

Two new species of *Moreaua* (*Ustilaginomycetes*), on *Actinoschoenus* and *Chrysitrix*, from Western Australia

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Received 10 November 2011 / Accepted 21 November 2011

Abstract. Two new species of *Moreaua* are described from endemic species of *Cyperaceae* (sedges) in Western Australia. *Moreaua actinoschoeni* occurs on *Actinoschoenus* sp. in the far north, and *M. chrysitricis* occurs on *Chrysitrix distigmatosa* in the mid west. These are the first smut fungi to be found on these two genera of sedges. *Moreaua chrysitricis* is the third smut fungus to have been found on a sedge in the subfamily *Mapanioideae*.

Key words: *Actinoschoenus*, *Chrysitrix*, *Cyperoideae*, *Moreaua*, new species, smut fungi, taxonomy

Introduction

In 2008, one of us (RLB) collected a smut fungus on *Chrysitrix distigmatosa* (*Cyperaceae*, subfam. *Mapanioideae*). This sedge species is endemic to the interzone between the south-west and arid interior of Western Australia. In 2010, another of us (MDB) collected a different smut fungus on a species of *Actinoschoenus* (*Cyperaceae*, subfam. *Cyperoideae*), described as *Actinoschoenus* sp. “E” by Rye (1992) and still unnamed. This sedge species is endemic to the north-west Kimberley region. These two smut fungi belong to the genus *Moreaua*. Species of *Moreaua* infect hosts in the *Cyperaceae* (sedges), forming naked sori on floral parts (Vánky 2002). Worldwide 36 species of *Moreaua* are known, mostly from the Southern Hemisphere (Vánky 2012), with 21 species reported from Australia (Vánky & Shivas 2008). The known Australian species of *Moreaua* infect 13 different genera of sedges (Vánky & Shivas 2008) that all belong to the subfamily *Cyperoideae*, which together with the *Mapanioideae*, are the only two subfamilies recognized in the *Cyperaceae* (Muasya *et al.* 2009). These two *Moreaua* represent novel species, which are described below.

Materials and methods

Spore characteristics were studied using dried herbarium specimens. For light microscopy (LM) spores were suspended in a small droplet of lactic acid, covered with a cover glass, gently heated to boiling point to rehydrate the spores and eliminate air bubbles from the preparation, and studied at 1000× magnification. For scanning electron microscopy (SEM), spores were placed 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

Moreaua chrysitricis R.G. Shivas & Vánky, *sp. nov.*

Figs 1a, b, d, f

Mycobank # MB 563481

Sori in superficie organorum floralium interiorum sicut filamenta innumerabilia, 10–15 mm longa, vel fasciculi tenues inter bracteas protrudentes, massa nigra, agglutinata usque granuloso pulverea glomerulorum sporarum partim vel omnio

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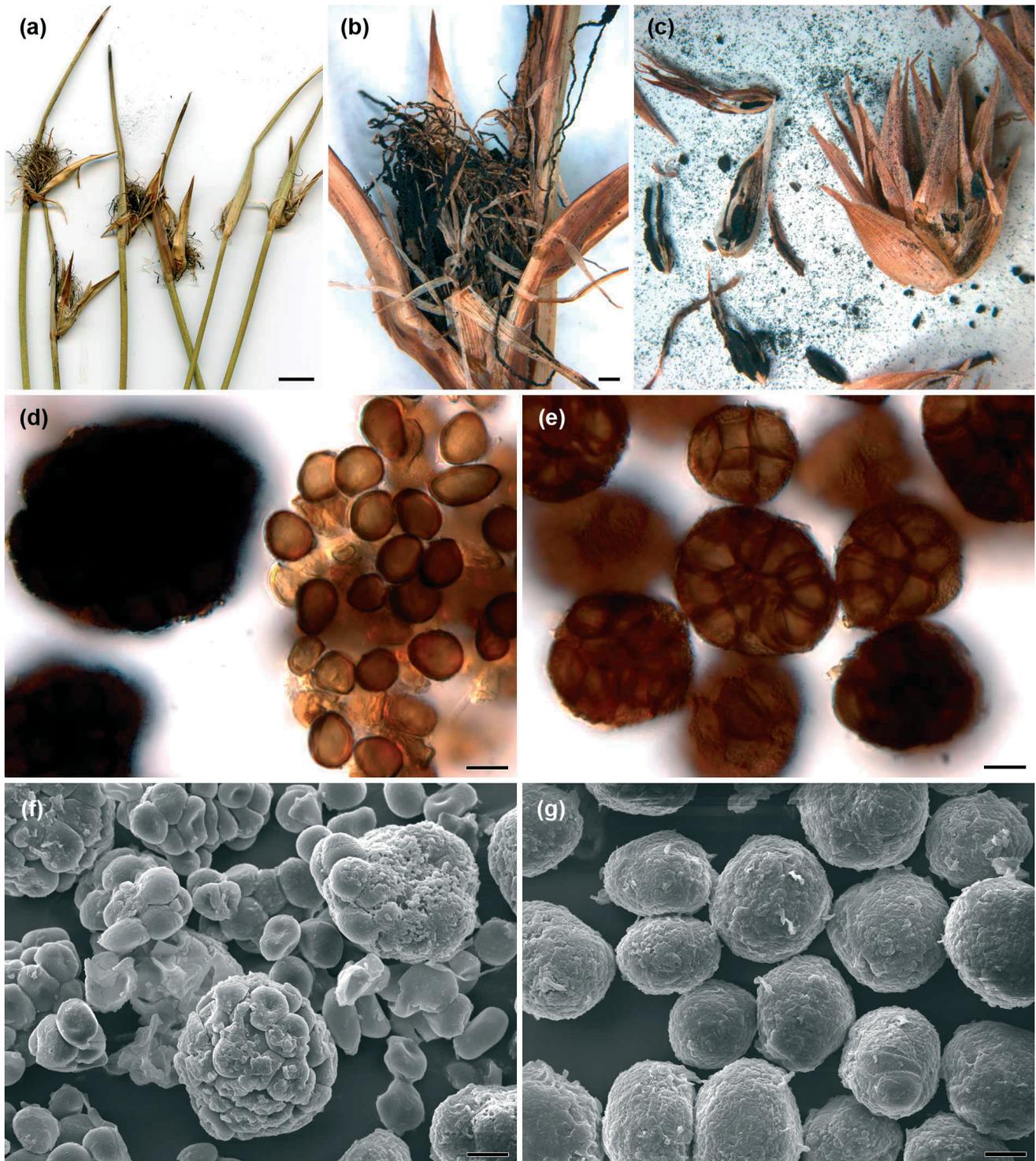


Fig. 1. *Moreaua* spp. from Western Australia. (a, b) *Chrysitrix distigmatosa* infected with *M. chrysitricis*. (c) *Actinoschoenus* sp. infected with *M. actinoschoeni*. (d) Spore balls and spores of *M. chrysitricis* under LM. (e) Spore balls of *M. actinoschoeni* under LM. (f) Spore balls and spores of *M. chrysitricis* under SEM. (g) Spore balls of *M. actinoschoeni* under SEM. Bars = 1 cm (a), 1 mm (b–c), 10 μ m (d–g)

cooperti. *Glomeruli sporarum* forma et magnitudine variabiles, globosi, subglobosi, ellipsoidales usque irregulares, raro elongati, 25–100 × 20–85 μm, atro-olivaceobrunnei, opaci, e sporis arcte congruentibus c. 10– usque 100(?), pressu duro separatis compositi. *Sporae* interiores glomerulorum globosae, subglobosae, ellipsoidales, elongatae, non raro cum papilla brevi, vel apice subacuto uno, 9–20 (–23) × 8–12,5 (–13,5) μm, rubro- usque olivaceobrunneae; pariete parum inaequaliter 0,5–1 (–1,5) μm crasso, apparenter levi usque valde leviter punctato; superficies libera sporarum externarum convexa, dense, prominenter verrucosa, verrucae 2 vel nonnullis forte fusibiles in seriebus brevibus, in visu mediano pariete 1–2,5 (–3) μm crassos, verrucis 0,5–1 (–1,5) μm altis, cum apicibus rotundatis vel aliquot denudatis inclusis.

Typus in matrice Chrysitrix distigmata C.B. Clarke, Western Australia, c. 30 km NW of Mullewa, East Yuna Nature Reserve, 0.5–1.2 km S of Campbells Road, side of Wandin Creek, 28°25'16" S, 115°11'04" E, 19.IX.2008, leg. R.L. Barrett, M.D. Barrett & C. Karsten. Holotypus BRIP 54351, isotypi PERTH 08321825, HUV 21962.

Sori on the surface of inner floral organs (particularly the numerous anthers from male flowers surrounding each female flower), protruding between the bracts as numerous, 10–15 mm long filaments, partially or completely covered by a black, agglutinated to granular powdery mass of spore balls. **Spore balls** variable in shape and size, globose, subglobose, ellipsoidal to irregular, rarely elongate, 25–100 × 20–85 μm, dark reddish to olivaceous brown or opaque, composed of c. 10 to hundreds of tightly packed spores which separate by firm pressure. **Spores** inside the balls globose, subglobose, ellipsoidal, elongate, often with a short papilla or with a subacute tip, 9–20 (–23) × 8–12.5 (–13.5) μm, reddish to olivaceous brown; wall slightly unevenly 0.5–1 (–1.5) μm thick, apparently smooth to very finely punctate; free surface of the outer spores convex, densely, prominently verrucose, two or several warts may fuse into short rows, in median view wall 1–2.5 (–3) μm thick, including the 0.5–1 (–1.5) μm high warts with rounded or somewhat flattened tip.

On *Cyperaceae*: *Chrysitrix distigmata*. Known only from the type collection.

Chrysitrix, in the *Mapamoideae*, is a genus of four species, one in Australia and three endemic to Western Cape Province in South Africa. *Moreaua chrysitricis* is the first smut fungus reported from this genus.

Moreaua actinoschoeni R.G. Shivas & Vánky, sp. nov.

Figs 1c, e, g

Mycobank # MB5 63482.

Sori in superficie organorum floralium intimorum, massam nigram, agglutinatum usque granuloso pulveream glomerulorum sporarum formantes, involucris floralibus perfecte occulti. *Glomeruli sporarum* subglobosi, ellipsoidales usque parum irregulares, raro elongati, (20–) 25–60 (–70) × (20–) 25–45 μm, atro-castaneobrunnei, e sporis (2–) 5–50?, magis fragmentes pressu duro, quam separantes. *Sporae* rotundae, plerumque subpolyedriciter vel polyedriciter irregulaes, 10–20 × 7–14,5 μm,

olivaceobrunneae, in superficie conspicue, dense, irregulariter verrucosae, in latere contacto et sporae interiores conspicue leves; paries inaequaliter crassus, 0,8–6,5 μm, vel ad 8 μm in sporis elongatis ad superficiem liberam; imago obliqua sporae irregulariter undulata vel dentata cum verrucis 1–2,5 μm altis cum apice rotundato vel deplanato.

Typus in matrice Actinoschoenus sp., Western Australia, 29.8 km W of Mt Agnes, Prince Regent River Reserve, 15°57'40" S, 125°27'04" E, 26.III.2010, leg. M.D. Barrett. Holotypus BRIP 54345, isotypi PERTH 08321817, HUV 21963.

Sori on the surface of inner floral organs, forming a black, agglutinated to granular powdery mass of spore balls completely hidden by the floral envelopes. **Spore balls** subglobose, ellipsoidal to slightly irregular, rarely elongate, (20–) 25–60 (–70) × (20–) 25–45 μm, reddish brown, composed of (2–) 5–50? spores that break rather than separate by hard pressure. **Spores** rounded, usually subpolyhedrally or polyhedrally irregular, 10–20 × 7–14.5 μm, reddish brown, free surface evidently, densely, irregularly verrucose, on contact sides and inner spores apparently smooth; wall unevenly thick, 1–6.5 μm, spore profile irregularly undulate or dentate by 1–2.5 μm high rounded or flattened warts.

On *Cyperaceae*: *Actinoschoenus* sp. "E" in *Flora of the Kimberley Region* (Rye 1992: 1038–1039). Known only from the type collection.

Actinoschoenus is a genus of 5–10 species, extending from Madagascar to southern Asia, including southern China and northern Australia (Rye 1992: 1036). *Moreaua actinoschoeni* is the first smut fungus reported from this genus.

Discussion

The discovery of these two new species of *Moreaua* on sedges indicates that there is likely an abundance of species of smut fungi yet to be found and described, from the native Australian flora. Until now, all species of *Moreaua* had been found on hosts in the subfamily *Cyperoideae*. *Moreaua chrysitricis* represents the first species of *Moreaua*, and the third smut fungus found on sedges in the subfamily *Mapanioideae*. The other two smut fungi in this subfamily are the two known species of *Cintractiella*, *C. lamii* Boedijn on *Hypolytrum* sp. from PNG, and *C. diplasiae* (Henn.) M. Piepenbr. on *Diplasia carataefolia* from South America. With these discoveries the number of *Moreaua* spp. found in Australia rises to 23, and the number of genera of sedges in Australia that may be infected by *Moreaua* spp. to 15.

Acknowledgement. We are grateful to Dr. Sándor Tóth (St. István University, Gödöllő, Hungary) for preparing the Latin descriptions.

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