by a single base. However, it was difficult to align these two sequences with that from *T. hypodytes*, due to large numbers of mutations and indels. A Blast2 search using the *T. hypodytes* sequence revealed highest similarities to two partial ITS sequences on GenBank belonging to *T. hypodytes* (AF045867) and *T. williamsii* (AF045869). The next similar matches were to species of *Ustilago*. The ITS sequence differences between the *Tranzscheliella* and *Ustilago* species provide preliminary data supporting two separate genera. Further research using the conserved rDNA large subunit region is required to confirm that *Tranzscheliella* is phylogenetically separate from *Ustilago/Sporisorium*.

In the absence of published molecular data for most *Tranzscheliella* and *Tranzscheliella*-like smuts, it is premature to draw conclusions about the morphological characters that differentiate species of *Tranzscheliella* from those of *Ustilago*. However, from what we already know, we predict that it will be possible to differentiate these two genera from each other by sorus and spore morphology.

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