

Report

An undetermined fungus infecting fruits of *Tetragonia* (Aizoaceae) in Australia

John Walker

Honorary Research Associate, Forest Resources Research, Science and Research, NSW Department of Primary Industries, P.O. Box 100, Beecroft, NSW 2119, Australia.
Email: john.walker.myc7@bigpond.com

Abstract

A rare fungus of unknown identity infecting fruits of *Tetragonia* spp. in Western Australia and New South Wales is described and illustrated. Known only from three, minute collections, it produces elongated, sometimes Y-shaped, hyaline conidia in pale pustules, and ornamented, subglobose to oval, dark, thick-walled spores embedded in infected host tissue. Molecular work at Tübingen on the Western Australian collection indicates that it is an ascomycete.

John Walker (2007). An undetermined fungus infecting fruits of *Tetragonia* (Aizoaceae) in Australia. *Australasian Mycologist* 26 (1): 51-54.

Introduction

This rare fungus is known from only three, minute collections. Its taxonomic position is unknown, and, since its first finding in 1971, the only literature reference to it is in the list of Western Australian records of fungal and bacterial diseases of plants (Shivas 1989), where it is reported as '*Melanopsichium* sp.'. The work detailed here was carried out in 1983 but in the ensuing 23 years, no other specimens have been seen and no mention of a similar fungus has been found in the literature. It is described and illustrated here to bring it to the notice of plant pathologists, mycologists and botanists, in the hope that further collections may be found.

Materials and methods

Spores were mounted in clear lactophenol, or lactophenol with 0.1% acid fuchsin, warmed gently to expel air bubbles and examined. After scanning spores, ten were measured,

and any abnormally small or large spores noted. Herbarium abbreviations follow Holmgren *et al.* (1981) and Index Herbariorum (2006), and abbreviations for fungus and plant names follow Brummitt and Powell (1992).

Description and discussion

The earliest collection is on *Tetragonia diptera* F. Muell., from Shark Bay, Western Australia, made by H.L. Harvey about 1971. Harvey sent this specimen to the C.A.B. International Mycological Institute (IMI), where it was tentatively identified as a smut, *Melanopsichium* sp. (see Shivas 1989). Through the courtesy of the Director, Herb IMI, the specimen (IMI 162907) has been examined. It consists of stem fragments, and a broken fruit containing a dark mass of brown to black, subglobose, oval to limoniform, thick-walled, ornamented spores. In 1983, on two specimens of *T. tetragonioides* (Pallas) Kuntze sent by Mr D. Parsons to the author from Moree, NSW, extremely light infection was

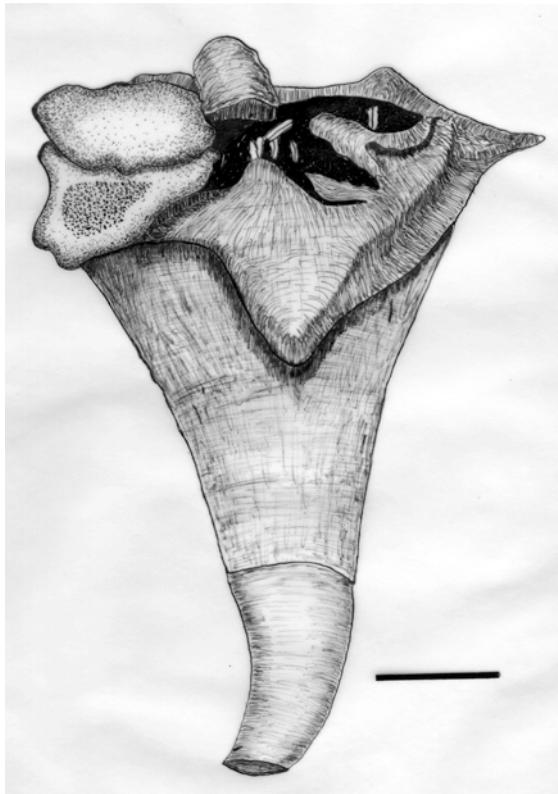


Figure 1. Fruit of *T. tetragonioides* from DAR 33869a showing two pale blisters on the upper left, the lower with a darker central patch containing dark spores. Bar: 2 mm.

found on a few fruits (Fig. 1) and on neighbouring stem and leaf tissue. Small, white to creamy-white, embedded blisters 1–3 mm across contained hyaline, cylindrical or Y-shaped, conidium-like bodies. Amongst these and in adjacent host tissue, dark spores were present, identical to those seen in the Shark Bay specimen. Germination of conidia and spores placed on agar plates was not observed. The Western Australian specimen appears more mature than those from NSW. No similar fungus recorded from *Tetragonia* is known. It is described and illustrated here from the available collections.

Pustules very few, creamy white, embedded in tissues of fruit calyx remnants (Fig. 1), rarely stem and leaves, not erumpent, 3–3.5 mm diam., containing hyaline hyphae and conidia, and darker subglobose to oval bodies mixed with conidia and in adjacent host tissue. *Conidia* (Fig. 2C) cylindrical to obclavate, tapering to apex, sometimes Y-shaped, straight to slightly sinuous, unicellular or rarely

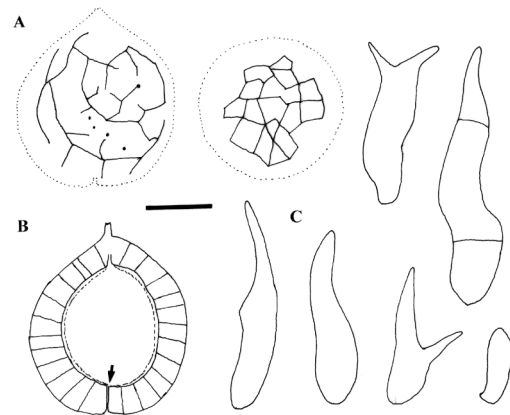


Figure 2. *Tetragonia* fungus DAR 33869a (A) Two spores showing irregular and regular reticulate patterns. (B) Spore in median longitudinal section showing thick wall with radial striations, small pore through wall at base (arrow), with torn fragment of mother hypha at top and indistinct pore. (C) Six conidia, straight and Y-forms, from sori, one with two transverse septa. Bar: 10 μ m.

with 1 (–2) transverse septa, 11–33 \times 4–6 μ m when unicellular, to 45 μ m long when septate, with a small refringent basal hilum. *Spores* (Figs 2A, B, 3, 4) in host tissue associated with conidial pustules, subglobose to broadly oval, some approaching limoniform, golden brown, 24–33 \times 23–28 μ m, wall complex, apparently double, 3.5–6 μ m thick, ornamented with a regular or broken reticulum showing numerous fine radial lines. At one or both ends of the spore, a broken fragment of hypha remains, with a fine pore penetrating the spore wall (Fig. 2B). *Chlamydospores* (perhaps immature spores) few, mixed with spores, subglobose, oval to ovoid, brown to dark brown, to 15 μ m diam. or up to 20 \times 14 μ m, with a thin, smooth wall. Germination of conidia, spores and chlamydospores was not seen, either in specimens or when they were placed on Potato Dextrose Agar (PDA) plates.

Under the light microscope, the reticulate ornamentation of spores appears to be inside the thickened wall, with raised dissepiments of the inner wall forming the fine radial striae seen in equatorial view (Figs 2A, B). SEM and TEM studies are necessary to understand the precise nature of this ornamentation.

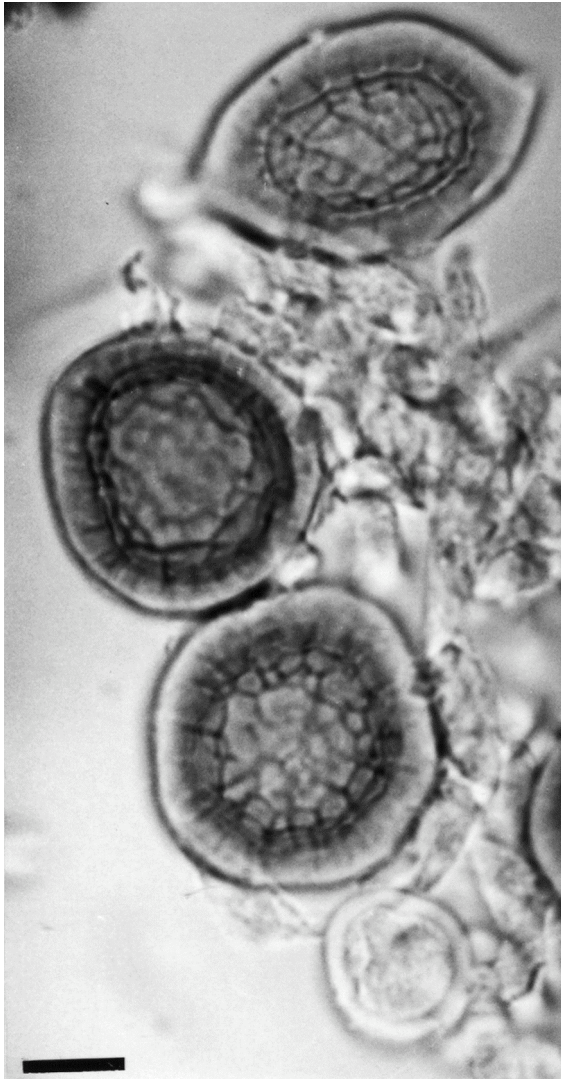


Figure 3. Three spores in surface view, showing variation in spore shape and irregularly reticulate ornamentation. DAR 33869a. Bar: 10 μ m.



Figure 4. Three spores in equatorial view. Thick walls show fine, radial striae (arrow). DAR 33869a. Bar: 10 μ m.

What may be this fungus was isolated in culture on PDA by plating plant tissue pieces containing both conidia and spores from DAR 33869a. Colonies were white at first, soon darkening to brown, with radial folds and a slightly raised convoluted heap at the centre. The surface was covered with a moist mat of repent hyphae but no aerial mycelium. The reverse was dark brown, and a brown pigment diffused into the agar. Diameter growth was 20–24 mm in 21 days at 25°C. Smooth-walled, brown, oval to cylindrical, terminal and intercalary chlamyospores were produced on hyphae in the agar. They were more variable

in size and shape that the bodies called chlamyospores in sori, and were often delimited from the parent hyphae by several transverse septa. In cultures eight weeks old, small patches of yellow crystals had developed on the colony surface.

At first, I suspected that this fungus might be a smut. Its Y-shaped, hyaline conidia and dark, thick-walled, ornamented spores reminded me of the smut *Tilletia ayresii* Berk., an ovary smut of *Panicum* spp. and the type species of the genus *Conidiosporomyces* (see Vánky 2002). However, as pointed out to me by Dr K.

Vánky, Tübingen, all species placed to date in *Conidiosporomyces* are smuts of panicoid grasses and it is most unlikely that this genus infects plants outside this host group. Recent DNA studies (Castlebury, Carris and Vánky 2005) suggest that *Conidiosporomyces* does not differ significantly from *Tilletia* at generic level and is best retained in *Tilletia*. With the exception of the genus *Erratomyces* Piepenbring & Bauer (1997) on leguminous hosts, all known genera and species of *Tilletiales* infect hosts in *Poaceae*.

In September 2005, I sent a minute fragment from DAR 33869a to Dr Vánky for his opinion. At that time, he expressed interest in its identity and, in later correspondence (20 Feb. 2006), said that molecular work at Tübingen on the Western Australian collection IMI 162907 indicated that it is an ascomycete. At present, it is not possible to assign the *Tetragonia* fungus even to an order. Further work on spore germination and DNA studies on fresh collections are required. It is hoped that this note will encourage pathologists, mycologists and botanists to search for this poorly known fungus.

Specimens examined: **New South Wales:** on *Tetragonia tetragonioides* (Pallas) Kuntze, Moree, 28 July 1983, D. Parsons, DAR 33869a; Moree, 19 Sept. 1983, D. Parsons, DAR 33901. **Western Australia:** on *Tetragonia diptera* F. Muell., Shark Bay, 1971, H.L. Harvey W.A. 1487, IMI 162907 (as '*Melanopsichium* sp. '; microscope slide as DAR 59828).

Acknowledgements

I am grateful to Mr D. Parsons who, when District Agronomist at Moree, observed and collected this inconspicuous fungus on *Tetragonia* for the first time in NSW, and brought it to my attention. The Curator, Herb IMI, is thanked for lending the Western

Australian collection. I am grateful to Dr K. Vánky, Tübingen, for correspondence about this fungus, for commenting on a specimen sent to him, and for providing results of the molecular study at Tübingen on IMI 162907. I thank the Agricultural Scientific Collections Trust, NSW Department of Primary Industries, for the loan of equipment, and access to the literature and specimen collections in DAR. I am also grateful to the Science and Research Section, Forest Resources Research, NSW Department of Primary Industries, West Pennant Hills for provision of laboratory and library space and facilities.

References

- Brummitt, R.K. & Powell, C.E. (eds) (1992). *Authors of Plant Names*. Royal Botanic Gardens, Kew.
- Castlebury, L.A., Carris, L.M. & Vánky, K. (2005). Phylogenetic analysis of *Tilletia* and allied genera in order Tilletiales (Ustilaginomycetes; Exobasidiomycetidae) based on large subunit nuclear rDNA sequences. *Mycologia* **97**, 888-900.
- Holmgren, P.K., Keuken, W. & Schofield, E.K. (1981). *Index Herbariorum. Part I. The Herbaria of the world*. 7th edn. Bohn, Scheltema & Holkema, Utrecht.
- Index Herbariorum (2006). <http://sciweb.nybg.org/science2/IndexHerbariorum.asp>
- Piepenbring, M. & Bauer, R. (1997). *Erratomyces*, a new genus of Tilletiales with species on Leguminosae. *Mycologia* **89**, 924-936.
- Shivas, R.G. (1989). Fungal and bacterial diseases of plants in Western Australia. *Journal of the Royal Society of Western Australia* **72**, 1-62.
- Vánky, K. (2002). *Illustrated genera of smut fungi* (2nd Ed.). The American Phytopathological Society: St. Paul, Minnesota.