The naming and typification of the breadfruit, Artocarpus altilis, and breadnut, A. camansi (Moraceae)

Authors: Ferrer-Gallego, P. Pablo, and Boisset, Fernando

Source: Willdenowia, 48(1) : 125-135

Published By: Botanic Garden and Botanical Museum Berlin (BGBM)

URL: https://doi.org/10.3372/wi.48.48109

Willdenowia
Annals of the Botanic Garden and Botanical Museum Berlin

P. PABLO FERRER-GALLEGO[1*] & FERNANDO BOISSET[2]

The naming and typification of the breadfruit, *Artocarpus altilis*, and breadnut, *A. camansi* (*Moraceae*)

Version of record first published online on 5 April 2018 ahead of inclusion in April 2018 issue.

Abstract: The historical background and typification of the widely distributed and highly appreciated breadfruit tree, *Artocarpus altilis* (≡ *Sitodium altile*; *Moraceae*), and breadnut, *A. camansi*, is discussed. *Sitodium altile* is lectotypified selecting a watercolour painting by Sydney Parkinson made in Tahiti in 1769, during James Cook's first voyage around the world (1768–1771) in HMS *Endeavour*, and preserved at the Natural History Museum of London. A specimen from E. D. Merrill's "illustrative specimens" of Blanco's Philippine plants in the United States National Herbarium is designated as the neotype for *A. camansi*.

Key words: *Artocarpus*, breadfruit, breadnut, E. D. Merrill, HMS *Endeavour*, lectotype, *Moraceae*, neotype, nomenclature, *Sitodium*, Sydney Parkinson

Article history: Received 22 November 2017; peer-review completed 7 February 2018; received in revised form 16 February 2018; accepted for publication 20 February 2018.

Citation: Ferrer-Gallego P. P. & Boisset F. 2018: The naming and typification of the breadfruit, *Artocarpus altilis*, and breadnut, *A. camansi* (*Moraceae*). – Willdenowia 48: 125–135. doi: https://doi.org/10.3372/wi.48.48109

Introduction

The genus *Artocarpus* J. R. Forst. & G. Forst. (from the Greek *artos*: bread, and *karpos*: fruit) includes nearly 70 tropical tree species distributed from India, east through Southeast Asia, and into Oceania (Williams & al. 2017). The genus is characterized by its fleshy compound infructescences (syncarps) (see Jarrett 1976). It is the largest genus in the tribe *Artocarpeae* and the third largest genus in the *Moraceae* (after *Ficus* L. and *Dorstenia* L.) (Jarrett 1959a, 1959b, 1960; Berg & al. 2006; Ragone 2006; Zerega & al. 2010; Williams & al. 2017). Biogeographically, the centre of diversification of *Artocarpus* is thought to be Borneo, and from there the genus experienced several dispersal events into SE Asia and Oceania, mainly during the Miocene (Williams & al. 2017). Several species of *Artocarpus* are cultivated in the tropics for food and other utilities. Among the most widely used species are *A. altilis* (Parkinson) Fosberg (domesticated breadfruit), *A. camansi* Blanco (breadnut) and *A. heterophyllus* Lam. (jackfruit) (Ragone 2006; Haq 2006; Jones & al. 2013; Blancke 2016).

The most complete phylogeny of the tribe *Artocarpeae* has suggested the division of *Artocarpus* into four subgenera: *Artocarpus*, *Cauliflori* (F. M. Jarrett) Zerega, *Prainea* (King) Zerega and *Pseudojaca* Trécul (Zerega & al. 2010). *Artocarpus altilis*, together with the wild relatives *A. camansi* (Blanco 1837) and *A. mariannensis* Trécul (Trécul 1847), form the breadfruit complex, a well-supported monophyletic lineage in *A.* subg. *Artocarpus* (Zerega & al. 2005, 2010; Williams & al. 2017). This complex has been variously treated by different authors as either several distinct (Blanco 1837; Trécul 1847; Fosberg 1960; Zerega & al. 2005, 2010) or a single, highly variable species (Jarrett 1959b; Berg & al. 2006). Here we follow Zerega & al. (2005, 2010), and

1 Servicio de Vida Silvestre, Centro para la Investigación y Experimentación Forestal, Generalitat Valenciana, Avda. Comarques del País Valencià 114, 46930 Quart de Poblet, Valencia, Spain; *e-mail: flora.cief@gva.es (author for correspondence).
2 Departament de Botànica i Geologia, Facultat de Ciències Biològiques, Universitat de València, Avda. Dr. Moliner 50, 46100 Burjassot, Valencia, Spain.

A. altilis and *A. camansi* are the subject of this paper. *Artocarpus altilis* is a primary component of traditional agroforestry systems in Oceania, and is a tree highly appreciated for its starchy syncarps, medicinal uses, ease of cultivation and environmental services (Rumphius 1741; Hooker 1828; Jarrett 1959b; Berg & al. 2006; Zerega & al. 2004, 2005, 2006; Ragone 1997, 2006; Jones & al. 2010, 2011). *Artocarpus camansi* (breadnut) is native to New Guinea and possibly the Moluccas and the Philippines (Jarrett 1959b). It is considered the wild progenitor of *A. altilis*, and has been introduced for its edible seeds to the Caribbean and South America. (Zerega & al. 2005, 2006).

Throughout the Pacific, hundreds of breadfruit cultivars have been selected for their adaptations to local ecological conditions (including the saline soils of coral atolls), nutritional value and fruiting patterns (Ragone 1988, 1997, 2006; Jones & al. 2010). The highest levels of genetic diversity are found in Micronesia (where hybrids are common), followed by Melanesia, where seeded cultivars are common, which contrasts with the low levels of genetic diversity found in E Polynesia, where seedless triploid cultivars predominate (Zerega & al. 2005, 2006). Melanesian and Polynesian breadfruit cultivars are thought to be derived from *Artocarpus camansi*, and some Micronesian cultivars from hybridization between *A. altilis* and *A. mariannensis* and subsequent introgression (Fosberg 1960; Zerega & al. 2004, 2005, 2006; Jones & al. 2013; Elevitch & al. 2014). The hybrids between *A. altilis* and *A. mariannensis* are highly variable in morphology between early generation and domesticated hybrids (Jones & al. 2013). Some 3000 years ago, the spread of early cultivars was facilitated by the Lapita culture, a people that sailed from SE Asia eastwards through the Pacific into Melanesia and then into Polynesia (Ragone 2006; Zerega & al. 2004, 2005, 2006, 2010; Jones & al. 2011, 2013).

In the 18th century, European nations recognized the potential of the breadfruit as a cheap source of food for slave populations, and they attempted to introduce a few seedless varieties in their tropical colonies (Ellis 1775; Hooker 1828; Jarrett 1959b; Zerega & al. 2006). One of the first attempts to transport plants from the Pacific to the Caribbean was led by Captain William Bligh (see Fosberg 1960) on the HMS *Bounty*, a voyage that failed due to a mutiny (Bligh 1792). However, subsequent attempts were successful (Jarrett 1959b: 323).

For its potential in food security, the breadfruit is included as one of the priority crops by the Global Crop Diversity Trust (https://www.croptrust.org/) and included in Annex 1 of the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO 2009; Jones & al. 2010, 2011, 2013; http://globalbreadfruit.com/). However, rising sea levels, natural disasters and genetic and cultural erosion constitute increasing threats to the diversity of Pacific breadfruit cultivars in the 21st century (Zerega & al. 2006; Jones & al. 2011).

To our knowledge, both *Artocarpus altilis* and *A. camansi*, two key species in the breadfruit complex, need corrections made to their current typifications. The purpose of this paper is to fix the application of those names through proper typification based on consideration of the respective protologues and original material.

Historical background

The circumnavigation of the globe by Lieutenant James Cook in HMS *Endeavour* (1768–1771), was the first British voyage devoted to geographical, astronomical and scientific discovery (Banks 1896; Beaglehole 1955; Stearn 1968, 1969; Rix 2012; Gooding 2017a). It was a voyage commissioned by the Royal Society to observe the transit of Venus across the Sun in Tahiti and then to sail in search of the Southern Continent. Sir Joseph Banks (1743–1820), at his own cost, arranged a small team to study the natural history during the voyage, including the Swedish naturalist and botanist Daniel Carl Solander (1733–1782), and recruited three draughtsman, Alexander Buchan (?–1769), Hermann Spöring (1733–1771) and Sydney Parkinson (c. 1745–1771), the last as painter of botanical objects (Banks 1896; Groves 1962; Rauschenberg 1968; Rice 2010; Gooding 2017a).

HMS *Endeavour* touched at Madeira, Brazil and Tierra del Fuego before reaching the Society Islands, New Zealand and E Australia (Beaglehole 1955; Banks 1896). After Buchan died in Tahiti, the full artistic responsibility shifted to Parkinson. From New Zealand, the number of plants collected was so overwhelming that Parkinson could do no more than sketches with detailed colour references, with the idea of completing the works later (Lack & Ibáñez 1997). Unfortunately, Parkinson died of malaria and dysentery in January 1771 during the homeward voyage across the Indian Ocean from Batavia (Jakarta) to the Cape of Good Hope (Stearn 1978; Diment & al. 1984; Rice 2010; Gooding 2017a). He left over 674 precise outline drawings and 269 finished watercolour paintings, remarkable for their artistic design and great scientific interest (Stearn 1968, 1969; Carter & al. 1981; Blunt 1983; Diment & Newington 1985; Diment & al. 1987; Lack & Ibáñez 1997; Gooding 2017b).

The botanical discoveries were impressive, with over 30 000 herbarium specimens, representing over 3600 species, of which 1300 were previously unknown to science (Carter & al. 1981). Once in London, Solander devised a system of cataloguing the information on loose slips of paper, continued the study of the botanical collections and wrote several manuscripts for floras, in which he proposed new names and made detailed descriptions in Latin (Groves 1962; Diment & Wheeler 1984; Gooding 2017b). The descriptions of the plants collected in the Society Islands (at Tahiti and Moorea, Huahine, Raiatea and Tahaa) from April to August 1769 are found in Solander's manuscripts *Plantae Otaheitenses* and *Plantae*

Insularum Oceani Pacifici, respectively. There are also two alphabetical indexes of the plants collected: *Index Speciminun Plantarum Insulae Otaheitenses* and *Index Speciminum Plantarum Insulae Otaheite reliquarumque insularum Oceani Pacifici* (Diment & Wheeler 1984). Unfortunately, none of these writings (preserved at the Natural History Museum of London) was ever published.

Banks and Solander were also involved in the publication of an ambitious illustrated Flora of the voyage based on Parkinson's botanical drawings, *The Florilegium*, that was to include the most precise and exquisite botanical illustrations and the description of the plants new to science (Gooding 2017b). Over 13 years, Banks employed a team of five artists and 18 skilled engravers to make a total of 743 copper plates of which 738 are extant (Stearn 1968, 1969; Carter & al. 1981; Diment & al. 1984, 1987; Gooding 2017b). Unfortunately, and despite all the efforts and money invested, the sudden death of Solander in May 1782, and other reasons, prevented its publication (Stearn 1969; Diment & al. 1984; Duyker 1998; Gooding 2017b). After Banks's death, in 1820, the botanical specimens, the illustrations, copper plates and proofs became the property of the British Museum (Natural History) (Diment & Newington 1985; Diment & al. 1984, 1987). A total of 318 lithographs of Australian plants were published at the beginning of the 20th century (Banks & Solander 1900–1905), and a selection of 30 engravings were printed in black-and-white (Blunt & Stearn 1973). The first complete full-colour edition of *Banks' Florilegium* was published in a boxed edition limited to 100 copies (Diment & Humphries 1980). More recently, a selection of the *Banks' Florilegium* has been published (see Studholme 2017).

Typification of the names

Artocarpus altilis and its synonyms

It seems that the first mention of the breadfruit by Europeans was that of Pedro Fernandez de Quiros, the Portuguese pilot in Mendaña's second voyage through the S Pacific Ocean (1595–1596) (Jarrett 1959b; Maude 1959). In the 16th century, the Spanish undertook several expeditions from Peru into the C Pacific and they were likely responsible for distributing the Polynesian breadfruit into both Micronesia and the Philippines in the 17th century (Jarrett 1959b; Ragone 1997; Zerega & al. 2006).

Among the several pre-Linnaean references (see Jarrett 1959b: 322), one of the most important is Rumphius's *Herbarium amboinense*, where breadfruit and its close relatives appear as "*Soccus Lanosus*", "*Soccus granosus*" and "*Soccus Silvestris*" (Rumphius 1741: 110, 112, 114, T. 32, 33, 34). Jarrett (1959b:115) included "*Soccus Lanosus*" and "*Soccus granosus*" in the seedless and seeded forms of breadfruit. However, following the current taxonomy and nomenclature, Rumphius's names refer to three different species: "*Soccus Lanosus*" [= *A. altilis* (Parkinson) Fosberg] is breadfruit (the seedless type); "*Soccus granosus*" [= *A. camansi* Blanco] is seeded breadnut; and "*Soccus Silvestris*" [= *A. horridus* F. M. Jarrett] is a wild species of the Moluccas very closely related to breadfruit (Zerega, pers. comm.).

The first Linnaean name of the breadfruit, *Sitodium altile* Parkinson, was published after the death of Sydney Parkinson by his brother, Stanfield Parkinson, in "*Journal of a voyage to the South Seas in H.M.S. Endeavour*" (Parkinson 1773: 45–46), in a chapter entitled "*Plants of use for food, Medicine & c. in Otaheite*". The species appeared together with the Tahitian name "E ooroo" including a long description with some important characters and general comments on its uses ("… this tree grows to between thirty and forty feet high, has large palmate leaves, of a deep grass green on the upper-side but paler on the under; and bears male and female flowers, which come out single at the bottom or joint of each leaf."; see http://nla.gov.au/nla.cs-ss-jrnl-parkinson-075). In his publication, Stanfield used the scientific names from Sydney's journal. Sydney took the names in his journal from Solander's manuscripts when on board HMS *Endeavour* (Gooding 2017b) and made the drawings of the natural objects under the direction of Banks and Solander (Parkinson 1773: 36).

In 1776, Johann Reinhold Forster and his son George, the botanists on Cook's second voyage (1772–1775), named the genus *Artocarpus* (Forster & Forster 1776: 101) and described the species *A. communis* J. R. Forst. & G. Forst. (l.c.: 102, t. 51–51a–f), disregarding Parkinson's name (Baum 1903; MacCaughey 1917; Stearn 1968, 1969). These names first appeared a year previously, in the 1st edition of the Forsters' *Characteres generum plantarum* (1775), but are not validly published there because this work is listed among the "opera utique oppressa" (suppressed works) under the *International Code of Nomenclature for algae, fungi and plants* (McNeill & al. 2012, hereafter "*ICN*"; see http://botany.si.edu/references/codes/props/index.cfm). Also in 1776, the breadfruit was given other names: *Radermachia incisa* Thunb. (Thunberg 1776: 253) and *Rima* Sonn. (Sonnerat 1776: 99, t. 57–60). In 1781, the younger Linnaeus transferred *Radermachia incisa* to *Artocarpus*, as *A. incisus* (Thunb.) L. f. (Linnaeus 1782: 411). In the 19th century, the Augustinian friar F. M. Blanco (1778–1845) published his *Flora de Filipinas* (Blanco 1837), where he described *A. rima* Blanco (as "*Arcthocarpus*") for the plants growing in those islands (Jarrett 1959b). However, this name has been treated as a synonym of *A. communis* (Jarrett 1959b) or currently of *A. altilis* (Zerega & al. 2005).

Fosberg (1939: 231) proposed the conservation of *Artocarpus* against *Sitodium* Parkinson, because of the continuous use of the former name since 1776, but maintained the priority of the *S. altile* over *A. communis*, proposing the new combination *A. altilis* (Parkinson) Fosberg, the name currently used (see Fosberg 1941, 1960; Dandy

1967; Berg 2005; Berg & al. 2006; Ragone 2006; Zerega & al. 2004, 2005, 2006, 2010; Williams & al. 2017). However, some authors have questioned the validity of Parkinson's name, highlighting deficiencies in the botanical description (Merrill 1954; Jarrett 1959b; St. John 1972; Stone 1974), or have considered that the first acceptable binomial was the name published without a hyphen in the German translation (Parkinson 1774) (see St. John 1972; Stone 1974, 1988). It was likely for the latter reason that Florence (1997: 143) accepted the first valid publication of the name as "*Sitodium altile* S. C. Parkinson ex Z., Naturforscher (Halle) 4: 244, pl. 2. 1774" (see Degener & Degener 1978), the author "Z" later identified by Pieper (2006) as Friedrich August Zorn von Plobsheim (1711–1789). The name *S. altile* Parkinson ex Zorn was lectotypified by Florence (1997: 143) with a published illustration reproduced from Parkinson's original watercolour illustration, whereas we lectotypify the name *S. altile* Parkinson with that original illustration (see below). Because the two types are not the same illustration, the names are heterotypic and therefore homonyms, the later of which is illegitimate under *ICN* Art. 53.1.

The hyphen in "*Sitodium-altile"* (Parkinson 1773) was regarded as a orthographic error by Jarrett (1959b: 310). Because Parkinson used a hyphen in all the binomials in this work, we consider it as a typographical device that is not part of the name and can therefore be disregarded for nomenclatural purposes. Jarrett (1959b: 116–117) considered Parkinson's description unscientific and inadequate, and for that reason cited (p. 307) the names *Sitodium altile* and *Artocarpus altilis* as "nomina subnuda" and chose *A. communis* as the validly published name for the breadfruit. However, in our opinion, the description found in Parkinson's protologue is amply adequate for the purposes of *ICN* Art. 38.1(a) and we therefore consider Parkinson's name to be validly published.

Jarrett (1959b: 307) designated as the lectotype of *Artocarpus communis* a specimen preserved at BM as "Holotype: without provenance, *Forster s.n.* (BM); ? isotype, Tahiti (K)", clearly referring to the sheet now with the barcode BM000900567. This sheet bears a single leaf, and a duplicate specimen is preserved at K, with the barcode K000357659 (see Smith 1981).

Regarding the type of *Sitodium altile*, because Fosberg (1941) did not designate a type when he proposed the combination *Artocarpus altilis*, Zerega & al. (2005: 611) indicated the same Forster specimen at BM as "lectotype". However, this "lectotypification" is ineffective according to *ICN* Art. 7.10 because Forster's specimen at BM cannot be considered part of Parkinson's original material, and any possible correction to a neotype under *ICN* Art. 9.9 must also be rejected because there exists original material (*ICN* Art. 9.7 and 9.13). No specimens or illustrations were cited in the protologue by Parkinson, nor were any illustrations published as part of the protologue, but there exist uncited elements that need to be considered.

Among the herbarium material of *Artocarpus altilis* collected by Banks and Solander on Cook's first voyage, Diment & al. (1987: 157) indicated "2 sheets, 1 – Otaheite, 2 – Otaheite, Huahine, Ulhietea (? syntypes)". At BM there are two specimens. The first sheet, with barcode BM000752555 (Fig. 1), bears two branches with leaves; it includes a small printed label "Society Islands 1769 / Banks & Solander", a larger printed label "Plants of / Captain Cook's First Voyage / (H.M.S. Endeavour) / 1768–1771 / Society Islands: Otaheite / 13 April – 1 June 1769 & 4 June – 13 July 1769 / 'hab. in Otaheite, Huaheine, Ulaietea / reliquisque insulis elevationibus oceani / pacifici' / Coll. Joseph Banks & Daniel Solander" and a determination label by J. Florence dated 1993. The digital image in Fig. 1 shows an annotation "Tahiti – Banks & Solander (Cook's 1st. Voyage).", which presumably has been digitally copied from the verso and pasted onto the recto. Berg (1998: 21; 2015: 4) cited this specimen as a syntype "Tahiti, *Banks & Solander s.n.* (BM!)". The second sheet, with barcode BM001209950 (Fig. 2), bears two branches with leaves and two separate leaves (all very deeply lobed); it includes a hand-written label "*Sitodium altile*. Mscr", a small printed label "Society Islands 1769 / Banks & Solander", a larger printed label "Plants of / Captain Cook's First Voyage / (H.M.S. Endeavour) / 1768–1771 / *Artocarpus communis* / Tahiti [and '(1769)' in pencil] / Coll. Joseph Banks & Daniel Solander", a label indicating that the specimen was sampled for DNA in 2017 and a determination label by J. Florence dated 1993. The digital image in Fig. 2 shows an annotation "Tahiti – Banks and Solander (Cook's 1st. Voyage)", which presumably has been digitally copied from the verso and pasted onto the recto.

These two specimens at BM, although very different, belong taxonomically to *Artocarpus altilis* and were undoubtedly collected on Cook's first voyage. Clearly important is that both specimens lack any annotation by Parkinson and neither is linked to any of Parkinson's illustrations (Carter & al. 1981) (see below), and therefore they cannot be considered as original material (*ICN* Art. 9.3). On the other hand, the term "?syntype" used by Diment & al. (1987: 157) and Berg (1998, 2015) is inappropriate because the specimens were not cited in the protologue (*ICN* Art. 9.5), and use of the term syntype cannot logically be corrected to lectotype under *ICN* Art. 9.9. In this sense, Smith (1981: 207) wrote "there may be Tahitian collections of the breadfruit at BM from the first Cook voyage, but it would seem unwarranted to consider any of them a holotype".

There are, however, unpublished illustrations that are undoubtedly original material for *Sitodium altile*. While in the Society Islands, Parkinson made 15 sketches and 113 finished watercolours, all preserved at BM (Stearn 1978; Carter & al. 1981; Diment & al. 1987). Among them, there is one finished watercolour of *Artocarpus altilis* (Fig. 3), depicting a branch with leaves, three infruct-

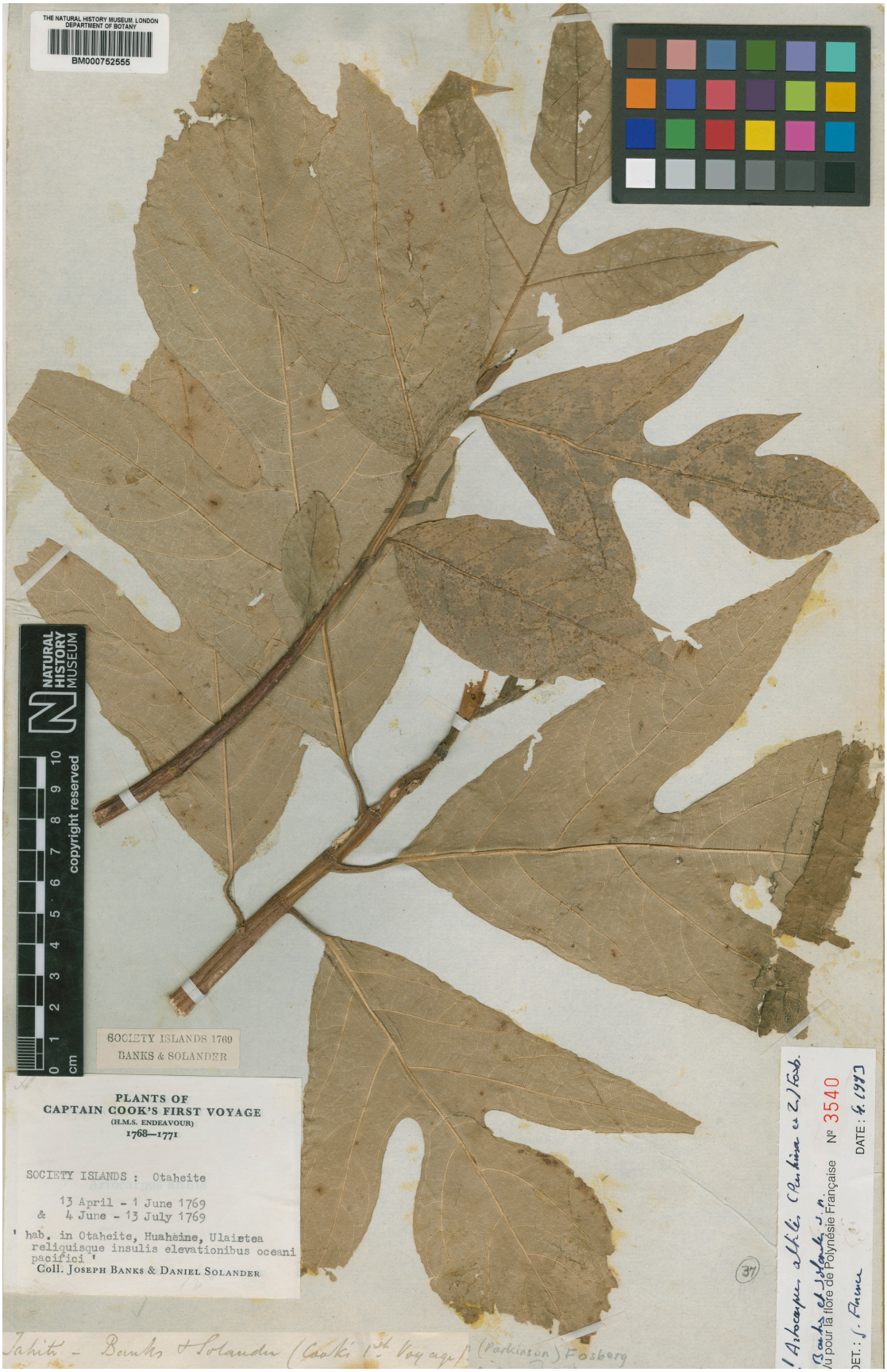

Fig. 1. Specimen of *Artocarpus altilis*, showing two branches with leaves, collected by Banks & Solander in 1769 in Tahiti, preserved in BM (barcode BM000752555). – Image reproduced with kind permission of the Trustees of the Natural History Museum, London.

Fig. 2. Specimen of *Artocarpus altilis*, showing two branches with three leaves, collected by Banks & Solander in 1769 in Tahiti, preserved in BM (barcode BM001209950). – Image reproduced with kind permission of the Trustees of the Natural History Museum, London.

escences (syncarps) and a male inflorescence, annotated "*Sitodium altile*. / Sydney Parkinson pinxit 1769" in one hand and "*Artocarpus incisa*, L. f." and "Otaheite" in two other hands. From this watercolour, John Frederick Miller made a copy in pen-and-ink wash, which is also at BM, together with five original pencil sketches by Parkinson, four of which are annotated "*Sitodium altile* / *Otaheite*". The five sketches comprise two drawings of branches with syncarps, one of a branch with male inflorescences, one of a single syncarp in longitudinal and cross-section, and a remarkable study of a single leaf (see Diment & al. 1987: 157–158). At the bottom of one of the sketches of a branch with syncarps, there is the annotation "The leaves dark grass green with pale yellow green veins the underside pale green with prominent veins, the male flower & spatha pale yellow green, the fruit a yellow green."

The watercolour painting and the five pencil sketches comprise the extant original material of the name *Sitodium altile*. Fosberg (1960) noted that the type on the name could be selected from these drawings. From among the original material we designate Parkinson's excellent finished watercolour as the lectotype of *S. altile*. This illustration is very complete and the best original element. Most importantly, it can be identified unambiguously as representing the traditional concept and current use of the name *Artocarpus altilis* (e.g. Parkinson 1773; Fosberg 1960; Florence 1997; Zerega & al. 2005; Ragone 2006; Berg & al. 2006, 2015).

Sitodium altile Parkinson, J. Voy. South Seas: 45. 1773 [*"Sitodium-altile"*] ≡ ***Artocarpus altilis*** (Parkinson) Fosberg in J. Wash. Acad. Sci. 31: 95. 1941. – **Lectotype (designated here):** Parkinson's watercolour illustration, annotated "*Sitodium-altile*. / Otaheite / Sydney Parkinson pinxit 1769" and preserved at the Natural History Museum London (Fig. 3).

= *Sitodium altile* Parkinson ex Zorn in Naturforscher (Halle) 4: 244. 1774, nom. illeg. (*ICN* Art. 53.1) ≡ *Artocarpus altilis* O. Deg. & I. Deg. in Phytologia 39: 144. 1978, nom. illeg. (*ICN* Art. 53.1). – Lectotype (designated by Florence 1997: 143): [illustration] "*Der Brodbaum*" in Parkinson (1774: t. 2) [illustration reproduced from Parkinson's watercolour illustration].

= *Artocarpus communis* J. R. Forst. & G. Forst., Char. Gen. Pl., ed. 2: 102. 1776. – Lectotype (designated by Jarrett 1959b: 307 [as "holotype", corrected here according to *ICN* Art. 9.9]): *Forster s.n.* (BM [barcode BM000900567]!; isolectotype: K [barcode K000357659]!).

= *Radermachia incisa* Thunb. in Kongl. Vetensk. Acad. Handl. 37: 253. 1776 ≡ *Artocarpus incisus* (Thunb.) L. f., Suppl. Pl.: 411. 1782. – Lectotype (designated by Jarrett 1959b: 307 [as "holotype", corrected here according to *ICN* Art. 9.9]): Java, *Thunberg s.n.* (UPS 135210!; isolectotype: L [barcode L0052850]!).

= *Artocarpus rima* Blanco, Fl. Filip.: 671. 1837 ["*Arcthocarpus*"]. – **Neotype (designated here):** [Philippines], Manila, Luzon, Mar 1914, *Merrill Species Blancoanae No. 603* (US [barcode 00688527, US catalog no. 904280]!).

Artocarpus camansi

The name *Artocarpus camansi* was published in the first edition of Francisco Manuel Blanco's *Flora de Filipinas* (Blanco 1837: 670), but he did not cite any gatherings. This species was also included in the second edition of Blanco's work (Blanco 1845: 467). Most of his descriptions were based on fresh material collected by himself or brought to him by other persons, and some descriptions were based on dried specimens received from his various colleagues, but the original material did not survive (Merrill 1918).

With the aim of resolving the problem of the status of Blanco's names, Merrill distributed an exsiccata of 16 sets of "illustrative specimens" for each species that functioned as replacements for the lost original material (Merrill 1918). Many of Blanco's names have been neotypified based on the "illustrative specimens" from Merrill's series *Species Blancoanae* (Nicolson & Arculus 2001). However, although Merrill (1918: 124) wrote "*Merrill*: *Species Blancoanae No. 830*" from Manila, Luzon, Philippines as "illustrative specimen" of *Artocarpus camansi*, this is a gathering consisting of several specimens and could therefore serve only as a "first-step" neotypification according to *ICN* Art. 9.17, but only if Merrill's statement were considered to be a designation of a type in accordance with *ICN* Art. 7.10 (see Nicolson & Arculus 2001). Much more recently, Zerega & al. (2005) wrote "NEOTYPE: Manila, Luzon, Philippines, *Merrill Species Blancoanae 830*, designated by Merrill in Sp. Blanco. 124. 1918 (US!, No. 00904515)". However, this intended neotypification is ineffective because, in lacking the phrase "designated here" or an equivalent, which is required from 2001 onwards, it is contrary to *ICN* Art. 7.10. We therefore designate here the same specimen as the neotype of *A. camansi*.

Artocarpus camansi Blanco, Fl. Filip.: 670. 1837. – **Neotype (designated here):** [Philippines], Manila, Luzon, Feb 1915, *Merrill Species Blancoanae No. 830* (US [barcode 00730771, US catalog no. 904515]!; isoneotype: L [barcode L0817646]!).

Acknowledgements

We are grateful to Ranee Prakash, Jacek Wajer and Jovita C. Yesilyurt (Natural History Museum, London) for her help in the study of the herbarium sheets at BM. Thanks go to Mats Hjertson (Museum of Evolution,

Fig. 3. Lectotype of *Sitodium altile* Parkinson (≡ *Artocarpus altilis* (Parkinson) Fosberg). Finished watercolour by Sydney Parkinson of the breadfruit tree (as *Sitodium altile*), made at Otaheite (Tahiti) in 1769 during James Cook's first voyage. – Image reproduced with kind permission of the Trustees of the Natural History Museum, London.

Botany Section Uppsala University, Sweden) for his help in the study of the herbarium sheet at UPS. Special thanks go to Nyree Zerega, for her suggestions and valuable remarks that have helped to improve the manuscript, and to an anonymous reviewer. Finally, we wish express our gratitude to Nicholas Turland for his dedication and careful work in reviewing and editing the manuscript.

References

Banks J. 1896: Journal of the Right Hon. Sir Joseph Banks … during Captain Cook's first voyage in H.M.S. Endeavour in 1768–71 to Terra del Fuego, Otahite, New Zealand, Australia, The Dutch East Indies, etc. (ed. by Sir Joseph D. Hooker). – London: Macmillan.

Banks J. & Solander D. 1900–1905: Illustrations of the botany of Captain Cook's voyage round the world in the H.M.S. Endeavour in 1768–1771. With determinations by James Britten. 3 vols. – London: Printed by order of the trustees of the British Museum.

Baum H. E. 1903: The name of the breadfruit. – Science, n.s., **18:** 439.

Beaglehole J. C. (ed.). 1955: The journals of Captain James Cook on his voyages of discovery **1.** The voyage of the Endeavour 1765–1771. – Cambridge: Cambridge University Press for the Hackluit Society.

Berg C. C. 1998: *Moraceae* (excl. *Ficus*). – Pp. 1–123 in: Harling G. & Andersson L. (ed.), Flora of Ecuador **60.** – Göteborg, Stockholm & Quito: University of Götenborg, Riksmuseum & Pontificia Universidad Católica del Ecuador.

Berg C. C. 2005: Flora malesiana precursor for the treatment of *Moraceae* 8: other genera than *Ficus*. – Blumea **50:** 535–550.

Berg C. C. 2015: *Moraceae*. – Pp. 1–91 in: Davidse G., Sousa Sánchez M., Knapp S. & Chiang Cabrera F. (ed.), Flora mesoamericana **2(3).** – St. Louis: Universidad Nacional Autónoma de México, Missouri Botanical Garden Press & the Natural History Museum, London. – Online at http://www.tropicos.org/Project/FM

Berg C. C., Corner E. J. H. & Jarrett F. M. 2006: *Moraceae* – genera other than *Ficus*. – Flora malesiana, series **I** – seed plants. Volume **17** / part **1.** – Leiden: Nationaal Herbarium Nederland.

Blancke R. 2016: Tropical fruits and other edible plants of the world: an illustrated guide. – Ithaca: Comstock Publishing Associates, Cornell University Press.

Blanco F. M. 1837: Flora de Filipinas: según el sistema sexual de Linneo. – Manila: Imprenta de Sto. Thomas.

Blanco F. M. 1845: Flora de Filipinas: según el sistema sexual de Linneo, ed. 2. – Manila: D. Miguel Sanchez.

Bligh W. 1792: A voyage to the South Sea, undertaken by command of His Majesty, for the purpose of conveying the bread-fruit tree to the West Indies, in His Majesty's ship the Bounty, commanded by Lieutenant William Bligh. – London: George Nicol.

Blunt W. 1983: Sydney Parkinson and his fellow artists. – Pp. 14–45 in: Carr D. J. (ed.), Sydney Parkinson. Artist of Cook's Endeavour Voyage. – London & Canberra: British Museum (Natural History) & Croom Helm.

Blunt W. & Stearn W. T. 1973: Captain Cook's Florilegium: a selection of engravings from the drawings of plants collected by Joseph Banks and Daniel Solander on Captain Cook's first voyage to the islands of the Pacific. – London: Royal College.

Carter H. B., Diment J. A., Humphries C. J. & Wheeler A. C. 1981: The Banksian natural history collections of the Endeavour voyage and the relevance to modern taxonomy. – Pp. 61–70 in: Wheeler A. C. & Price J. H. (ed.), History in the service of systematics. – London: Society for the Bibliography of Natural History.

Dandy J. E. 1967: Index of generic names of vascular plants 1753–1774. – Regnum Veg. **51:** 1–130.

Degener O. & Degener I. 1978: Outrageously presumptuous! Again breadfruit, *Artocarpus altilis* (J. P. du Roi) Deg. & Deg. and Tahiti-chestnut, *Inocarpus fagifer* (J. P. du Roi) Deg. & Deg. – Phytologia **39:** 143–146.

Diment J. A. & Humphries C. J. (ed.). 1980: Banks' Florilegium: a publication in thirty-four parts of seven hundred and thirty-eight copperplate engravings of plants collected on Captain James Cook's first voyage…gathered and classified by … Sir Joseph Banks … and Dr. Daniel Solander … engraved … after drawings … by Sydney Parkinson. – London: Alecto Historical Editions in association with the British Museum (Natural History).

Diment J. A., Humphries C. J., Newington L. & Shaugnessy E. 1984: Catalogue of the natural history drawings commissioned by Joseph Banks on the Endeavour voyage 1768–1771 held in the British Museum (Natural History), part I: botany: Australia. – Bull. Brit. Mus. (Nat. Hist.), Bot. **11:** 1–183.

Diment J. A., Humphries C. J., Press J. R., Shaugnessy E. & Newington L. 1987: Catalogue of the natural history drawings commissioned by Joseph Banks on the Endeavour voyage 1768–1771 held in the British Museum (Natural History), part 2: botany: Brazil, Java, Madeira, New Zealand, Society islands and Tierra del Fuego. – Bull. Brit. Mus. (Nat. Hist.), Bot. **12:** 1–158.

Diment J. A. & Newington L. 1985: Botanical prints and drawings at the British Museum (Natural History). – Art Libraries Journal **10(1):** 5–28.

Diment J. A. & Wheeler A. 1984: Catalogue of the natural history manuscripts and letters by Daniel Solander (1733–1782), or attributed to him, in British collections. – Arch. Nat. Hist. **11:** 457–488.

Duyker E. 1998: Nature's Argonaut: Daniel Solander 1733–1782: naturalist and voyager with Cook and Banks. – Melbourne: Melbourne University Press.

Elevitch C., Ragone D. & Cole I. 2014: Breadfruit production guide: recommended practices for growing, harvesting, and handling. Ed. 2. – Kalaheo & Holualoa: Hawai'i Breadfruit Institute of the National Tropical Botanical Garden & Hawai'i Homegrown Food Network.

Ellis J. 1775: A description of the mangostan and the bread-fruit: the first, esteemed one of the most delicious, the other, the most useful of all the fruits of the East Indies: to which are added, directions to voyagers, for bringing over these and other vegetable productions, which would be extremely beneficial to the inhabitants of our West India Islands. – London: for the author, sold by Edward and Charles Dilly.

FAO 2009: The international treaty on plant genetic resources for food and agriculture. – Rome: Food and Agriculture Organization.

Florence J. 1997: Flore de la Polynésie française. Collection Faune et flore tropicales **1.** – Paris: Éditions de l'Orstom.

Forster J. R. & Forster G. 1775: Characteres generum plantarum. – Londini: no publisher stated.

Forster J. R. & Forster G. 1776: Characteres generum plantarum. – Londini: Prostant apud B. White, T. Cadell & P. Elmsly.

Fosberg F. R. 1939: Nomenclature proposals for the 1940 Botanical Congress. – Amer. J. Bot. **26:** 229–231.

Fosberg F. R. 1941: Names in *Amaranthus*, *Artocarpus*, and *Inocarpus*. – J. Wash. Acad. Sci. **31:** 93–96.

Fosberg F. R. 1960: Introgression in *Artocarpus* in Micronesia. – Brittonia **12:** 101–113.

Gooding M. 2017a: The making of Banks' Florilegium I: the voyage of *Endeavour* (1768–1771). – Pp. 7–19 in: Mabberley D., Gooding M. & Studholme J. (ed.), Joseph Banks' Florilegium. – London: Thames & Hudson.

Gooding M. 2017b: The making of Banks' Florilegium II: the Florilegium (1772–1990). – Pp. 296–305 in: Mabberley D., Gooding M. & Studholme J. (ed.), Joseph Banks' Florilegium. – London: Thames & Hudson.

Groves E. W. 1962: Notes on the botanical specimens collected by Banks and Solander on Cook's first voyage, together with an itinerary of landing localities. – J. Soc. Bibliogr. Nat. Hist. **4:** 57–62.

Haq N. 2006: Jackfruit, *Artocarpus heterophyllus*. – Southampton: Centre for Underutilised Crops, University of Southampton.

Hooker J. D. 1828: *Artocarpus incisa*. Bread-fruit tree (α and β). – Bot. Mag. **55:** t. 2869–2871.

Jarrett F. M. 1959a: Studies in *Artocarpus* and allied genera, I. General considerations. – J. Arnold Arbor. **40:** 1–29.

Jarrett F. M. 1959b: Studies in *Artocarpus* and allied genera, III. A revision of *Artocarpus* subgenus *Artocarpus*. – J. Arnold Arbor. **40:** 113–155, 298–368.

Jarrett F. M. 1960: Studies in *Artocarpus* and allied genera, IV. A revision of *Artocarpus* subgenus *Pseudojaca*. – J. Arnold Arbor. **41:** 73–140.

Jarrett F. M. 1976: The syncarp of *Artocarpus* – a unique biological phenomenon. – Gard. Bull. Singapore **24:** 35–39.

Jones A. M. P., Murch S. J. & Ragone D. 2010: Diversity of breadfruit (*Artocarpus altilis*, *Moraceae*) seasonality: a resource for year-round nutrition. – Econ. Bot. **64:** 340–351.

Jones A. M. P., Murch S. J., Wiseman J. & Ragone D. 2013: Morphological diversity in breadfruit (*Artocarpus*, *Moraceae*): insights into domestication, conservation, and cultivar identification. – Genet. Resources Crop Evol. **60:** 175–192.

Jones A. M. P., Ragone D., Tavana N. G., Bernotas D. W. & Murch S. J. 2011: Beyond the Bounty: breadfruit (*Artocarpus altilis*) for food security and novel foods in the 21st century. – Ethnobot. Res. Applic. **9:** 129–149.

Kochummen K. M. 2000: *Artocarpus* J. R. & G. Forster. nom. conserv. – Pp. 187–212 in: Soepadmo E. & Saw L. G. (ed.), Tree flora of Sabah and Sarawak, Malaysia. – Kuala Lumpur: Sabah Forestry Department, Forest Research Institute Malaysia & Sarawak Forestry Department.

Lack H. W. & Ibáñez V. 1997: Recording colour in late eighteenth century botanical drawings: Sydney Parkinson, Ferdinand Bauer and Thaddäus Haenke. – Bot. Mag., n.s., **14:** 87–100.

Linnaeus C. filius. 1782 ["1781"]: Supplementum plantarum systematis vegetabilium editionis decimæ tertiæ, generum plantarum editionis sextæ, et specierum plantarum editionis secundæ. editum a Carolo a Linné. – Brunsvigæ: Impensis Orphanotrophei.

MacCaughey V. 1917: The genus *Artocarpus* in the Hawaiian Islands. – Torreya **17:** 33–49.

Maude H. E. 1959: Spanish discoveries in the Pacific. A study in identification. – J. Polynes. Soc. **68:** 285–326.

McNeill J., Barrie F. R., Buck W. R., Demoulin V., Greuter W., Hawksworth D. L., Herendeen P. S., Knapp S., Marhold K., Prado J., Prud'homme van Reine W. F., Smith G. F., Wiersema J. H. & Turland N. J. (ed.) 2012: International Code of Nomenclature for algae, fungi, and plants (Melbourne Code) adopted by the Eighteenth International Botanical Congress Melbourne, Australia, July 2011. – Regnum Veg. **154.**

Merrill E. D. 1918: Species blancoanae: a critical revision of the Philippine species of plants described by Blanco and by Llanos. – Manila: Department of Agriculture and Natural Resources. Bureau of Science. Publication No. **12.**

Merrill E. D. 1954: The botany of Cook's voyages. – Chron. Bot. **14:** 164–383.

Nicolson D. H. & Arculus D. 2001: Candidates for neotypification of Blanco's names of Philippine plants: specimens in the U.S. National Herbarium. – Taxon **50:** 947–954.

Parkinson S. 1773: A journal of a voyage to the South Seas, in His Majesty's ship, The Endeavour. – London: Stanfield Parkinson.

Parkinson S. 1774: Die Pflanzen der Insel Outahitee, aus der Parkinsonischen Reissebeschreibung gezogen, und mit Anmerkungen erlautert. [Translation and editing by "Z" of the chapter on plants from Parkinson, 1773]. – Naturforscher (Halle) **4:** 220–258.

Pieper H. 2006: "Z" – the breadfruit author identified. – Willdenowia **36:** 589–593.

Ragone D. 1988: Breadfruit varieties in the Pacific atolls. – Suva: Integrated Atoll Development Project, United Nations Development Programme.

Ragone D. 1997: Promoting the conservation and use of underutilized and neglected crop series 10: Breadfruit, *Artocarpus altilis* (Parkinson) Fosberg. – Rome: International Plant Genetic Resources Institute.

Ragone D. 2006: *Artocarpus altilis* (breadfruit), ver. 2.1. – In: Elevitch C. R. (ed.), Species profiles for Pacific Island agroforestry. – Hōlualoa: Permanent Agriculture Resources (PAR). – Published at http://www.traditionaltree.org

Rauschenberg R. A. 1968: Daniel Carl Solander: Naturalist of the "Endeavour". – Trans. Amer. Philos. Soc. **58:** 1–66.

Rice T. 2010: Voyages of discovery. – London: the Natural History Museum.

Rix M. 2012: The golden age of botanical art. – London: Andre Deustch.

Rumphius G. E. 1741: Herbarium amboinense **1.** – Amstelaedami: Apud Franciscum Changuion & al.; Hagae Comitis: Apud Petrum Gosse & al.; Ultrajecti: Apud Stephanum Neaulme.

Smith A. C. 1981: Flora vitiensis nova: a new Flora of Fiji **2.** – Lawaii: Pacific Tropical Botanical Garden.

Sonnerat P. 1776: Voyage à la Nouvelle Guinée. – Paris: Chez Ruault, Libraire, rue de la Harpe.

St. John H. 1972: The scientific names in the German edition of Parkinson's plants of use for food, medicine, etc., in Otaheite. – Biol. J. Linn. Soc. **4:** 305–310.

Stearn W. T. 1968: The botanical results of the Endeavour voyage. – Endeavour **27:** 3–10, t. 1–9.

Stearn W. T. 1969: A Royal Society appointment with Venus in 1769; the voyage of Cook and Banks in the Endeavour in 1768–1771 and its botanical results. – Notes & Rec. Roy. Soc. London **24:** 64–90.

Stearn W. T. 1978: The botanical results of Captain Cook's three voyages and their later influence. – Pacific Stud. **1:** 147–162.

Stone B. C. 1974: The correct botanical name for the breadfruit. – J. Polynes. Soc. **83:** 92–93.

Stone B. C. 1988: Notes on the genus *Pandanus* (*Pandanaceae*) in Tahiti. – Bot. J. Linn. Soc. **97:** 33–48.

Studholme J. 2017: The modern printing of the Florilegium. – Pp. 307–311 in: Mabberley D., Gooding M. & Studholme J. (ed.), Joseph Banks' Florilegium. – London: Thames & Hudson.

Thunberg C. P. 1776: Beskrfning på et nytt örte-genus, kalladt Radermachia, hvilket redan utaf Rumphius blifvit afritadt och, faftan ofullkomligen, besckrifvit; men un efter sexual-methoen noga undersökt. – Kongl. Vetensk. Acad. Handl. **37**: 250–255.

Trécul A. 1847: Mémoire sur la famille des Artocarpées. – Ann. Sci. Nat., Bot., sér. 3, **8:** 38–157.

Williams E. W., Gardner E. M., Harris R. III, Chaveerach A., Pereira J. T. & Zerega N. J. C. 2017: Out of Borneo: biogeography, phylogeny and divergence date estimates of *Artocarpus* (*Moraceae*). – Ann. Bot. **119:** 611–627.

Zerega N. J. C., Nur Supardi N. N. & Motley T. J. 2010: Phylogeny and recircumscription of *Artocarpeae* (*Moraceae*) with a focus on *Artocarpus*. – Syst. Bot. **35:** 766–782.

Zerega N. J. C., Ragone D. & Motley T. J. 2004: Complex origins of breadfruit (*Artocarpus altilis*, *Moraceae*): implications for human migrations in Oceania. – Amer. J. Bot. **91:** 760–766.

Zerega N. J. C., Ragone D. & Motley T. J. 2005: Systematics and species limits of breadfruit (*Artocarpus*, *Moraceae*). – Syst. Bot. **30:** 603–615.

Zerega N. J. C., Ragone D. & Motley T. J. 2006: Breadfruit origins, diversity, and human-facilitated distribution. – Pp. 213–238 in: Motley T. J., Zerega N. J. C. & Cross H. B. (ed.), Darwin's harvest: new approaches to the origins, evolution and conservation of crops. – New York: Columbia University Press.

Willdenowia
Open-access online edition www.bioone.org/loi/will
Online ISSN 1868-6397 · Print ISSN 0511-9618 · Impact factor 0.680
Published by the Botanic Garden and Botanical Museum Berlin, Freie Universität Berlin