NON-SEASONAL PLANT FOODS IN THE PALAWA (TASMANIAN ABORIGINAL) DIET: 1. THE YAM DAISY *MICROSERIS LANCEOLATA* (WALP.) SCH.BIP.

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with one text-figure and one plate

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The tuberous roots of the Yam Daisy/murnong *Microseris lanceolata* were a staple plant food for Indigenous peoples in Victoria and New South Wales. In contrast, although the Yam Daisy occurs in Tasmania, it is not recorded as being eaten by the Tasmanian Aborigines (palawa) although fossil Liguliflorae pollen indicate that this perennial herb was growing here before European occupation in 1805. Unlike in Victoria up to the 1840s, as yet, there is no fossil evidence to show the species was sufficiently common to make a significant non-seasonal contribution to the palawan diet. However, assuming an adequate supply of the tubers, the palawa could have obtained energy from the modest content of simple sugars (via glycolysis) and its substantial content of fructans (prebiotics, converted to absorbable fatty acids by gut bacteria). Its sweet taste at certain seasons may have encouraged seasonal consumption. Recent research suggests that fructans may have health benefits, e.g., improved immune function; however, it seems improbable that the palawa specifically recognised those benefits.
Key Words: Indigenous non-seasonal plant foods, Tasmanian Aborigines, palawa, *Microseris lanceolata*, Yam Daisy, murnong, fossil pollen, carbohydrates, fructan, inulin

INTRODUCTION

The postulated high protein/low carbohydrate ("palaeo") diets that sustained traditional hunter-gatherer societies for millennia are a current focus in the anthropological literature as well as in the "food fad" culture (www.meltorganic.com/the-paleo-diet-real-or-fad/ (accessed 20 April 2017)). An Australian example of the former is the study of over 800 Indigenous plant foods, which concluded that the traditional diet was high in dietary fibre but relatively low in available carbohydrates, with over half being sugars derived from fruit and honey (Brand-Miller & Holt 1998). More generally, Cordain *et al*. (2000) and Ströhle & Hahn (2011) have demonstrated that the diets of modern hunter-gatherers vary markedly in their carbohydrate content but, whenever and wherever it is ecologically possible, >50% of their subsistence is derived from animal foods.

Whether a diet that is extremely restricted in carbohydrates is harmful to human health, is uncertain (compare Westman 2002, Cummings & Mann 2012). However, this will not have been a concern for First Peoples living in environments where fruit, nuts, seeds and honey provide a year-round source of carbohydrate but might have been for the palawa (Tasmanian Aborigines) living on the mid-high latitude island of Tasmania with its rich fauna but depauperate edible flora and short plant-growing season (see Monroe 2014).

Precisely which native plant foods in Tasmania were exploited by the palawa has been debated since the 1830s, partly due to the limited documentary evidence (see reviews by Noetling 1910, Hiatt 1967, Cane *et al*. 1979, Ryan 1981, Woodward *et al*. 1987, Plomley & Cameron 1993) and partly because the macrofossil remains of edible plants are rarely if ever preserved in Indigenous cultural deposits, unlike faunal remains (compare Lourandos 1968, Garvey 2007, 2011).

This is the first of two short papers reviewing the microfossil (pollen and spore) evidence for edible plants that potentially provided a non-seasonal source of food for the palawa before European occupation of Tasmania in 1805. The edible species discussed here is the Yam Daisy *Microseris lanceolata* (Walp.) Sch.Bip., a perennial herb (forb) species now found growing in open habitats that are free from grazing across much of southern and eastern mainland Australia and lowland Tasmania except the South-West (avh.ala.org.au/occurrences/search?taxa=Microseris+lanceolata#tab_mapView (accessed 28 November 2016)).

BACKGROUND

The tuberous roots (tubers) of the Yam Daisy are widely considered to have been a staple Indigenous food in mainland Australia (Gott 1982, 1983, 2016) but were not amongst the edible plants in Tasmania witnessed being eaten (or assumed to have been eaten) by the palawa by early nineteenth century observers such as the "protector of the Aborigines" George Augustus Robinson (1791–1866) (compare Anon 1834, Gunn 1842, Backhouse 1843, Plomley 2008). A search of newspapers prior to 1850 via

Trove (trove.nla.gov.au/(accessed 2016-2017)) has failed to uncover any additional record that might indicate *Microseris lanceolata* was eaten by the palawa; the earliest herbarium specimens of *M. lanceolata* in Tasmania date to 1840s (M. de Salas pers comm.). This contrasts with the recent proposal (Romanin *et al.* 2016) that fossil pollen of the type (Liguliflorae) produced by *M. lanceolata* at Diprose Lagoon in the northern Midlands are evidence that the Yam Daisy was an important root vegetable in the palawa diet before European settlement of the district in the early 1820s and presumably also before European occupation of the State in 1805.

Key issues are: (1) How reliable is the Colonial period ethnographic evidence? (2) Can fossil pollen grains produced by *M. lanceolata* be distinguished from the morphologically very similar pollen produced by other native and introduced species within the tribe Liguliflorae (synonyms Cichorieae, Lactuceae) of the cosmopolitan daisy/daisy-bush family Asteraceae, in particular the large numbers of introduced widely naturalised "weed" Liguliflorae in Tasmania (see Curtis 1963, Gott 1983)? (3) Are relative abundances of fossil Liguliflorae pollen adequate to show the Yam Daisy *M. lanceolata* was growing in large numbers in the Midlands before the 1820s (see Romanin *et al.* 2016)? (4) Are there alternative reasons why the daisy might have been eaten other than as a source of energy?

In examining these issues we emphasise that, unlike mainland Australia, all Liguliflorae in Tasmania are introduced species except for *M. lanceolata* and a native dandelion, *Taraxacum aristum* G.Hagl. & Markl., that is confined to high elevation sites on the Central Plateau (figs 1a, 1b).

MICROSERIS LANCEOLATA (Walp.) Sch.Bip.

Microseris lanceolata is a summer-dormant perennial forb up to 40 cm tall that differs from herbs such as the sedges and grasses in having a rosette of broad/flat rather than narrow/linear leaves. The fleshy tuberous root used by the species to store carbohydrate is edible, can be eaten cooked or raw, and was observed to be harvested by Indigenous people in southwest Victoria in 1840 (Gott 1982, 1983). Numerous geographic variants are recorded. For example, the Tasmanian species is markedly smaller than the mainland Australian form (Gott 1982). The tuberous root in Victorian populations varies from "radish-like" in shallow rocky soil, branched and "rather fibrous" under alpine conditions, and "more carrot-like and tapering" in the lowlands (Leigh & Mulham 1965, cited in Gott 1982).

Since reaching Australia and New Zealand, apparently some 2.6 million years ago (see Macphail 1999a, Partridge 1999, Vijverberg *et al.* 1999), *Microseris* has evolved into four morphologically distinct ecotypes categorised as "alpine", "murnong", "fine pappus" and "coastal" (Vijverberg *et al.* 2000). The latter two ecotypes now are considered to represent a separate species, which is endemic to New Zealand [*Microseris scapigera* (Sol. ex A.Cunn) Sch. Bip.], although in the past Tasmanian specimens were also assigned to this species (compare Curtis 1963 p. 381, Sneddon 1977). With reservations (see vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/sip_salt_native_yam (accessed 28 February 2017)), the "alpine" and "murnong" ecotypes are assigned to the one species *M. lanceolata* that is endemic to Australia despite the differing ecologies. For example, the "alpine" ecotype is restricted to elevations above 1000 m in the mountains in southeast Australia whilst the "murnong" ecotype is only found in lowland habitats. In contrast, introduced Liguliflorae species are very widely naturalised at most elevations, including in Tasmania, and occur in grazed agricultural land, disturbed and undisturbed open forests and on roadsides. We note this near-ubiquitous distribution is poorly reflected in herbarium collections.

Modern pollen

Distinguishing pollen of native Liguliflorae such as *M. lanceolata* from pollen of the widely naturalised "weed" genera such as *Crepis* (Hawk's Beard), *Hypochaeris* (Cat's Ear) *Sonchus* (Sowthistle) and *Taraxacum* (Common Dandelion) is difficult using characters visible under bright field microscopy. For example, all Liguliflorae pollen types are characterised by a cell wall (exine) in which the outer layer (sexine) is raised in a pattern of ridges (lophae) surrounding a variable number of large, window-like (fenestrate) apertures (lacunae); the ridges are ornamented with single rows of spines (echinae) (see Punt *et al.* 2007). Moore *et al.* (1991) and Beug (2004) have divided the European genera into a number of morphotypes, e.g., *Crepis*-type, *Sonchus*-type and *Taraxacum*-type, but do not include *Microseris*. At present it is uncertain which, if any, of these morphological classes would best accommodate modern (or fossil) pollen of *M. lanceolata* (compare Fig. 2, Plate 57 in Moar 1993) (pl. 1).

Fossil pollen

Fossil Liguliflorae pollen have been recorded on Colonial period archaeological sites in southeast mainland Australia and Tasmania and sporadically in lake sediments and peat in Tasmania that post-date European settlement (Macphail 1999b, 2001, 2016, Macphail & Casey, 2008, M.K. Macphail unpubl. data). One exception in Tasmania is Hazards Lagoon on the Freycinet Peninsula on the East Coast, where Mackenzie & Moss (2014) have recorded trace numbers of fossil Liguliflorae pollen in sediments broadly dated to the middle Holocene ca. six thousand (kyr) years ago, and Late Pleistocene ca. 11–18 kyr ago (fig. 1c). A second (unpublished) record is Liguliflorae pollen in ca. 1.5 kyr old peat at the Skullbone Plain Reserve above 1100 m elevation on the western side of the Central Plateau (F. Hopf pers.comm.) although here the source could be *Taraxacum aristum*. As far as is known, Diprose Lagoon (41°48'S 147°22'E) at Cleveland in the northern Midlands is the only published site where Liguliflorae pollen have been found in significant numbers (4%) in independently-dated sediments that accumulated in the period between the European settlement of the Midlands in the 1820s

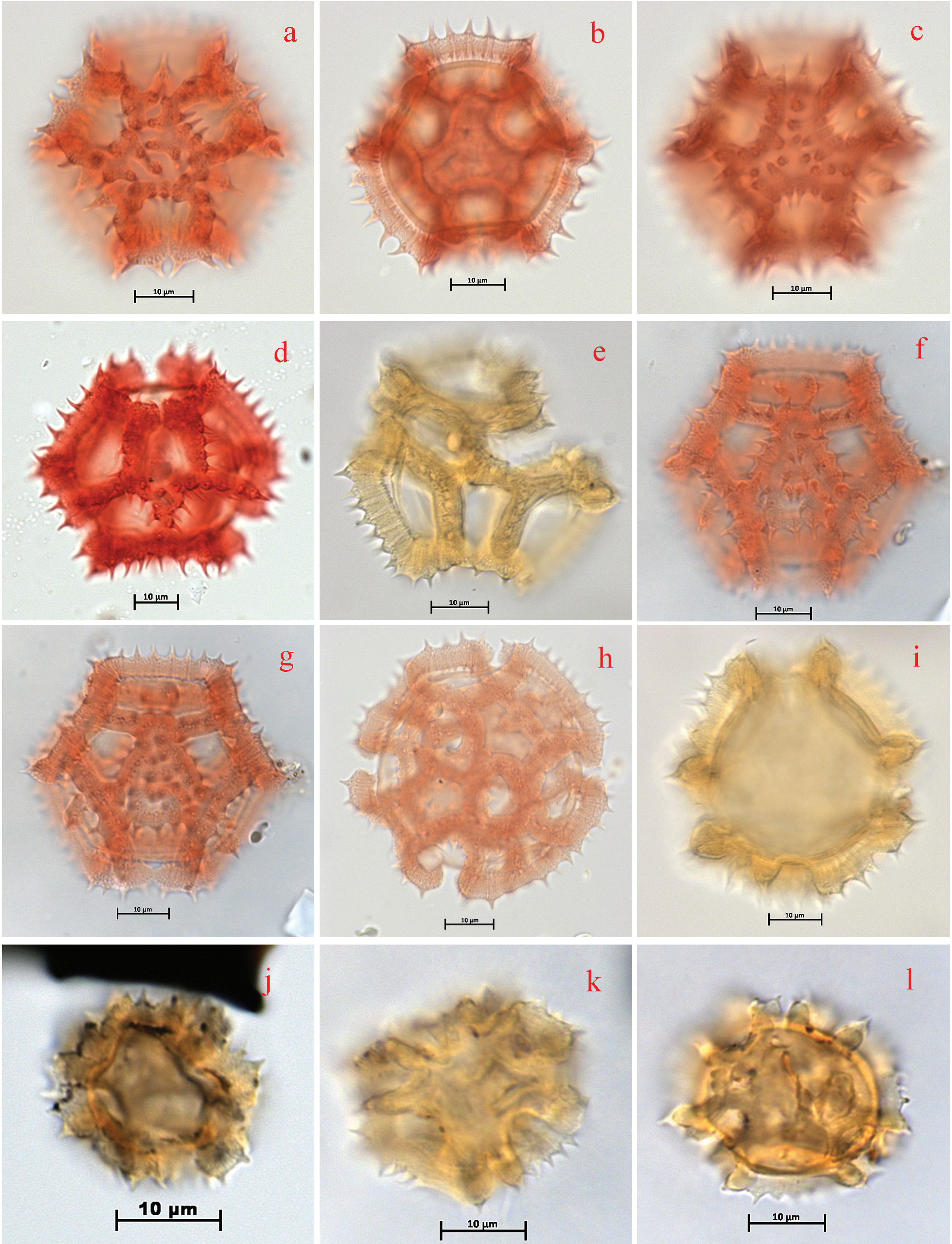

PLATE 1 — Modern Liguliflorae pollen. a–c: *Microseris lanceolata* (Walp.) Sch.Bip. pollen in high median and low optical view (coll. Rodway Herbarium 1969). d: *Cichorium intybus* L. (Chicory) pollen in median optical view (cultivated, New South Wales). e: *Lactuca sativa* L. (Lettuce) pollen in median optical view (cultivated, New South Wales). f–h: *Taraxacum officinale* Weber (Common Dandelion) pollen in high and median optical view (naturalised, New South Wales). i: *Sonchus asper* (L.) Hill (Prickly Sowthistle) pollen in median optical view (naturalised, New South Wales). j: fossil Liguliflorae pollen in median polar view (specimen from a bag of charred grain, Barangaroo Historical Archaeological Site, Sydney ca. 1860). k–l: fossil Liguliflorae pollen in median polar view (specimens preserved in buried soils, Montpelier Retreat Historical Archaeological Site, Hobart, 1805–1823). Differences in pollen size reflect differences in processing techniques and swelling of the modern grains over time.

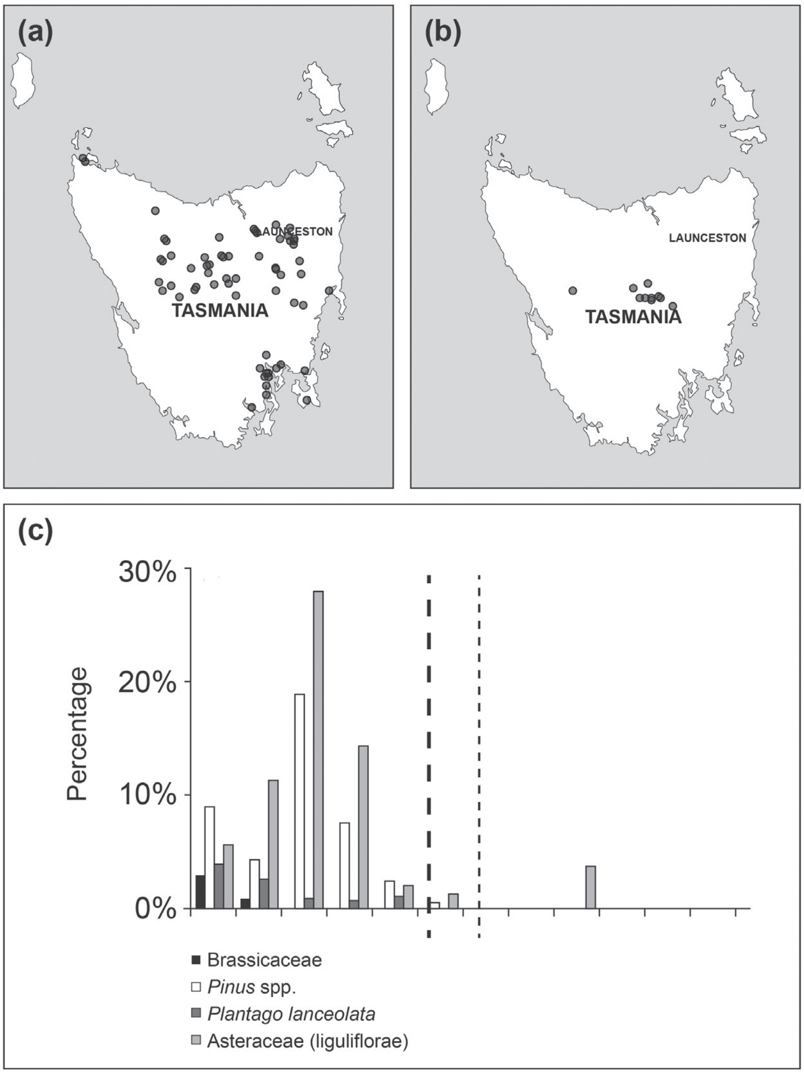

FIG. 1 — (a) Distribution of *Microseris lanceolata* in Tasmania; (b) distribution of *Taraxacum aristum* in Tasmania; (c) relative pollen abundance of pine (*Pinus*), *Microseris*-type (Liguliflorae) and other herbs such as the crucifers (Brassicaceae) and European Plaintain (*Plantago lanceolata*) that are typically associated with European agricultural activity in the Midlands of Tasmania. The coarse-dashed vertical line (LHS) indicates the depth the first grain of *Pinus* pollen was found; the fine-dashed vertical line (RHS) indicates the approximate date that Europeans arrived in Tasmania. The *x*-axis is graduated in 2 cm intervals from the surface sediment on the left to 24 cm depth on the right.

and Tasmania as a whole in 1805 (Romanin *et al.* 2016). In contrast, relative abundances of Liguliflorae pollen at the same site attain values of up to 28% in sediments that post-date ca. 1820.

DISCUSSION

Which plant foods actually were eaten by the palawa is debatable given that (1) only a limited number of accounts date to the early to mid nineteenth century when the traditional culture was still being maintained in Tasmania and (2) a number of these accounts almost certainly were subject to observer biases (including gender bias). Similarly, occurrences of fossil Liguliflorae pollen in sediments that pre-date European settlement of Tasmania are not in themselves unequivocal evidence that the source species was *Microseris lanceolata* or that this edible plant was sufficiently abundant to be a food resource. A third *caveat* is that a food resource can be abundant but, for cultural reasons, may not have been exploited by the palawa, e.g., bony fish over the past three ka (compare Gunn 1842, Jones 1978, Rowland 1983, Low 1988, Taylor 2007). These issues are discussed below:

1. How reliable is the Colonial ethnographic evidence?

Plomley & Cameron (1993 p. 2) caution against the assumption that, "because a plant was used as food by [mainland] Australian Aborigines it was therefore so used by the Tasmanian Aborigines". Although G.A. Robinson and J. Backhouse were familiar with the Yam Daisy and record the species being harvested by Aboriginal women in Victoria in the 1840s (see Backhouse 1843, Gott 1983), there is no evidence that these observers were familiar with it as an Indigenous food in Tasmania or their observations were biased against "women's work". Observer bias, however, remains a problem when interpreting other Tasmanian Colonial records. An example is the different importance attached to particular plant foods. At one extreme is Backhouse (1843) who comments their food consisted mainly of roots and some species of fungus, but subsequently included tree-fern stems (species not stated) and the "root" (rhizome) of the common bracken fern *Pteridium esculentum* (G.Forst.) Cockayne. In contrast, Davies (1846 p. 79) downplays the role of plants, describing the native bread or "truffle" [*Laccocephalum mylittae* (Cooke & Masse) Nuúñez & Ryvarden] as "the only vegetable production they use" even though he later mentions "parts of the tree-fern" (again species not stated) and "grass-tree" (presumably *Xanthorrhoea australis* R.Br.). The debate regarding Indigenous plant foods is further complicated by (i) the uncertain identity of many plants cited in the Colonial documents and (ii) a failure to state explicitly which plants had been seen to be consumed, as opposed to those that might have been eaten, e.g., Gunn (1842).

An equally relevant issue is that the Yam Daisy is highly palatable to stock (Gott 1983) and therefore any observations made in the Midlands in the 1830s–1840s are likely to postdate massive decimation of the species by the large sheep population (estimated to number ca. 182 000 as early as 1820: Boyce 2010) over the preceding one to two decades. For these reasons, a cautious assessment is the early Colonial ethnographic observations are useful working hypotheses, rather than firm evidence that particular species such as *Microseris lanceolata* were or were not eaten by the palawa.

2. Can *Microseris lanceolata* pollen be distinguished from other Liguliflorae species and was the species sufficiently common in Tasmania to have been a staple food resource?

If, as appears to be the case, the Diprose Lagoon specimens are *in situ*, then it is almost certain that the fossil Liguliflorae pollen at 17 cm depth represents *M. lanceolata*, not *Taraxacum aristum* or an introduced Liguliflorae species (fig. 1c). Reasons for this are the lowland setting (191 m elevation) and, as far as is known, the absence of other extant or extinct native Liguliflorae species in the Tasmanian Midlands. In contrast, relative pollen abundances of up to 28% that post-date the first occurrence of *Pinus* pollen almost certainly represent one of the widely naturalised exotic "weed" Liguliflorae, e.g., the Common Dandelion *T. officinale*. Circumstantial support for the latter interpretation is provided by the increased relative abundance of Liguliflorae pollen, which is mirrored by (i) an increase in other definite and probably introduced agricultural "weeds" such *Plantago lanceolata* (European Plantain), Brassicaceae, (crucifers) and *Rumex* (docks) and (ii) a decrease in relative abundance of native herbs such as Chenopodiaceae (samphires/salt-bush) and Asteraceae subfamily Tubuliflorae, as well as tree genera such as *Allocasuarina*/*Casuarina*, (she-oaks) and *Eucalyptus sensu lato* (eucalypts). The latter trend reflects European clearing of the mosaic of grasslands and dry sclerophyll woodland (savanna woodland) that had dominated the Midlands for most of the Holocene (compare Macphail & Jackson 1978, Sigleo & Colhoun 1981, Fensham 1989, Fensham & Kirkpatrick 1989). Accordingly Romanin *et al.'s* (2016) interpretation that *M. lanceolata* was growing in savanna grasslands in the Midlands (and therefore might have been a food resource) before ca. 1820 appears well-supported.

The related question of abundance is less straightforward although data from southeast mainland Australia concerning the production and dispersal of Liguliflorae pollen and their relative abundance in modern and pre-European sediments are available for comparison. For example, modern pollen data from pollen traps, surface sediments and buried soils on archaeological sites, including in Tasmania, indicate that Liguliflorae pollen are produced in large amounts but these grains are only transported short distances away from the parent plants (Dodson 1983, Kershaw *et al*. 1994, Macphail 1999b, 2016, Macphail & Casey 2008, M.K. Macphail unpubl. data). Similar relative abundances of fossil pollen are recorded at coastal sites in southwest Victoria, a region where "millions of murnong [occurred] all over the plains" in 1840 (Robinson 1840, cited in Gott 1982 p. 64). Closer to the coast, relative abundances of Liguliflorae pollen vary from trace to <10% in mid-late Holocene swamp sediments in the Cape Bridgewater–Discovery Bay district but reach 60% in the nearby Bridgewater caves (Head no date, 1988). On the wider geographic scale, Liguliflorae pollen are found in trace to frequent numbers (>10%) in modern surface samples in southern New South Wales and in larger numbers in deposits where the parent plants are likely to have been growing on the site. However, the pollen type was not recorded in a survey of modern and pre-European settlement sediments in southeast Australia (Kershaw *et al*. 1994). Accordingly, the comparatively low value (4%) of Liguliflorae pollen recorded in Diprose Lagoon before ca. 1820 is unlikely to represent extensive populations of *M. lanceolata* in the surrounding landscape. By extrapolation, the Yam Daisy is not likely to have been a staple plant food resource in the northern Midlands although this may not have been the case elsewhere in Tasmania. For example we note that an entry for possible *M. lanceolata* (cited as *Scorzonera lawrencii* Hook.) collected by R.C. Gunn and now housed in the Kew Herbarium, UK, cites the species as being "Hab. Abundant" (Hooker 1847 p. 124; http://specimens.kew.org/herbarium/K000796798 (accessed 20 April 2017)).

3. Factors that may have influenced palawa consumption of *Microseris*

Whilst the distribution and population densities will have a critical factor in the availability of the Yam Daisy, we recognise other influences potentially might have been important in determining whether the tubers were consumed. These are food "taboos", "convenience of collection", the "sweet taste" and biomedical considerations.

Food taboos: The utilisation of plants, especially trees, can be subject to cultural restrictions (see Meyer-Rochow 2009). Whether the consumption of *Microseris lanceolata* by the palawa was subject to cultural dictates as has been proposed for bony fish (compare Jones 1978, Taylor 2007) is unknown.

Convenience: Mainland (mainly Victorian) sources indicate that the tubers were easy to collect and could be eaten raw or cooked (Gott 1983), but the Tasmanian variety has smaller tubers (Gott 1982), which may have required more effort to collect.

Sweet taste: Europeans who have eaten the tubers have commented on the "radish-like" and "sweet" taste of the tubers (see Cribb & Cribb 1976). The latter characteristic is likely to reflect the substantial amounts of fructans (fructose polymers, in particular inulin), and modest amounts of simple mono- and di-saccharide sugars (mainly fructose and glucose). There is some evidence that in autumn the fructan level declines and the level of simple sugars increases (Incoll *et al.* 1989, Gott 1983). Since simple sugars are much sweeter than fructans, the seasonal variation in composition might explain the inconsistent reporting of sweetness and also the reported (Gott 1983) seasonal variations in Yam Daisy consumption by indigenous Victorians.

Biomedical considerations: With the exception of the Jerusalem Artichoke (*Helianthus tuberosus* L.) and Garlic (*Allium sativum* L.), the few samples of *Microseris lanceolata* tubers analysed to date have been found to have fructan concentrations that are substantially higher than any of the fruits and vegetables in the current "western" diet in Australia (Muir *et al.* 2007). Although fructans per se cannot be digested by enzymes secreted by the human gastrointestinal tract, inulin-rich foods are prebiotics, stimulating the proliferation of specific bacteria in the large intestine and have distinctive health properties. For example, these bacteria convert fructans to short-chain fatty acids, which when taken up by colon mucosal cells are postulated to produce an enhanced immune response (Roberfroid 2005). Whether the palawa (or, indeed, indigenous mainlanders) attributed any specific health impacts to the Yam Daisy or other inulin-rich plant foods is beyond the scope of this paper (compare Brand Miller *et al.* 1998).

CONCLUSIONS

We conclude that there is as yet no unequivocal evidence, either palynological or ethnographic, that *Microseris lanceolata* grew in significant numbers in Tasmania prior to European settlement to give the species the "staple plant food" status claimed for the Yam Daisy in Victoria (compare Bowdler 1981). This, however, does not preclude the indigenous consumption of the Yam Daisy in Tasmania, possibly for other cultural reasons such as the seasonal variation in availability and its sweet taste. If so, it was probably on a limited scale, as the recorded palawa vocabularies do not include any word associated with "roots" that can be identified with the Yam Daisy (compare Plomley 1976, Gott 1983). Whilst the tubers (at least the Victorian variety) have some compositional features, such as a high fructan content, that might provide ancillary health benefits (Kolida & Gibson 2007, Leach 2007, Slavin 2013), it seems unlikely to assume that this aspect would have influenced its consumption by palawa.

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