



BUNODOPHORON ¹

Gintaras Kantvilas ²

Bunodophoron A.Massal., *Mem. Imp. Reale Ist. Veneto Sci.* 10: 76 (1861).

Type: *B. australe* (Laurer) A.Massal.

Thallus fruticose, erect, decumbent or entangled, partly or wholly dorsiventrally flattened or, less commonly, terete to subterete; upper surface a shade of green, typically with yellowish, greyish or olive-brown tints; lower surface whitish or pale brown. Photobiont trebouxoid. Ascomata mazaedia, black, powdery, usually ventral or subapical but orientated to the ventral side, comprised of the disintegrated contents of the apothecium and exciple mixed with spores, initially covered by a whitish thalline veil, soon becoming fully or partly exposed, sometimes through a crack or hole; spore dispersal passive. Ascospores simple, globose, pale grey to reddish brown, rarely \pm hyaline, usually ornamented with mazaedial material adhering to the walls. Conidiomata pycnidia, immersed at the apices of branchlets; conidia bacilliform to oblong, $3-8 \times 1.5-2.5 \mu\text{m}$. Chemistry: sphaerophorin (UV+ white) and/or biosynthetically related substances occur in most species, whereas isousnic acid is known in two; associated compounds commonly include stictic or proto-cetraric acids, and/or their derivatives.

A genus of about 26 species, widespread in climax forests in cool, moist regions of the world but confined to higher elevations in tropical and subtropical latitudes. The genus attains its greatest diversity in the rainforests of the Southern Hemisphere. Eleven species occur in Tasmania where they are conspicuous rainforest epiphytes. The lower parts of tree runks, especially those of mature *Nothofagus cunninghamii*, are a favoured habitat, with species of *Bunodophoron* forming attractive tufts or swards protruding from amongst bryophytes. Whereas some species have a broad ecological amplitude, others display a distinct predilection for particular rainforest types. It is also not unusual to find species of *Bunodophoron* on sheltered rocks in alpine areas, wet heathlands or in locally moister microhabitats in sclerophyll forests. The Tasmanian species also occur in New Zealand, southern South America and/or south-eastern mainland Australia and are excellent examples of taxa with an austral cool temperate, "Gondwanan" distribution.

Although most species (and specimens) are readily identifiable in the field, chemical composition (determined by TLC) and ascospore dimensions can be essential for confirming the identity of some taxa. Distinguishing the sphaerophorin-type compounds is critical (and potentially tricky), and their characterisation is summarised in Table 1. Chemical spot tests should be carried out on fertile branches where the concentration of compounds tends to be highest. Ascospore measurements exclude the coarse mazaedial material that typically ornaments the spore walls.

Key references: Kantvilas & Wedin (1992); Wedin (1995, 2001).

1	Thallus with a yellowish to yellowish green tinge (containing isousnic acid); branches \pm terete throughout, or with only the main branches slightly compressed	2
	Thallus a shade of green, olive-brown or grey (lacking isousnic acid), usually markedly flattened at least partly	3

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2 Tasmanian Herbarium, Tasmanian Museum & Art Gallery, PO Box 5058, UTAS LPO, Sandy Bay, TAS 7005, Australia.

2(1)	Ascospores pale to dark grey, 6–10 μm diam.; thallus composed of stout main branches bearing bundles of short, \pm coralloid laterals; very common and widespread	9 <i>B. ramuliferum</i>
	Ascospores grey-brown to reddish brown, 10–16.5 μm diam.; thallus slender, richly branched, with ultimate branchlets not in bundles; rare	7 <i>B. notatum</i>
3(2)	Mazaedium \pm covered by the white, thalline veil which ruptures only at maturity	4
	Mazaedium well-exposed early in development	5
4(3)	Ascospores 10–16 μm diam.; mazaedia exposed through an irregular crack in the thalline veil; medulla P+ red (protocetraric acid); very common and widespread	4 <i>B. insigne</i>
	Ascospores 15–23 μm diam.; mazaedia exposed through a round hole; medulla P- or + faint yellowish (protocetraric acid absent or in trace concentrations only); very rare	11 <i>B. tibellii</i>
5(3)	Medulla P+ red (protocetraric acid present)	6
	Medulla P- or weakly + orange (lacking protocetraric acid but sometimes with stictic acid)	8
6(5)	Ascospores 6–10 μm diam.; fertile branches sparingly branched, often tongue-like; apothecia not fringed with sterile branchlets; sphaerophorin present	3 <i>B. imshaugii</i>
	Ascospores >10 μm diam.; fertile branches sparingly or richly branched, not tongue-like; apothecia frequently fringed with sterile branchlets; sphaerophorin absent	7
7(6)	Main branches crowded and imbricate, rather richly branched, usually growing \pm perpendicular to the substratum, with abundant, branched, often \pm coralloid sterile branchlets along the margins and fringing the apothecia	6 <i>B. murrayi</i>
	Main branches scattered, sparingly branched, loosely decumbent; margins of branches and apothecia with lateral branchlets flattened, absent or occasional	2 <i>B. flaccidum</i>
8(5)	Receptacle of apothecia very prominent, \pm globose or conical, subtended by \pm subterete branches or a narrow 'waist' and arising from very flattened, broad, basal branches	9
	Receptacle not prominent; all branches generally similarly flattened	10
9(8)	Receptacle \pm globose; upper surface never pruinose; ascospores 7–11 μm diam.; medulla P+ pale orange, K+ yellowish (containing sphaerophorin and stictic acid)	5 <i>B. macrocarpum</i>
	Receptacle subglobose, soon flaring and conical; upper surface pruinose when young; ascospores 9–15 μm diam.; medulla P-, K- (containing 4-O-methylhypocetraric acid)	10 <i>B. scrobiculatum</i>
10(8)	Upper surface pale bluish grey, often \pm glossy; ascospores hyaline to pale grey, 5.5–9.5 μm ; medulla P+ faint yellow-orange (containing sphaerophorin and stictic acid)	1 <i>B. australe</i>
	Upper surface greyish green to olive-green, matt; ascospores reddish brown, 9–17 μm ; medulla P- (containing patagonic acid)	8 <i>B. patagonicum</i>

1 *Bunodophoron australe* (Laurer) A.Massal.

Mem. Imp. Reale Ist. Veneto Sci. 10: 76 (1861); —*Sphaerophorus australis* Laurer, *Linnaea* 2: 44 (1827).

Thallus \pm erect, horizontal or weakly decumbent, forming extensive swards or discrete tufts; fertile branches narrowly compressed to broadly flattened, occasionally subterete towards the apothecia, sparsely to richly dichotomously branched, to c. 70 mm tall, 1–2.5 mm wide, generally widening only slightly at the apothecia, commonly with flattened or subterete and tapering, sterile lateral branchlets fringing the main branches, less commonly so at the apothecia; upper surface pale bluish grey to greenish grey, sometimes almost whitish, smooth, rather glossy, wrinkled and transversely cracked only in older or most exposed parts of the thallus; lower surface concolorous, or whitish or pale brown, smooth or a little dimpled. Mazaedia subapical and ventrally orientated, more rarely apical, to 3 mm wide, exposed from the earliest stages of development, with the margins of the thalline receptacle entire or ragged and dentate. Ascospores hyaline to grey, (5.5–)6–7.7–9(–9.5) μm diam.

Chemistry: sphaerophorin, stictic acid and constictic acid (major compounds) plus other substances; medulla K+ weak yellow, KC-, C-, P+ pale orange, UV+ white.

Very common and widespread in Tasmania from lowland to alpine elevations, chiefly in rainforest where it is one of the most common epiphytes. Less frequently it occurs in relict, moister vegetation types in low rainfall areas, or on rocks in moorland and heathland. Forms from exposed rocks tend to form cushions of \pm terete, erect branches with terminal mazaedia. The pale bluish grey colour makes this one of the most easily

recognised species of the genus, contrasting with the yellow-greens, greens or olive-greens of its relatives. When moist, the glossy thallus has an almost plastic appearance. *Bunodophoron australe* is known also from the south-eastern mainland of Australia, New Zealand, southern South America and some subantarctic islands, including Macquarie Island. For many years, it was referred to in the literature as *Sphaerophorus melanocarpus* (Sw.) DC. [= *Bunodophoron melanocarpum* (Sw.) Wedin], a species now recognised as being confined to the tropics and the cool temperate, oceanic forests of the Northern Hemisphere.

Myrtle Forest, Colinsvale, 42°52'S 147°09'E, 1963, J. Somerville (HO); Cradle Mtn NP, above Waldheim, 1968, W.A. Weber & D. McVean (distributed as *Lichenes Exsicc. Colo.*: 289) (HO); track to Gould Plateau, 42°00'S 146°04'E, 950 m, 2004, G. Kantvilas 13/04 (HO).

2 *Bunodophoron flaccidum* (Kantvilas & Wedin) Wedin

Pl. Syst. Evol. 187: 232 (1993); —*Sphaerophorus flaccidus* Kantvilas & Wedin, *Nova Hedwigia* 54: 494 (1992). Type: Tasmania, Truchanas Huon Pine Reserve, 42°39'S 146°58'E, on dead *Nothofagus cunninghamii* in rainforest, 110 m, 26 April 1985, G. Kantvilas 185/85 (holo—HO!; iso—BM!, UPS!).

Thallus very lax, loosely pendant or decumbent; fertile branches markedly flattened, simple or sparsely dichotomously divided, to 80 mm long, 1–4(–5) mm wide, with apices often ± ascending; sterile branches occasional, flattened, tapering, to 7 mm long and 1 mm wide, lateral on the main branches or fringing the apothecia; upper surface pale grey-green to olivaceous yellow-green, smooth, with scattered transverse cracks, becoming undulate to weakly wrinkled at the apothecia; lower surface whitish, smooth to undulate or wrinkled in the oldest parts. Mazaedia exposed from the earliest stages, mostly 2–5 mm wide and a little broader than the supporting branch, subapical or ventral due to the main branch extending and producing up to 3 tiers of mazaedia; margins entire or fringed with 3–4 branchlets that rarely become fertile. Ascospores reddish brown, (10–)11–12.9–15(–16) µm.

Chemistry: protocetraric acid and ascomatic acid (major compounds) plus traces of other substances; medulla K–, KC–, C–, P+ red, UV+ whitish.

Occasional in thamnic and implicate rainforest on the west coast; also known from New Zealand. The most likely confusing species is *B. murrayi*, which differs by having crowded branches that grow ± perpendicular to their substratum, has coralloid branchlets fringing the main branches and apothecia, and occurs in callidendrous rainforest.

Mt Dundas Track, 41°56'E 145°28'E, 280 m, 1988, G. Kantvilas 542/88 (HO); Lower Pieman Road near Wilson River, 41°43'S 145°06'E, 170 m, 1989, G. Kantvilas 261/89 (HO); Anthony Road, 41°49'S 145°38'E, 480 m, 1993, G. Kantvilas 231/93 (HO).

3 *Bunodophoron imshaugii* (Ohlsson) Wedin

Pl. Syst. Evol. 187: 233 (1993); —*Sphaerophorus imshaugii* Ohlsson in D.J. Galloway, *New Zealand J. Bot.* 21: 197 (1983).

Thallus ± erect, ascending or weakly decumbent, typically forming small swards; fertile branches markedly flattened, simple or sparsely dichotomously branched, sometimes bifurcate at the apices, to c. 25(–30) mm tall, 1–4(–6) mm wide, rather tongue-like, with rounded apices occasionally deflexed and forming a slight hood around the mazaedium; sterile lateral branches likewise flattened, sparingly dichotomously branched, scattered, shorter than the fertile branches, mostly basal or, less commonly, marginal on the fertile branches; upper surface olive-green to greenish brown, sometimes blackened, smooth when young, becoming transversely cracked, usually wrinkled at the apothecia; lower surface pale brown, smooth to wrinkled. Mazaedia ventral, ± as wide as the supporting branch but usually a little waisted below, exposed from the earliest stages, with the margins ragged or entire and lacking any fringing branchlets. Ascospores grey-brown to reddish brown, 6–7.6–9.5(–10) µm diam.

Chemistry: sphaerophorin and protocetraric acid (major compounds) plus traces of other substances; medulla K–, KC–, C–, P+ red, UV+ whitish.

Widespread and locally common from lowland to subalpine elevations in Tasmania, especially in thamnian and implicate rainforest; also known from New Zealand and southern South America. As for other species of the genus, the trunks of old trees, commonly *Nothofagus cunninghamii* or *Athrotaxis selaginoides*, are a preferred habitat. The small ascospores are unique for the genus, although *B. imshaugii* is easily recognised in the field due to its neat, tongue-like fertile branches. However, an uncommon form of *B. patagonicum* is morphologically similar but is distinguished chemically (it is P-) and by its larger ascospores.

Lake Judd Forest, 42°59'S 146°23'E, 640 m, 1973, G.C. Bratt 73/906 (HO); 1 km S of Giblin River mouth, 43°05'S 145°41'E, 10 m, 1986, A. Moscal 12013 (HO); Cradle Valley, 1040 m, 1988, G. Kantvilas 13/88 (distributed as *A. Vězda: Lich. Sel. Exsicc.: 2235*) (HO).

4 *Bunodophoron insigne* (Laurer) Wedin

Pl. Syst. Evol. 187: 233 (1993); —*Sphaerophoron insigne* Laurer, *Linnaea* 2: 45 (1827); *Sphaerophoron australe* f. *insigne* (Laurer) J.S.Murray, *Trans. Roy. Soc. New Zealand* 88: 190 (1960).

Thallus ± erect, horizontal or weakly decumbent, forming extensive swards; fertile branches flattened, sparsely to richly dichotomously branched, to c. 80 mm tall, 1–4 mm wide, widening, sometimes quite abruptly, to 10 mm at the apothecia, bearing abundant, flattened or subterete, tapering, sterile lateral branchlets fringing the main branches and the apothecia; upper surface olive-green to greenish brown, smooth when young, soon becoming wrinkled and transversely cracked, sometimes with coarse, isidia-like outgrowths; lower surface whitish or pale brown, smooth or wrinkled and dimpled. Mazaedia subapical or ventral due to the extension of the fertile branch beyond the apothecia, occasionally developed in tiers of 2–3 along a single branch, when young evident as bulbous swellings covered by the whitish thalline veil, at maturity exposed through an irregular crack. Ascospores reddish brown, 10–12.9–16 µm diam.

Chemistry: sphaerophorin, ascomatic acid and protocetraric acid (major compounds) plus traces of other substances; medulla K-, KC-, C-, P+ red, UV+ whitish.

Together with *B. australe*, *B. insigne* is the most common and widespread species of the genus in Tasmania. It is found mostly in rainforest, where its prime habitat is the mature trunks of *Nothofagus cunninghamii*. Where such trees occur at the forest margins or in sunny forest gaps, *B. insigne* typically forms extensive colonies extending many metres up the trunk, with its distinctive lobes protruding through bryophytes and other fruticose lichens, notably *B. australe* and other species of the genus. The relatively robust branches and veiled mazaedia, together with the red-brown ascospores and strong P+ red medullary reaction make this species easily recognisable. Differentiation from *B. tibellii* should be based on ascospore size, especially because with age, the thalline veil covering the mazaedia in both species flakes away and the mazaedia then appear round. *Bunodophoron insigne* is also known from mainland Australia, New Zealand and southern South America.

Newmans Creek, Tasman Peninsula, 43°05'S 147°50'E, 1922, W.A. Weymouth 24 (HO); Mueller Rd, 3 km W of Styx Rd, 560 m, 1984, G. Kantvilas 645/84 (distributed as *A. Vězda: Lich. Sel. Exsicc.: 2010*) (HO); Savage River NP, E side of Baretop Ridge, 41°18'37"S 145°26'51"E, 580 m, 2015, G. Kantvilas 67/15 (HO).

5 *Bunodophoron macrocarpum* (Ohlsson) Wedin

Pl. Syst. Evol. 187: 233 (1993); —*Sphaerophorus macrocarpus* Ohlsson, in D.J. Galloway, *New Zealand J. Bot.* 21: 197 (1983).

Thallus ± erect to horizontal, usually forming tufts or extensive colonies; fertile branches to 60 mm tall, subterete at the base, then broadly flattened to 10(–15) mm wide and giving rise to abundant, thin, brittle, flattened to terete and ± coralloid sterile branchlets and stouter branches that become terete to subterete, to 3 mm wide and support ± globose or hemispherical apothecia carried above the thallus mass; upper surface pale grey-green to olive-green, smooth on the wider, sterile branch parts but becoming markedly wrinkled, cracked and sometimes beset with short outgrowths in subterete parts and at the thalline receptacle; lower surface whitish or pale brown, ± smooth on wider branches, elsewhere wrinkled. Mazaedia terminal, orientated to the ventral side, to 6 mm wide and considerably wider than the supporting branch,

globose and mostly enclosed by the incurved receptacle when young, soon exposed and with the receptacle flaring and becoming abraded, sometimes fringed with \pm coralloid branchlets. Ascospores reddish brown to grey-brown, 7–8.9–10(–11) μm diam.

Chemistry: sphaerophorin, stictic acid and constictic acid (major compounds) plus other, biosynthetically related substances; medulla K⁺ yellowish, KC⁻, C⁻, P⁺ pale orange, UV⁺ whitish.

Widespread but rarely common in rainforest, especially at higher elevations; also known from New Zealand and southern South America. It mostly occurs on trunks and horizontal branches of *Nothofagus cunninghamii* and other trees, often intermixed with *B. australe* and *B. ramuliferum*. The globose apothecia, usually carried above the mass of basal, imbricate, sterile branches on stout branches that are either \pm terete for much of their length or at least have a terete waist below the apothecium, are diagnostic. The sterile, broadly flattened, basal branches can resemble the very rare species, *Calycidium cuneatum*, which differs chemically and, when fertile, has brown, marginal apothecia.

King William Saddle, 42°13'S 146°06'E, 850 m, 1984, G. Kantvilas 491/84 & P. James (BM, HO); Algonkian Mtn, 42°24'S 146°036'E, 950 m, 1990, G. Kantvilas 57/90 (HO); North-East Ridge of Mt Anne, 42°55'58"S 146°26'25"E, 1090 m, 2016, G. Kantvilas 64/16 (HO).

6 *Bunodophoron murrayi* (Ohlsson) Wedin

Pl. Syst. Evol. 187: 234 (1993); —*Sphaerophorus murrayi* Ohlsson, in L. Tibell, *Nordic J. Bot.* 1: 335 (1981).

Thallus \pm erect, horizontal or weakly decumbent, usually forming tufts; fertile branches markedly flattened, sparsely dichotomously branched, to c. 50 mm tall, 1.5–4 mm wide, sometimes widening to 7 mm at the apothecia, with abundant, branched, flattened or subterete and \pm coralloid, sterile lateral branchlets fringing the main branches and the apothecia; upper surface olive-green to greenish brown, smooth when young, soon becoming wrinkled and transversely cracked, sometimes with terete, isidia-like outgrowths; lower surface whitish or pale brown, wrinkled. Mazaedia ventral, exposed from the earliest stages. Ascospores reddish brown, (10–)11–12.5–15 μm diam.

Chemistry: protocetraric acid and ascomatic acid (major compounds) plus traces of other substances; medulla K⁻, KC⁻, C⁻, P⁺ red, UV⁺ whitish.

Relatively uncommon and widely scattered in callidendrous rainforest. Although probably most closely related to *B. flaccidum*, which has an identical chemistry and ascospores but a starkly different habit and ecology, *B. murrayi* is more likely to be confused with *B. insigne* on account of its relatively robust, crowded, fertile branches with abundant sterile laterals. The two species occur in similar habitats, typically growing on the trunks of mature trees where they protrude horizontally from mats of epiphytic bryophytes, but they are readily distinguished by the veiled young mazaedia of the latter. The absence of sphaerophorin aids in the identification of sterile specimens. This species is also known from the south-eastern Australian mainland and New Zealand.

Zeehan, 41°54'S 145°20'E, 1893, L. Rodway (HO); Bun Hill, Forestier Peninsula, 42°58'S 147°56'E, 320 m, 1989, G. Kantvilas 340/89 (HO); Western Explorer Rd, c. 1 km S of Donaldson River, 41°28'S 145°05'E, 220 m, 2003, G. Kantvilas 561/03 (HO).

7 *Bunodophoron notatum* (Tibell) Wedin

Pl. Syst. Evol. 187: 234 (1993); —*Sphaerophorus notatus* Tibell, *Publ. Herb. Univ. Uppsala* 10: 9 (1982).

Thallus forming entangled tufts 30–70 mm tall; branches terete, densely \pm isotomic-dichotomously branched, 1–2 mm wide, widening to 4–5 mm at the apothecia or gradually tapering to a point when sterile; upper surface pale greenish to yellowish green, smooth, becoming wrinkled and scrobiculate at the apothecia; lower surface concolorous. Mazaedia subapical on the ventral surface, carried above the mass of the thallus on relatively stout branches, exposed from the earliest stages, with the thalline receptacle split, ragged and flaring. Ascospores grey-brown to reddish brown, 10–12.8–16(–16.5) μm diam.

Chemistry: isousnic, stictic and constictic acids (major compounds); medulla K \pm weak yellowish, KC $-$, C $-$, P $-$, UV $-$.

Very rare in Tasmania, and known from just a few localities where it occurs on the trunks and canopy limbs of old *Nothofagus cunninghamii* trees in callidendrous rainforest; also known from New South Wales and New Zealand. Several of the Tasmanian localities have been severely degraded by logging and conversion of native forest to plantations, to the extent that suitable habitat is no longer present. Consequently the species is listed as "Endangered" under the *Tasmanian Threatened Species Protection Act 1995*. Distinguishing this species from the common *B. ramuliferum* can be tricky, although the tuft-forming habit of *B. notatum* is distinctive and the larger, grey-brown to reddish brown spores and absence of sphaerophorin are diagnostic.

Mt Victoria, 41°20'S 147°50'E, 1970, G.C. Bratt 70/1359 *et al.* (HO); 3 km SW of Mt Agnew, 41°55'S 145°11.5'E, 190 m, 1989, G. Kantvilas 127/89 (HO); Belmont Road, 41°23.5'S 145°32'E, 460 m, 1989, G. Kantvilas 279/89 (HO).

8 *Bunodophoron patagonicum* (C.W.Dodge) Wedin

Pl. Syst. Evol. 187: 234 (1993); —*Pleurocybe patagonica* C.W.Dodge, *Nova Hedwigia* 16: 484 (1969); *Sphaerophorus patagonicus* (C.W.Dodge) Ohlsson, in D.J. Galloway, *New Zealand J. Bot.* 21: 197 (1983).

Thallus \pm erect, horizontal or weakly decumbent, usually forming spreading colonies or tufts; fertile branches markedly flattened, strap-like, sparsely to richly dichotomously branched, to c. 80 mm tall, 1.5–6(–12) mm wide, usually widening a little at the apothecia, with abundant, branched, flattened or terete sterile lateral branchlets fringing the main branches and the apothecia, or with marginal, knob-like, easily abraded outgrowths or, more rarely, with the margins \pm entire and a little thickened or recurved; upper surface olive-green to greenish brown to olive-brown, smooth to wrinkled and transversely cracked, markedly wrinkled at the apothecia; lower surface whitish or pale brown, wrinkled. Mazaedia ventral, 2–7 mm wide, exposed from the earliest stages, with the thalline receptacle flaring and ragged. Ascospores reddish brown, (9–)10–12.8–15.5(–17) μ m diam.

Chemistry: patagonic acid and ascomatic acid (major compounds), with traces of other related compounds; medulla K $-$, KC $-$, C $-$, P $-$, UV $+$ white.

Widespread and relatively common in rainforest, especially at higher elevations, frequently growing on mature trunks of *Nothofagus cunninghamii*, intermixed with other species of *Bunodophoron*. This is a highly variable species, unequivocally determined only by its unusual chemistry. The typical form, with abundant, marginal, sterile, lateral branchlets is most similar to *B. murrayi*. Smaller forms with entire margins and rather hooded fertile branches can resemble *B. imshaugii*, which has smaller ascospores. Intermediate forms are also known. *Bunodophoron patagonicum* also occurs on the south-eastern Australian mainland, in New Zealand and in southern South America.

Van Diemens Land [Tasmania], 1804, R. Brown (HO); Weldborough Pass, 41°13'S 147°57'E, 500 m, 1985, G. Kantvilas 144/85 (HO); Pelion Plains, c. 1 km SW of Pelion Hut, 41°50'S 146°02'E, 900 m, 1992, G. Kantvilas 237/92 (HO).

9 *Bunodophoron ramuliferum* (I.M.Lamb) Wedin

Pl. Syst. Evol. 187: 234 (1993); —*Sphaerophorus ramulifer* I.M.Lamb, *Farlowia* 4: 426 (1955).

Thallus generally forming discrete tufts or swards, growing \pm perpendicular to the substratum; fertile branches sparsely dichotomously branched, terete or a little compressed, 30–70 mm tall, 1–1.5(–2) mm wide, widening to 2–3 mm at the apothecia; sterile branches marginal, generally markedly divergent from the main branches, relatively short, coralloid, in brittle bundles; upper surface pale yellowish to yellowish grey, smooth or becoming a little wrinkled, especially at the apothecia; lower surface concolorous or paler. Mazaedia subapical on the ventral surface, soon fully exposed, with the thalline receptacle ragged, sometimes with a fringe of terete branchlets. Ascospores pale to dark grey, (6–)7–8.2–10 μ m diam.

Chemistry: isousnic acid, sphaerophorin, stictic acid and constictic acid (major compounds); medulla K \pm weakly yellowish, KC $-$, C $-$, P \pm weakly yellow-orange, UV $+$ whitish.

Very common and widespread in rainforest, especially at higher elevations, where it inhabits trunks and large branches, usually in mixtures with other species of the genus. It is also frequently found on rocks in heathland where the thallus can be extremely reduced, sometimes to a dense, coralloid-isidiose crust; in such cases, chemistry may be required for unequivocal identification. It is also known from mainland Australia, Macquarie Island, New Zealand and southern South America. The pale yellowish colour distinguishes it from most other species of *Bunodophoron*. The small, grey spores and the presence of sphaerophorin separate it readily from *B. notatum*.

Mt Wellington, Tom Thumb Track, 42°53'S 147°12'E, 1000 m, 1963, G.C. Bratt 567 & J.A. Cashin (HO); Little Fisher River, 41°45'S 146°20'E, 950 m, 1982, G. Kantvilas 102/82 (HO); Quamby Bluff, 41°40'S 146°42'E, 950 m, 1990, M. Wedin 3144 (HO, UPS).

10 *Bunodophoron scrobiculatum* (C.Bab.) Wedin

Pl. Syst. Evol. 187: 234 (1993); —*Sphaerophoron australe* var. *scrobiculatum* C.Bab., in J.D. Hooker, *Fl. N.Z.* 2: 304 (1855).

Thallus broadly flattened, erect, ascending or decumbent, forming spreading patches; fertile branches mostly to 50 mm long, 6–12 mm wide, arising amongst shorter, rather lacerate sterile branches, sometimes with marginal, subterete branchlets, apically developing a narrowed, ± terete “waist” or stout stalk 1.5–5 mm wide subtending the globose to conical apothecia; upper surface pale grey-green to yellowish green, sometimes blackened in older or exposed parts, smooth and faintly pruinose when young, developing occasional transverse cracks and becoming very coarsely wrinkled at the apothecial receptacle; lower surface whitish to pale yellowish brown, smooth. Mazaedia subterminal, orientated to the ventral side, exposed from the earliest stages of development, globose when young, at maturity becoming conical, with the receptacle flaring widely to 5–13 mm and becoming ragged. Ascospores grey to grey-brown or red-brown, (9–)9.5–11.6–13(–15) µm diam.

Chemistry: 4-O-methylhypocetraric acid; medulla K–, KC–, C–, P–, UV+ white.

Common in western and south-western Tasmania, typically in implicate rainforest where it colonises bryophyte-festooned trunks and horizontal branches; also known from New Zealand and southern South America. When fertile, the broad, flaring, conical apothecia with a wrinkled receptacle are unmistakable. Sterile specimens of short, flattened, basal branches could be confused with *B. macrocarpum* or *Calycidium cuneatum*, but in doubtful cases, the chemistry of *B. scrobiculatum* is diagnostic.

Islet Lake, 42°52'S 147°58'E, 800 m, 1975, K. Davies 75/1034 (HO); Serpentine River, 42°46'S 145°58'E, 460 m, 1980, G. Kantvilas 42/80 (BM, COLO, HO, LSU); 4 km N of Precipitous Bluff, 43°25'S 146°36'E, 730 m, 1990, G. Kantvilas 113/90 (HO).

11 *Bunodophoron tibellii* (Wedin) Wedin

Pl. Syst. Evol. 187: 234 (1993); —*Sphaerophorus tibelli* Wedin, *Lichenologist* 24: 129 (1992).

Similar to *B. insigne* in colour and habit, but with the fertile branches generally more robust, shorter (to 50 mm) and wider (to 11 mm). However, this morphology falls within the range of *B. insigne*, and the two species are unequivocally distinguished only by their ascospore size [(15–17.7–21(–23) µm diam. in *B. tibellii*] and their chemical composition.

Chemistry: sphaerophorin, ascomatic acid and associated compounds; protocetraric acid absent or in trace concentrations only; medulla P– or faintly yellowish, K–, KC–, C–, P–, UV+ whitish.

Very rare in Tasmania and known from three widely separated localities where it was epiphytic in rainforest. Also known from New Zealand.

Near 14 mile peg on Gordon River Road, 42°45'S 146°25'E, 480 m, 1972, G.C. Bratt 72/1927 (HO); Arve Loop, 43°08'S 146°45'E, 360 m, 1981, G. Kantvilas 271/81 (HO); Boyd Forest Reserve, 42°49'S 146°19'E, 400 m, 1990, M. Wedin 3055 (UPS).

Table 1: Characterisation of some key compounds in *Bunodophoron* by TLC

	sphaerophorin	patagonic acid	ascomatic acid	4-O-hypomethylprotocetraric acid
short-wave UV	dark	dark with a purple glow	dark	dark
long-wave UV	+ faint purple	+ bright purple	+ faint purple	+ faint purple
long-wave UV, moistened with acid	+ faint purple	+faint purple	nil	+ faint purple
long-wave UV after acid and heat	dull bluish with a paler, yellow-green halo	dull bluish with a paler, yellow-green halo	dark or weak dull bluish	bright pale blue
visible light after acid and heat	pale yellow with a greyish halo	pale yellow with a greyish halo	colourless to pale blue-grey	colourless to pale yellow
visble light after acid, heat and storage	orange, later brownish	orange, later brownish	colourless	bright pink after a few days, later reddish brown
Rf in solvent A (after Elix 2014)	45	38	37	39

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