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***Placynthium australiense* sp. nov. (lichenised Ascomycota, Placynthiaceae) from South Australia**Patrick M. McCarthy^a & Gintaras Kantvilas^b^a Australian Biological Resources Study, G.P.O. Box 787, Canberra, Australian Capital Territory 2601*E-mail:* Patrick.McCarthy@environment.gov.au^b Tasmanian Herbarium, P.O. Box 5058, UTAS LPO, Sandy Bay, Tasmania 7005*E-mail:* Gintaras.Kantvilas@tmag.tas.gov.au**Abstract**

Placynthium australiense P.M.McCarthy & Kantvilas (Peltigerales, Placynthiaceae) is described from hard mesic limestone in south-eastern South Australia. It is characterised by having discontinuous colonies of mainly squamulose thalli that lack a hypothallus and prothallus, as well as comparatively broad, 1-septate ascospores. Three other lichens, *Candelariella aurella* (Hoffm.) Zahlbr., *Endocarpon pallidum* (Nyl.) Nyl. and *Verrucaria calciseda* DC., are reported for the first time from South Australia.

Key words: biodiversity, lichen, new species, taxonomy, *Placynthium*, South Australia.

Introduction

The lichen genus *Placynthium* (Ach.) Gray (Peltigerales, Placynthiaceae), with about 25 species, grows mainly on dry to moist or inundated calcareous and siliceous rocks in temperate regions of the Northern Hemisphere. The usually dark to blackish thallus contains a cyanobacterial photobiont, often has a well-developed prothallus, and ranges in habit from crustose-areolate and densely coralloid-isidiate to squamulose with entire or dissected margins, or rosette-like with short to elongate lobes. Apothecia are black, lecideine, with an amyloid hymenium, mainly 8-spored *Peltigera*-type asci, and hyaline, transversely septate ascospores.

The earliest records of *Placynthium* from Australia were of *P. nigrum* (Huds.) Gray from Tasmania (Bratt & Cashin 1975) and, later, that species and *P. subradiatum* (Nyl.) Arnold from southern New South Wales (Weber 1977). Henssen (1984) reported the latter from the Australian Capital Territory, while Allen et al. (2001) cited collections of *P. nigrum* from South Australia and the A.C.T. Records of both species from Victoria (McCarthy 2013) require confirmation. In this contribution, a new species, *P. australiense*, is described from hard mesic limestone in south-eastern South Australia, while three associated lichens, *Candelariella aurella* (Hoffm.) Zahlbr., *Endocarpon pallidum* (Nyl.) Nyl. and *Verrucaria calciseda* DC., are new records for the state.

Methods

Observations and measurements of photobiont cells, thallus and apothecium anatomy, asci, ascospores and conidia were made on hand-cut sections mounted in

water and dilute KOH (K). Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K.

Taxonomy***Placynthium australiense* P.M.McCarthy & Kantvilas, sp. nov.**

Thallus ater, epruinosis, non lobatus, areolatus vel ex squamulis constans, hypothallo prothalloque destitutus; algae *Scytonema pertinentes*; squamulae rotundatae vel irregulares, 0.3–3 mm latae, 0.1–0.6 mm crassae, dispersae vel in tumulis aggregatae, superficie laevi, nodulosa vel coralloideo-isidiata, margine vulgo effigurata. Apothecia abunda, atra, lecideina, 0.25–0.66 mm diametro, ascosporis uniseptatis, comparate latis, 9–15 µm longis, 5.5–8 µm latis.

Mycobank No.: MB 807101

Typus: SOUTH AUSTRALIA. **Murray River Region:** beside Marne River, 10 km NE of Springton, 34°40'12"S, 139°09'56"E, alt. 280 m, on gently sloping limestone slabs in pasture with *Eucalyptus camaldulensis*, 12 Apr. 2013, P.M.McCarthy 4010 (holo.: AD; iso.: CANB, HO).

Thallus epilithic, initially crustose, richly rimose or areolate and 30–60 µm thick, the areoles becoming larger and thicker and often subsquamulose or squamulose, these structures scattered and often resembling minute rosettes, or aggregated and forming colonies (2–) 5–10 (–15) mm wide, greenish-black to black, dull, not swollen and not noticeably gelatinous when wetted, epruinose at all stages of development; often a range of immature, mature and post-mature thalli occupying much of an area of limestone up to 10–20 cm wide, but generally discontinuous and interspersed with small colonies of crustose lichens (mainly Lecanoraceae, Physciaceae, Teloschistaceae and Verrucariaceae).

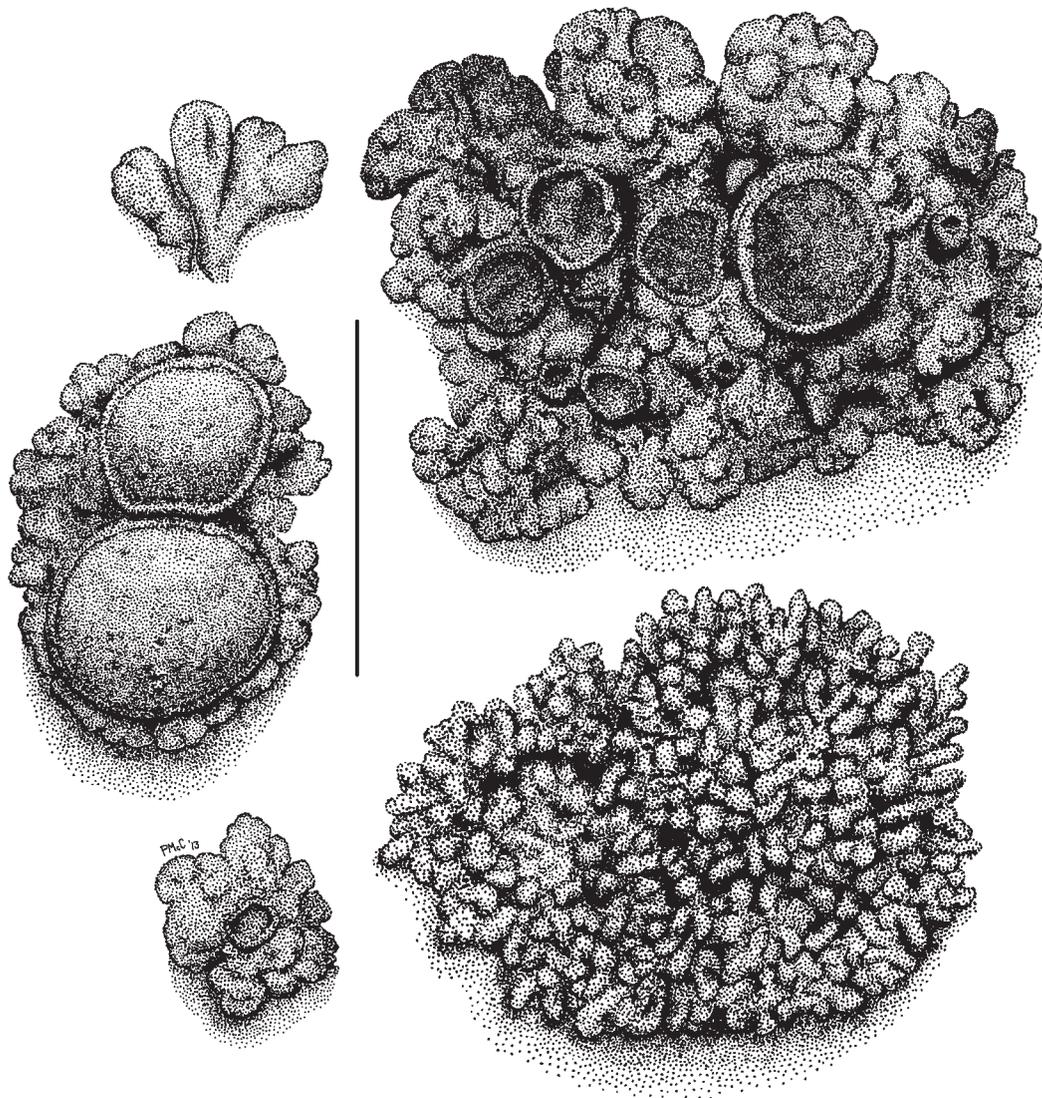


Fig. 1. *Placynthium australiense*. Habit of thalli and apothecia. Scale bar: 1 mm. — Holotype.

Squamules and areoles rounded to angular or irregular, closely aggregated in a crust or more scattered and often laminally short-lobulate (with lobules 40–80 μm wide) or marginally effigurate, (0.3–) 0.6–2.2 (–3) mm wide and 0.1–0.35 (–0.6) mm thick, thickest when the thallus is densely isidiate; squamules and areoles with a blackish underside, often markedly constricted at their attachment to the substratum, lacking dedicated attachment organs, such as rhizines. *Thallus margin* usually indistinct, rarely with contiguous to somewhat discrete simple lobes that are tightly appressed to the substratum, to 1 mm long and 0.15–0.25 mm wide. *Thallus surface* rather smooth, or granulose, nodulose or isidiate; isidia 20–50 (–80) μm diam. and up to 0.25 mm long, simple to irregularly branched, finger-like, furcate or \pm coralloid, usually more or less erect, others tilted to horizontal and smooth to contorted. *Thalline anatomy* paraplectenchymatous, the cells 5–10 (–15) μm diam., largest towards the thallus interior, indistinctly corticate; cortical zone yellowish-brown to olive-brown,

amorphous or with rounded and comparatively thick-walled cells 6–12 μm diam. *Photobiont* cyanobacterial, *Scytonema*-like, consisting of scattered or irregularly clustered cells and short to moderately long filaments, occupying almost the entire thallus; cells in filaments yellowish-brown, 8–12 μm wide and 4–10 μm long. *Hypothallus* absent. *Prothallus* usually absent around thalli as well as isolated squamules and areoles; a few squamules with an indistinct and discontinuous blue-black, fimbriate prothallus extending up to 0.3 mm beyond the margin. *Apothecia* sparse to very numerous, laminal, usually solitary, adnate to superficial, not constricted at the base, lecideine, (0.25–) 0.42 (–0.66) mm diam. [$n = 60$], jet-black, usually matt, occasionally slightly glossy (mainly immature apothecia), colour unchanged when wetted; disc usually plane, occasionally slightly to moderately concave or convex at maturity, the surface smooth to minutely and irregularly uneven; proper exciple concolorous with the disc or a little paler, smooth, usually entire, sometimes faintly undulate

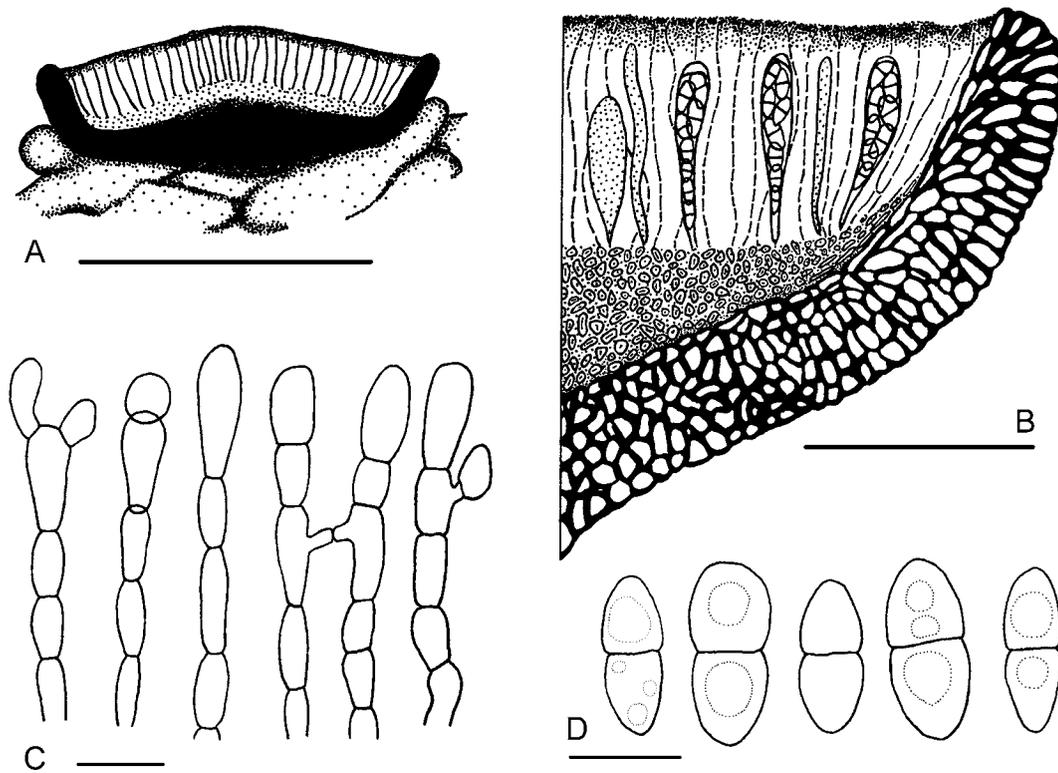


Fig. 2. *Placynthium australiense*. A, B sectioned apothecia (semi-schematic); C distal cells of paraphyses; D ascospores. Scale bars: A 0.5 mm; B 0.1 mm; C, D 10 μm . — A–D holotype.

or flexuose, 30–80 μm thick, often slightly raised, persistent or becoming almost excluded (especially around the most convex apothecia); in section uniformly dark, consisting of radiating, tightly packed hyphae, continuous below the hypothecium, (30–) 40–80 (–100) μm thick at the sides, 60–120 (–150) μm thick at the base; cells at the margin ellipsoid to elongate-ellipsoid, 8–17 \times 5–10 μm , with thick greenish-black walls. *Hypothecium* pale to medium greenish-brown or rather dark golden or orange-brown, 50–80 (–100) μm thick, not interspersed with oil droplets or granules, I+ deep blue (fading) to almost black (without pretreatment in K) or I+ deep blue (fading) to reddish-brown (with pretreatment). *Hymenium* 70–100 (–110) μm thick, not interspersed with oil droplets or granules, I+ persistently deep blue to bluish-black (with and without pretreatment in K), subtending a greenish-black or violet-blackish epihymenium 10–15 (–20) μm thick. *Paraphyses* unbranched to sparingly branched and anastomosed distally (scattered branches or anastomoses at all levels of the hymenium), short- to rather long-celled, 3–4 (–6) μm wide, thin-walled, remaining coherent in water and K; shape of apical cells very variable even within a single apothecium, ranging from strongly capitate, with the apical cell rounded or somewhat pointed and 4–5 (–6) μm wide and with a hyaline or partly dark green to violet-blackish wall, or the distal 3–5 cells a little shorter and broader than more proximal cells, or the apical cells little altered in size and shape other than being included

within the pigmented epihymenium. *Asci* narrowly to broadly clavate or clavate-cylindrical, 8-spored, 58–75 \times 12–17 μm [$n = 20$], with an external amyloid cap and a thin internal amyloid sheet adjacent to the apex of the ascoplasma. *Ascospores* colourless, 1-septate, overlapping-uniseriate to irregularly biseriata in the asci, ellipsoid, usually slightly constricted at the septum, uniformly thin-walled, lacking a distinct perispore, (9–) 12 (–15) \times (5.5–) 7 (–8) μm [$n = 90$]; cells more or less identical in size and shape; apices rounded to subacute; contents usually granular and guttulate. *Pycnidia* spherical, semi-immersed to almost fully immersed in the thallus, 70–100 μm diam., with a greenish-black apex and a hyaline conidiogenous layer; conidiophores short-celled, 10–20 μm long. *Conidia* bacilliform, 3–6 (–7) \times c. 0.7 μm . **Fig. 1–3.**

Remarks. *Placynthium australiense* is characterised by its blackish, epruinose, non-lobate thallus with squamules and areoles that are neither subtended by a hypothallus nor delimited by a prothallus; it contains a *Scytonema*-like photobiont. The squamules are rounded or irregular in shape, (0.3–) 0.6–2.2 (–3) mm wide and 0.1–0.35 (–0.6) mm thick, scattered or contiguous in small groups, with a smooth, nodulose or coralloid-isidiate surface, commonly with an effigurate margin, abundantly fertile with comparatively small, black, lecideine apothecia (0.25–) 0.42 (–0.66) mm diam. and with comparatively broad, 1-septate ascospores measuring (9–) 12 (–15) \times (5.5–) 7 (–8) μm .

Placynthium can be subdivided more or less evenly into species with distinct, radial, elongate, marginal lobes and those with thalli that lack well-defined lobes, although individual squamules can have minutely and shallowly effigurate margins. *Placynthium australiense* lies comfortably among the latter, its distinctive and persistently 1-septate spores setting it apart from all but three known taxa.

Placynthium tremniacum (A.Massal.) Jatta, from Iceland, the British Isles, continental Europe, Macaronesia, North Africa and Central Asia, has a glossy brown thallus, dark brown apothecia, an indistinct prothallus and narrower ascospores ($9\text{--}16 \times 4\text{--}6 \mu\text{m}$: Clauzade & Roux 1985; Jørgensen 2007; Gilbert & James 2009; Burgaz 2010). However, its relationship with *P. nigrum* has yet to be fully resolved, because while most recent authors have regarded the persistently 1-septate spores of *P. tremniacum* as being diagnostic for a distinct species, Czeika & Czeika (2007) examined syntype material, observed a minority of 3-septate propagules, and reduced *P. tremniacum* to synonymy under *P. nigrum*.

Placynthium anemoideum (Servit) Gyeln., from the British Isles, France, Croatia and Turkey, has isolated areoles with raised crenulate margins (Czeika & Czeika 2007: Fig. 6b) which are not unlike those of *P. australiense*, but the ascospores are smaller ($9\text{--}10 \times 5\text{--}6 \mu\text{m}$) and the apothecia are only c. 0.3 mm diam. (Clauzade & Roux 1985; Czeika & Czeika 2007; Gilbert & James 2009).

Finally, ascospores very similar to those of *P. australiense* occur in *P. tantaleum* (Hepp) Hue, which is known from Greenland, Iceland, Svalbard, the British Isles, continental Europe (Clauzade & Roux 1985; Czeika & Czeika 2007; Jørgensen 2007; Gilbert & James 2009; Burgaz 2010), south-western (Schultz 2002, as *P. nigrum* (Huds.) Gray) and north-eastern U.S.A., Canada (Henssen 1963, as *P. nigrum* var. *tantaleum* (Hepp) Arnold) and Central Asia. However, *P. tantaleum* has a glossy, mottled grey-brown thallus to 3 cm wide, resting on “a voluminous blue-green prothallus” (Jørgensen 2007) or on “a distinctive blue-black hypothallus” (Gilbert & James 2009).

Placynthium nigrum, the most common and widely distributed species, has comparatively elongate, 1–3-septate spores [$8\text{--}25 \times 4\text{--}6 \mu\text{m}$ (Clauzade & Roux 1985); $7\text{--}22 \times 3.5\text{--}6 \mu\text{m}$ (Schultz 2002); $10\text{--}15\text{--}(20) \times 4\text{--}6 \mu\text{m}$ (Jørgensen 2007); $8\text{--}18 \times 4\text{--}6 \mu\text{m}$ (Czeika & Czeika 2007); $7\text{--}22 \times 3.5\text{--}6 \mu\text{m}$ (Gilbert & James 2009); $7.5\text{--}20 \times 2.5\text{--}7.5 \mu\text{m}$ (Gilbert & James 2009)]. However, when Henssen reported *P. nigrum* from Argentina, Chile and New Zealand (Henssen 1984), she circumscribed the species “in the broad sense including var. *tantaleum* (Hepp) Arnold (see Henssen 1963)” and noted “only two-celled spores have been observed in the specimens from the Southern Hemisphere” (Henssen 1984). Recently, Jørgensen (2007) observed that while *P. tantaleum* usually occurs in and beside rivers, specimens

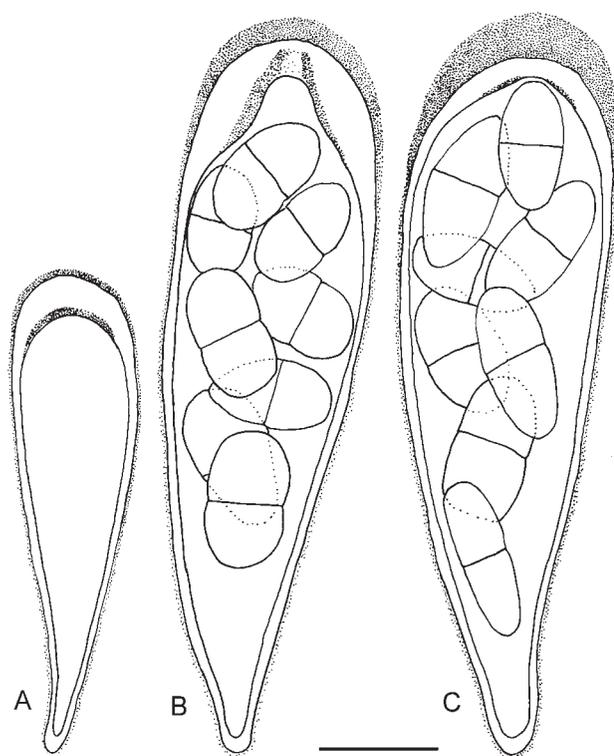


Fig. 3. *Placynthium australiense*. Immature (A), submature (B) and mature (C) asci stained with Lugol's Iodine. Scale bar: 10 μm . — HO isotype.

from drier habitats with thin-walled, 1-septate spores “appear only to be part of the variation of *P. nigrum*”. Among the South Australian and Tasmanian specimens examined, there seems to be a clear distinction, based on ascospore septation and dimensions, between *P. nigrum* as it is commonly circumscribed (see above) and *P. nigrum sensu* Henssen (1984) with comparatively short and broad 1-septate ascospores. Whether or not both can be accommodated within the variation of *P. nigrum* will require further study.

There have been inconsistencies in the description of the asci of *Placynthium* by previous authors. Whereas Jørgensen (2007) referred to an amyloid cap and internal sheets, Schultz (2002) mentioned an amyloid tube. Our observations are illustrated in Fig. 3 and interpreted thus: when young, the asci have an intensely amyloid external cap and a thin, internal, amyloid sheet at the base of the tholus adjacent to the apex of the ascoplasm (A). As the asci mature, a distinct, beak-like ocular chamber develops which pushes up through the inner amyloid sheet; the two sides of this sheet become orientated more or less vertically, somewhat approximating the appearance of an amyloid tube-like structure (B). With further development, this inner amyloid structure becomes more squashed and less prominent, although its vestiges can still be evident at the edges of the ocular chamber; the external cap remains prominent throughout (C).

Distribution & habitat. *Placynthium australiense* is known only from gently sloping, slab-like outcrops of hard limestone at its type locality in the Murray River region of south-eastern South Australia. Associated lichens include *Aspicilia contorta* (Hoffm.) Kremp., *Buellia albula* (Nyl.) Müll.Arg., *Caloplaca mereschkowskiana* S.Y.Kondr. & Kärnefelt, *Caloplaca* spp., *Candelariella aurella* (Hoffm.) Zahlbr.*, *Endocarpon pallidum* (Nyl.) Nyl.*, *Lecania turicensis* (Hepp) Müll.Arg., *Lecanora dispersa* (Pers.) Sommerf., *L. sphaerospora* Müll.Arg., *Placidium* sp., *Rinodina bischoffii* (Hepp) A.Massal., *Toninia* aff. *aromatica* (Sm.) A.Massal., *Verrucaria calciseda* DC.*, *V. muralis* Ach. and *V. nigrescens* Pers. The three species marked with an asterisk are new records for South Australia.

Key to the Australian Species of *Placynthium*

1. Central areoles commonly eroded, leaving arcs or rings of contiguous, radiating marginal lobes 1–1.5 mm long and 0.1–0.25 mm wide; prothallus and hypothallus absent *Placynthium subradiatum*
- 1: Central areoles not eroded; thallus without marginal lobes; prothallus and hypothallus present or absent
 2. Thallus a wide-spreading crust of more or less uniform, granulose- and coralloid-isidiate areoles; prothallus usually extending well beyond the thallus margin; hypothallus often thick and visible between the areoles *Placynthium nigrum* s.lat.
 - 2: Thallus of rounded to irregular squamules that are scattered or aggregated in small groups; prothallus absent or very faint; hypothallus absent *Placynthium australiense*

Additional specimens examined

Placynthium nigrum s.str.

SOUTH AUSTRALIA. **Murray River Region:** 15 km S of Angaston, on marble in pasture, 21 Oct. 1981, *J.A.Elix* 9243 (CANB 9602209, det. A. Henssen, Sep. 1982).

TASMANIA. Vale of Belvoir, alt. 840 m, on limestone outcrops in buttongrass moorland and heath, 16 May 1987, *G.Kantvilas* 61/87 (HO 569326); Tiger Road, 1 km NW of Florentine River bridge, 42°35'S, 146°26'E, alt. 370 m, on limestone boulder at edge of wet forest, 17 Dec. 2003, *G.Kantvilas* 742/03 (HO 524542).

Placynthium nigrum s.lat. (incl. sensu Henssen 1984)

SOUTH AUSTRALIA. **Yorke Peninsula:** Innes National Park, West Cape, 35°14'49"S, 136°49'31"E, alt. 45 m, on cliff-top limestone outcrops and boulders, 14 Apr. 2013, *P.M.McCarthy* 4029 (AD). **Kangaroo Island:** Cape Borda, 35°45'S, 136°35'E, alt. 100 m, on semi-exposed limestone rocks in dense heathy vegetation, 27 Sep. 1994, *H.Streimann* 54956 (AD, B, CANB); track to Cape Gantheaume, 36°04'S, 137°27'E, on coastal limestone outcrops in heathland, 29 Sep. 2008, *G.Kantvilas* 321/08 (AD, HO); Ravine des Casoars, 35°48'S, 136°35'E, alt. 5 m, on limestone outcrops in coastal heathland, 24 Sep. 2012, *G.Kantvilas* 453/12 (AD, HO); Point Ellen, 36°00'S, 137°11'E, alt. 5 m, on limestone outcrops in coastal heathland, 26 Sep. 2013, *G.Kantvilas* 214/13 (AD, HO).

TASMANIA. c. 6 km SW of Hardwood Hill, alt. 75 m, on limestone outcrops in sedgeland heath, 25 Apr. 1985, *G.Kantvilas* 178/85 (HO 308227, MB); Mole Creek, alt. 350 m, on limestone outcrop in paddock, 19 Feb. 1984, *P.James* &

G.Kantvilas 364/84 (BM, HO 308225, MB [det. A.Henssen]); W of Mole Creek, near Liena Road and Mersey Forest Road junction, 1 km NW of Florentine River bridge, 41°34'S, 146°15'E, alt. 350 m, on limestone outcrop in pasture, 19 Feb. 1984, *G.Kantvilas* 365/84 & *P.James* (BM, HO 564173); Eleven Road, Florentine Valley, 42°37'S, 146°26'E, alt. 430 m, on limestone boulder at edge of wet forest, 17 Dec. 2003, *G.Kantvilas* 744/03 (HO 524548); Flinders Island, Killiecrankie Bay, W of township, 39°50'S, 147°50'E, alt. 5 m, on outcrop of soft calcarenite along seashore, 2 Apr. 2007, *G.Kantvilas* 150/07 (HO 544228).

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