

FRUITS AND ARBORICULTURE IN THE INDO-PACIFIC REGION

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ABSTRACT

One unconscious bias that commonly creeps into accounts of the development and spread of agriculture is an emphasis on cereals and tubers. Since these are the basis of agriculture in the developed world, when students of prehistory construct narratives in the tropics they tend to focus on these classes of cultigen and to downplay both trees and herbs. The classic feature for distinguishing crops from their wild forbears in such narratives is morphological change, a criterion which may apply only weakly or not at all to trees and herbs. The domestication of tree products must be identified principally on distributional grounds as they are used and discarded far from their 'home' area.

Although prehistory in the Indo-Pacific region has begun to emphasise the importance of arboriculture in overall subsistence, it has been hamstrung by weak synchronic accounts of the taxonomy, origin and spread of the major and minor fruit trees. Recent ethnographic work has begun to remedy this situation, but has yet to be absorbed into archaeological models. Biogeography can therefore be of considerable importance in determining the evolution of arboricultural subsistence, especially in a region with so many islands, where settlement can be associated with the introduction of new species.

Another tool which has barely been used is comparative linguistics. Despite a relatively strong empirical base for the description of Pacific languages in general, rich ethno-botanical accounts of cultivated and protected trees are still scarce, reducing the potential to reconstruct the history of cultivated trees. But a variety of lexical databases do exist, incorporating terms for major fruit species which can enable us to reconstruct a notional history. In addition, the diversity of language phyla on the Southeast Asian mainland allows us to unravel the routes whereby fruit cultivation spread, through the analysis of loanwords. The paper attempts a broad-brush survey of the role of fruit cultivation in the East Asia/ Pacific region.

An unconscious bias that commonly creeps into accounts of the development and spread of agriculture is an emphasis on cereals and tubers. Since these are the basis of agriculture in the developed world, when students of prehistory construct narratives in the tropics they tend to focus on these classes of cultigen and to downplay both trees and herbs (although Harris, 1977, mentioned 'wild nuts' as one of his 'alternative pathways to agriculture'). The classic feature used to distinguish crops from their wild forbears in such narratives is morphological change, a criterion which may apply only weakly or not at all to these vegetation classes. As a consequence, the pattern of tree domestication must be identified largely on grounds of biogeography and current ethnography.

Although prehistory in the Indo-Pacific region has begun to emphasise the importance of arboriculture in overall subsistence, it has been hamstrung by weak synchronic accounts of the taxonomy, origin and spread of both major and minor fruit trees. Recent ethno-phytogeographic work has begun to remedy this situation, but has yet to be absorbed into archaeological models. A combination of ethnographic accounts and biogeography can therefore be of considerable importance in determining the evolution of arboricultural subsistence, especially in a region with so many islands, where settlement is often associated with the introduction of new species. DNA analysis of the affinities of tropical fruiting genera has only just begun, but we may well expect the results to emend or revise radically the conclusions of phenotypic analyses, as in the case of the persimmon, where Yonemori *et al.* (1998) showed from the amplified cpDNA of *Diospyros* spp. in Thailand that its affinities were quite different from those proposed in Ng (1978).

In the last few decades, there has been an expansion of reference material on Southeast Asian and Pacific fruits, notably Guillamin (1954), Massal and Barrau (1956), Teide (1967), Allen (1975), Chin and Yong (1982), Sillitoe (1983), Morton (1987), Eisemann and Eisemann (1988), Henderson

and Hancock (1989), Piper (1989), Verheij and Coronel (1992), Tarepe and Bourke (1992), Bourke (1994), Cooper and Cooper (1994), Othman and Subardhabandhu (1995), Tirtawinata et al. (1995), CIFOR (1996), Hutton (1996), Fernandez (1997), Walter and Sam (1999, 2002), Tate (2000), Puri (2001), Jensen (2001) and Mazumdar (2004). Some of these accounts are more scientific than others, and many include statements about the origins of fruit species that are highly speculative.

The recognition of the importance of arboriculture in the Indo-Pacific region should be attributed above all to the work of Douglas Yen (Yen 1974, 1977, 1985, 1992, 1994). Other useful studies are Barrau (1956, 1962, 1965), Ng (1975, 1976), Powell (1976, 1977), Mogeia (1991), Lepofsky (1992), Gosden (1995) and Athens, Ward and Murakami (1996). One of the distinctive features of arboriculture is the high degree of variability in use and degree of domestication. With cereal agriculture, once a plant is domesticated, it will often not survive except as a cultivated plant, perhaps because it no longer has a shattering head. Trees, in contrast, often survive very well when ignored by humans. Lepofsky (1992:202) highlights the role of 'encouraged volunteers', i.e. protecting self-seeded species, in the arboriculture of the Mussau islands. Hence the literature is full of conflicting reports; a tree that is intensively cultivated on one island may be 'wild' on another. A tree that is a famine food at one site can be a highly appreciated delicacy elsewhere. It may be eaten as a fruit, or only grown for its flowers or for shampoo. This reflects both the changing ecology, when a species that yields well on one island may be barren elsewhere, leading to it becoming wild or being used for quite another purpose. This is very much in contrast to cereal agriculture, where the failure of a species in a new ecology usually leads to its being dropped altogether.

Archaeobotany has begun to make contributions in some areas; macro-remains have been recorded from a number of Pacific islands (e.g. Kirch 1989; Hayes 1992; Powell 1982) and also the mainland (for overview see Latinis 1999, 2000; Latinis and Stark 1998). But results from flotation are still few and far between, although the next few years should see a significant increase in results. Nonetheless, an overview of synchronic use of fruits and recent distributional information ought to assist archaeologists in interpreting their finds. A problem particular to trees is that it is often difficult to distinguish natural occurrences from human use, except where the context is unambiguous.

Another tool which remains underused is comparative linguistics. Despite a relatively strong empirical base for the description of Pacific languages in general, rich ethnobotanical accounts of cultivated and protected trees are still scarce, reducing the potential to reconstruct the history of cultivated trees. But a variety of lexical databases do exist incorporating terms for major fruit species thereby

enabling us to reconstruct a notional history. Several papers have covered the reconstruction of plant names at various levels of Austronesian, including Verheijen (1984), Li (1994), Tryon (1994), Wolff (1994), Ross (1996), Lynch (2001), Blust (n.d.) and Reid (in press). Unfortunately, nothing like this exists for mainland phyla such as Austroasiatic, Daic, Sino-Tibetan or Hmong-Mien, so accounts based purely on Austronesian tend to give a one-sided picture. Although occasional detailed accounts of individual languages exist (e.g. Vidal 1962 for Lao), without comparative lexical databases this does not advance the project. However, the diversity of language phyla on the Southeast Asian mainland will sometimes allow us to unravel the routes whereby fruit cultivation spread, through the analysis of loanwords (e.g. Mahdi 1998).

Before accepting too uncritically the results of linguistics it is worth pointing out that reconstruction not counterpointed by biogeography has resulted in the publication of very misleading results. Dempwolff (1938) posits proto-Austronesian **nanas* and Li (1994) **paŋuDaN* for 'pineapple'. In reality, as Blust (n.d.) points out, the pineapple was carried from South America around the world by the Portuguese in the 16th century. The cognate set that served as basis for Dempwolff's reconstruction of **nanas* were all borrowings from Portuguese *ananas* 'pineapple', which in turn derives from a Tupi-Guarani language of Brazil. The cognate set for **paŋuDaN* are terms that have been transferred from the pandanus, the fruit of which looks similar to the pineapple and there is also apparently confusion with *piña*, the Spanish name widely borrowed in Philippines languages. Speakers seeing the pineapple were immediately reminded of the pandanus independently throughout the area where Austronesian languages are spoken. Similarly, Ross (1996:167) flags the apparent reconstruction of *Citrus* spp. in proto-Oceanic but notes that the edible forms of this genus are only likely to have reached the Pacific after European contact. Either the Oceanic forms originally applied to the scarcely edible leech-lime, *Citrus hystrix*, or to other genera with similar-looking fruit, such as *Clymenia* spp. or *Microcitrus* spp. This type of shifting of the referent of a lexical item, whereby old terms are applied to entirely new species such as New World introductions, or to indigenous but related species encountered as a population moves, should warn historical linguists of the importance of taking care when reconstructing flora and fauna. It is not enough to get the linguistics right, the biology must also be accurate.

A fresh compilation of the evidence from ethnography, linguistics and archaeology for the history of fruits in this region therefore seems timely. This paper is intended to confront the archaeobotanical, ethnographic and linguistic data; it attempts a broad-brush survey of the role of fruit trees in the Indo-Pacific region and gives examples of the

potential of comparative linguistics to model their history. This is not a zone chosen on a biogeographical basis, but is intended to add to the increasingly rich prehistory of the region revealed by archaeology.

FRUITS OF THE INDO-PACIFIC REGION

WHAT IS A FRUIT?

The botanical definition of a fruit is broadly the seed-bearing part of the plant and by this definition most fruits are small, inedible and often toxic. Nuts are similarly the seeds inside the fruits. I have used a more colloquial idea of a fruit as a plant product with edible flesh and possibly edible seeds, thereby including some species with edible nuts. The list includes fruits which are cultivated at least in some localities and those which are more than simply famine foods. In this paper I have confined the listing to woody trees cultivated for their fruit, thus omitting, for example, important staples, such as sago, fern palm and the banana, and also the many trees protected and cultivated for other reasons. Fruit-bearing cultivated and wild vines, such as the water-melon, are excluded, as are trees grown for their leaves, such as *Erythrina* spp.

CONSPECTUS OF FRUITS

Table 1 shows the most important fruits in the East Asian/Pacific region with their family, common English name and probable origin. Walter and Sam (1999:261 ff.) provide an important table of the claimed origin and likely dispersal to individual parts of the Pacific for each fruit. Walter and Sam (2002) is an English translation with slightly different pagination which has only recently become available, so the page numbers given here continue to refer to the original French edition. Places of origin must be treated with scepticism for many plants; detailed work will undoubtedly revise these speculations. Where the claimed origin is marked *x* to *y*, this implies that the species is indigenous to that geographical range; there is as yet no specificity as to the original locale of domestication. The alphabetic coding for the probable origin is explained in Table 2; this is intended to give some weight to different regions, but the uncertainties mean that it is not worth attributing statistical validity to these zones. Distribution tries to capture current range either worldwide or in the Indo-Pacific area; sometimes this may be the same as the range given in 'Origin'. Many of the major tropical fruits are now cultivated worldwide, but at least some have extended their range in prehistory through human agency. The Column marked LD? stands for Linguistic Data, and a plus sign implies that an analysis of names exists for the tree in at least some vernaculars. Discussion of these is given below. The archaeobotanical data (AD) are

essentially adopted unchanged from Kyle Latinis (2000); I have only cited the oldest dates and I have not included the references, since these are set out in the original publications.

ORIGINS AND SPREAD

WHERE DO COMMON FRUITS ORIGINATE?

Table 2 provides a simplified analysis of the origins of the fruits cultivated today in the Indo-Pacific region. I have used 'Malesia' as a catch-all category for trees domesticated in the large area between eastern India and insular Southeast Asia.

An aspect of this study that deserves greater emphasis is the relative importance of arboriculture in the Vanuatu/Solomons area, something noted by Douglas Yen some time ago (Yen 1974). A large number of species seem to originate in the zone between the Solomons and western Polynesia, most still having quite a limited distribution. It suggests they should be given considerably more linguistic and archaeological attention.

NOTES ON INDIVIDUAL SPECIES

The following text is intended to provide a brief commentary on some of the species tabulated here. I have cited both the (somewhat variable) English and scientific names in the text, and in each case these are referenced numerically to their entry in Table 1. Even scientific names are not very stable, witness the recent change of *Eugenia* spp. to *Syzygium* spp., so I have tried to use the most recent ones available.

Solomons and Vanuatu

The most important species domesticated in this region are *Barringtonia* spp., the cutnuts (19, 20, 21) (Jebb and Wise 1992). Yen (1995:839) notes evidence for the domestication of *B. procera* and *B. novae-hiberniae* in the Solomons; *B. novae-hiberniae* is wild in New Guinea and the seeds are toxic. Ross (1996:213) proposes **(w,v)ele* as the proto-Oceanic form for these three species, whose vernacular names regularly interchange. He notes that only *Barringtonia novae-hiberniae* would have been present in the Bismarcks at the time of the split-up of proto-Oceanic and so the reconstruction must refer to this species. Still confined largely to this zone, the cutnuts have been introduced into other regions such as New Guinea relatively recently. Tryon (1994:488) quotes a reconstruction for proto-Philippines, **butun*, although this is for another species, *Barringtonia asiatica*, used principally as a fish-poison. *Burckella obovata* (25) is found from the Moluccas to Vanuatu, including the Polynesian outliers Anuta, Rennell, Takuu and Tikopia (Biggs n.d.), and has been introduced to Fiji and Tonga as a domesticate. Ross (1996) reconstructs **ñatu(q)*

Table 1: Cultivated fruits of SE Asia and the Pacific

No.	Binomial	Family	Common Name	Origin	Distribution	Code (Table 2)	LD?	AD	References
1	<i>Adenanthera pavonina</i>	Fabaceae	coral pea, red bead tree	Malaysia	Pan-Pacific	F			Tryon (1994:485), Walter and Sam (1999:80)
2	<i>Aegle marmelos</i>	Rutaceae	bael	India	India, SE Asia, Philippines	H			Tate (2000:12)
3	<i>Aleurites moluccana</i>	Euphorbiaceae	candlenut	South India ?	Worldwide tropics	H	+	13,000 BP, Timor	Whistler (1991:52), Walter and Sam (1999:83)
4	<i>Anacardium occidentale</i>	Anacardiaceae	cashew	Brazil	Worldwide tropics	J			Fernandez (1997:52), Tate (2000:14)
5	<i>Ananas comosus</i>	Annonaceae	pineapple	Brazil	Worldwide tropics	J			Fernandez (1997:98), Puri (2001:26)
6	<i>Annona muricata</i>	Annonaceae	soursop	West Indies	Worldwide tropics	J			Fernandez (1997:36), Tate (2000:18), Puri (2001:9)
7	<i>Annona reticulata</i>	Annonaceae	bullock heart	West Indies	Worldwide tropics	J			Tate (2000:20)
8	<i>Annona squamosa</i>	Annonaceae	sweetsop, sugar apple	Mexico	Worldwide tropics	J			Tate (2000:22)
9	<i>Artifidesma buniis</i>	Euphorbiaceae	Chinese laurel, <i>bigray</i> , sala-mander tree	India, South-east Asia, W. Australia	India, South-east Asia, W. Australia	A			Fernandez (1997:16), Tate (2000:24)
10	<i>Areca catechu</i>	Palmae	betel palm	NE Indonesia ?	Pan-Pacific, mainland SE Asia	F	+	13,000 BP, Timor	Whitmore (1979), Puri (2001:110)
11	<i>Artocarpus altilis</i>	Moraceae	breadfruit	New Guinea ?	Worldwide tropics	C	+		Barrau (1957); Whistler (1991:55), Ragone (1991, 1997); Walter and Sam (1999:87)
12	<i>Artocarpus heterophyllus</i>	Moraceae	jackfruit	India	Worldwide tropics	H	+		Fernandez (1997:78), Tate (2000:28), Puri (2001:95)

13	<i>Artocarpus integer</i>	Moraceae	<i>chempedak</i>	Malesia	SE Asia	F	Tate (2000:30), Puri (2001:96)
14	<i>Averrhoa bilimbi</i>	Oxalidaceae	<i>bilimbi</i> , cucumber tree	Malesia	Mainland SE Asia	F +	Fernandez (1997:48), Tate (2000:32)
15	<i>Averrhoa carambola</i>	Oxalidaceae	<i>carambola</i> , star-fruit	SE Asia	Worldwide tropics	F +	Fernandez (1997:10), Tate (2000:34), Puri (2001:109)
16	<i>Baccaurea molleyana</i>	Euphorbiaceae	<i>rambai</i>	Sumatra	Southeast Asia	F	Morton (1987:220), Puri (2001:45)
17	<i>Baccaurea racemosa</i>	Euphorbiaceae	<i>kapundung</i>	Java	Indonesia	F	Morton (1987:220)
18	<i>Baccaurea ramiflora</i>	Euphorbiaceae	Burmese grape	India, China, SE Asia	India, China, SE Asia	F	
19	<i>Barringtonia edulis</i>	Lecythidaceae	cut nut	NE New Guinea, Vanuatu, Solomons, Fiji	NE New Guinea, Vanuatu, Solomons, Fiji	B +	Jebb and Wise (1992), Yen (1995:839), Walter and Sam (1999:107)
20	<i>Barringtonia novae-hiberniae</i>	Lecythidaceae	cut nut	NE New Guinea, Vanuatu, Solomons	NE New Guinea, Vanuatu, Solomons	B +	Jebb and Wise (1992), Yen (1995:839), Walter and Sam (1999:110)
21	<i>Barringtonia procera</i>	Lecythidaceae	cut nut	NE New Guinea, Vanuatu, Solomons	NE New Guinea, Vanuatu, Solomons	B +	Jebb and Wise (1992), Yen (1995:839), Walter and Sam (1999:113)
22	<i>Borassus flabellifer</i>	Palmae	Palmyra palm, sugar palm, sea-apple	India, SE Asia	Worldwide tropics	A	Whitmore (1979), Tate (2000:36)
23	<i>Bouea macrophylla</i>	Anacardiaceae	<i>gandaria</i>	Malaysia, Indonesia	SE Asia	F	Tate (2000:38)
24	<i>Burckella fijiensis</i>	Sapotaceae	tortoise pear	Fiji	Fiji, Futuna	D	Walter and Sam (1999:117)
25	<i>Burckella obovata</i>	Sapotaceae		Moluccas to Vanuatu	Moluccas to Vanuatu	B +	Walter and Sam (1999:119)
26	<i>Canarium harveyi</i>	Burseraceae	Canarium nut, pili nut	Solomons to Tonga	Solomons to Tonga	B +	Leenhouts (1965); Whistler (1991:63), Yen (1995:839), Walter and Sam (1999:125)

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27	<i>Canarium indicum</i>	Burseraceae	Java almond	Moluccas to Vanuatu	Pan-Pacific	B	+	14,000 BP, Sepik-Ramu	Leenhouts (1965), Yen (1995:839), Coronel (1996), Spriggs (1997:55), Walter and Sam (1999:128)
28	<i>Canarium odoratophyllum</i>	Burseraceae	<i>danau majang</i>	Malaysia and Western Indonesia	Malaysia and Western Indonesia	F			Puri (2001:27)
29	<i>Canarium ovatum</i>	Burseraceae	<i>pili nut</i>	Philippines	Philippines	F			Yen (1995:839), Coronel (1996)
30	<i>Canarium vulgare</i>	Burseraceae	?	Sulawesi to the Aru islands	Insular SE Asia, Sri Lanka	B			Yen (1995:839)
31	<i>Carica papaya</i>	Caricaceae	pawpaw	New World	Worldwide tropics	J			Tate (2000:40), Puri (2001:30)
32	<i>Casimiroa edulis</i>	Sapotaceae	Casimiroa, white sapote	New World	Worldwide tropics	J			Tate (2000:42)
33	<i>Chrysophyllum calmaro</i>	Sapotaceae	star apple	West Indies	Philippines	J			Fernandez (1997:18)
34	<i>Citrus aurantifolia</i>	Rutaceae	lime	Northern Burma	Worldwide tropics	G			Tate (2000:46)
35	<i>Citrus hystrix</i>	Rutaceae	leech-lime	Origin not known	Thailand to Bismarck archipelago	M			Puri (2001:136)
36	<i>Citrus macroptera</i>	Rutaceae	ghost-lime	Thailand to New Guinea	Introduced to Solomons, Vanuatu, New Caledonia	F			Whistler (1991:56), Walter and Sam (1999:134)
37	<i>Citrus maxima</i>	Rutaceae	shaddock, pomelo	Malaysia	Worldwide tropics	F			Whistler (1991:56), Tate (2000:48), Puri (2001:137)
38	<i>Citrus reticulata</i>	Rutaceae	tangerine	Malaysia	Worldwide tropics	F			Puri (2001:138)
39	<i>Citrus sinensis</i>	Rutaceae	sweet orange	South China, Viet Nam	Worldwide tropics	I			Fernandez (1997:40)
40	<i>Cocos nucifera</i>	Palmae	coconut	Malaysia?	Worldwide tropics	F	+	5830 BP, New Guinea, Sepik	Child (1974); Harries (1990); Whistler (1991:61), Fernandez (1997:82), Puri (2001:117)

41	<i>Cordia subcordata</i>	Boraginaceae	sea trumpet	Malesia	Pan-Pacific sea-shores and adjacent lowlands from east Africa to Polynesia.	F	4250-4050 BP, Bismarcks	Walter and Sam (1999:135)
42	<i>Corynocarpus cribbianus</i>	Corynocarpaceae		North Queensland, New Guinea, Solomons	North Queensland, New Guinea, Solomons	C	3200 BP, Bismarcks	Foreman (1978:111), Walter and Sam (1999:147)
43	<i>Dimocarpus longan</i>	Sapindaceae	<i>longan</i>	South China, Myanmar	China, SE Asia	I		Tate (2000:54), Puri (2001:139)
44	<i>Diospyros blancoi</i>	Ebenaceae	<i>mabolo</i> , butterfly	Philippines	SE Asia	F		Fernandez (1997:60), Tate (2000:56)
45	<i>Diospyros kaki</i>	Ebenaceae	persimmon	China, Japan	Worldwide tropics except Africa	I		Utsunomiya <i>et al.</i> (1998), Tate (2000:58)
46	<i>Diospyros major</i>	Ebenaceae	Fiji persimmon	Fiji ?	Fiji, Tonga, Uvea and Futuna	D		Whistler (1991:52)
47	<i>Dracontomelon dao</i>	Anacardiaceae	New Guinea walnut	India to Solomons	India to Solomons	A	+	Lepofsky (1992:209), Walter and Sam (1999:150)
48	<i>Dracontomelon lenticulatum</i> (<i>D. edule</i>)	Anacardiaceae	?	Malaysia	Introduced into New Guinea	F		Walter and Sam (1999:150)
49	<i>Dracontomelon vitiense</i>	Anacardiaceae	dragon plum	Bismarcks, Santa Cruz, Vanuatu, Fiji, Samoa	Bismarcks, Santa Cruz, Vanuatu, Fiji, Samoa	B	+	Tryon (1994:27), Walter and Sam (1999:150)
50	<i>Durio zibethinus</i>	Bombacaceae	<i>durian</i>	Malaya, Indonesia	Widespread in mainland and island SE Asia	F		Foreman (1995:221), Tate (2000:60)
51	<i>Ficus scabra</i>	Moraceae	Oceania fig	New Caledonia to Tonga and Samoa	New Caledonia to Tonga and Samoa	B		Walter and Sam (1999:157)
52	<i>Ficus tinctoria</i>	Moraceae	red dye fig	India to the Marquesas	India to the Marquesas	A		Whistler (1991:55), Walter and Sam (1999:161)
53	<i>Finnschia chloroxantha</i>	Proteaceae		Moluccas to Vanuatu, Palau, Aru islands	Moluccas to Vanuatu, Palau, Aru islands	B		Croft (1981:13), Walter and Sam (1999:162)
54	<i>Flacourtia rukam</i>	Flacourtiaceae	Indian plum	Malaysia to the Solomons	China, SE Asia, Fiji, Tonga, Carolines	F		Walter and Sam (1999:164)

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55	<i>Garcinia mangostana</i>	Clusiaceae	mangosteen	Indochina	Widespread in mainland and island SE Asia	G		Fernandez (1997:70), Tate (2000:62), Puri (2001:76)
56	<i>Gnetum gnemon</i>	Gnetaceae	Spanish joint fir	Assam to Fiji	Introduced to Sumatra, Java, Andaman islands	F	+	Walter and Sam (1999:170)
57	<i>Inocarpus fagifer</i>	Fabaceae	Tahiti chestnut	Java to Fiji	Introductions to Polynesia, Philippines, Micronesia	F	+	Whistler (1991:53), Walter and Sam (1999:172)
58	<i>Lansium domesticum</i>	Meliaceae	<i>lansat</i> , duku	Malaysia, Indonesia	Mainland SE Asia, S. India, Philippines	F		Fernandez (1997:56), Tate (2000:64), Puri (2001:89)
59	<i>Litchi chinensis</i>	Sapindaceae	litchi/lychee	South China/Viet Nam	Worldwide tropics except Africa	I		Morton (1987:249), Tate (2000:66)
60	<i>Mangifera altissima</i>	Anacardiaceae	<i>paho</i>	Indonesia, Philippines, Solomons	Indonesia, Philippines, Solomons	F	+	Fernandez (1997:87)
61	<i>Mangifera foetida</i>	Anacardiaceae	horse mango	Thailand, Malaysia, Indonesia	Introduced to southern Myanmar, Cambodia and Vietnam	G		Verheij and Coronel (1992)
62	<i>Mangifera indica</i>	Anacardiaceae	mango	India, Burma	Worldwide tropics	G	+	Mukherjee (1972), Fernandez (1997:64), Tate (2000:68)
63	<i>Mangifera minor</i>	Anacardiaceae	wild mango	New Guinea, Solomons	New Guinea, Solomons	C	+	
64	<i>Mangifera odorata</i>	Anacardiaceae	<i>kuwini</i> , <i>huani</i>	? Malaya	Insular and mainland SE Asia	F		Puri (2001:6)
65	<i>Manilkara zapota</i>	Sapotaceae	Sapodilla	Central America	Worldwide tropics except Africa	J		Fernandez (1997:22), Tate (2000:70)
66	<i>Morinda citrifolia</i>	Rubiaceae	Indian mulberry, <i>noni</i> , cheese fruit	Disputed Northern Australia/ Southeast Asia	Worldwide sea-coasts	M		Whistler (1991:56), Groenendijk (1992), Morton (1992), Tryon (1994:500),

67	<i>Muntingia calabura</i>	Elaeocarpaceae	arattles, <i>capulin</i> , Jamaica cherry	Tropical America	Philippines	J	Fernandez (1997:4)
68	<i>Neisoperma oppositifolium</i>	Apocynaceae	twin apple	?	Seychelles to Marquesas	M	Walter and Sam (1999:197)
69	<i>Nephelium lappaceum</i>	Sapindaceae	<i>rambutan</i>	Malaysia, Indonesia	SE Asia	F	Tate (2000:74), Puri (2001:143)
70	<i>Pandanus conoideus</i>	Pandanaceae	red pandanus	Moluccas, New Guinea	Moluccas, New Guinea, Bismarcks	C	Walter and Sam (1999:199)
71	<i>Pandanus dubius</i>	Pandanaceae	knob-fruited screwpine	Malaysia to Vanuatu	Malaysia to Vanuatu	F	Walter and Sam (1999:201)
72	<i>Pandanus julianettii</i>	Pandanaceae	highland pandanus	New Guinea	New Guinea	C	12,100 BP, New Guinea, Yuku
73	<i>Pandanus tectorius</i>	Pandanaceae	Pacific pandanus	Malaysia, Philippines to Austral islands, N Australia	Malaysia, Philippines to Austral islands, N Australia	F	Whistler (1991:61), Walter and Sam (1999:205)
74	<i>Pangium edule</i>	Flacourtiaceae	<i>payang</i> , <i>pangi</i>	insular SE Asia	Malaysia to Vanuatu	F	5800 BP, New Guinea, Sepik, Puri (2001:67) Dongan
75	<i>Parartocarpus venenosus</i>	Moraceae	?	?	Insular SE Asia, Melanesia	M	Ross (1996:187)
76	<i>Passiflora edulis</i>	Passifloraceae	passion fruit	Brazil	Worldwide tropics	J	Fernandez (1997:94), Tate (2000:76)
77	<i>Passiflora quadrangularis</i>	Passifloraceae	giant granadilla	New World	SE Asia	J	Morton (1987:328), Fernandez (1997:94), Tate (2000:78)
78	<i>Persea americana</i>	Lauraceae	avocado	Central America	Worldwide tropics	J	Fernandez (1997:8), Tate (2000:80)
79	<i>Phyllanthus acidus</i>	Euphorbiaceae	Otaheite gooseberry	? South Asia	SE Asia	H	Jensen (2001:173)
80	<i>Phyllanthus emblica</i>	Euphorbiaceae	Indian gooseberry	? Burma	China, SE Asia	G	Jensen (2001:173)

BLENCH: FRUITS AND ARBORICULTURE IN THE INDO-PACIFIC REGION

81	<i>Plthocellobium dulce</i>	Leguminosae	Madras thorn fruit, Manila tamarind	Central America	Philippines	J	Fernandez (1997:20)
82	<i>Pometia pinnata</i>	Sapindaceae	taun tree, Fiji longan	Sri Lanka, Yunnan, Samoa	SE Asia, pan-Pacific	F	5800 BP, New Guinea, Sepik, Dongan Walter & Sam (1999:216)
83	<i>Pouteria sapota</i>	Sapotaceae	marmelade plum	Mexico	Philippines, Vietnam	J	Morton (1987:398), Fernandez (1987:20)
84	<i>Psidium guajava</i>	Myrtaceae	guava	Mexico	Worldwide tropics	J	Tate (2000:82), Puri (2001:106)
85	<i>Punica granatum</i>	Punicaceae	pomegranate	Central Asia	Old World tropics	L	Tate (2000:82), Jensen (2001:181)
86	<i>Salacca zalacca</i>	Palmae	snakefruit	Indonesia	Indonesia, Indo- China	F	Tate (2000:86), Puri (2001:122)
87	<i>Sandoricum koetjape</i>	Meliaceae	santol	Indo-China	Southeast Asia	G	Jensen (2001:183)
88	<i>Spondias cytherea</i> (= <i>S. Anacardiaceae</i> <i>dulcis</i>)		ambarella, Tahiti apple	?	Pan-Pacific	M	+ 4250-4050 BP, Bismarcks, Arawes, Kumbun, Apalo Whistler (1991:50), Walter and Sam (1999:223)
89	<i>Sterculia vilfensis</i>	Sterculiaceae		Vanuatu, Fiji	Vanuatu, Fiji	B	Walter and Sam (1999:234)
90	<i>Syzygium aqueum</i> and <i>S. samarangense</i>	Myrtaceae	water apple, Curacao apple	Southeast Asia	Southeast Asia	F	Fernandez (1997:62)
91	<i>Syzygium cumini</i>	Myrtaceae	Java plum, <i>jambolan</i>	India, Burma, Andaman Islands	Worldwide tropics	H	Morton (1987: 375), Fernandez (1997:20)
92	<i>Syzygium jambos</i>	Myrtaceae	rose apple, Malabar plum	Malaysia	Worldwide tropics	F	Jensen (2001:195)
93	<i>Syzygium malaccense</i>	Myrtaceae	Malay apple	?	SE Asia, pan-Pacific	M	Weisler (1991), Whistler (1991:55), Walter and Sam (1999:236), Tate (2000:88), Jensen (2001:197)

94	<i>Tamarindus indica</i>	Leguminosae	tamarind	Africa	Worldwide tropics	K	Gunasena and Hughes (2000), Tate (2000:90)
95	<i>Terminalia catappa</i>	Combretaceae	Indian almond, sea almond	Malaysia	Worldwide tropics	F	Coode (1978:72), Morton (1985), Whistler (1991:51), Yen (1995:840), Walter and Sam (1999:240)
96	<i>Terminalia kaernbachii</i>	Combretaceae	okari nut	New Guinea, Aru islands	introduction in the Solomons	C	Coode (1978:82), Yen (1995:840), Walter and Sam (1999:244)
97	<i>Xanthophyllum obscurum</i>	Polygalaceae	kayu batu	Western Indonesia	Western Indonesia	F	Puri (2001:131)
98	<i>Ziziphus mauritiana</i>	Rhamnaceae	Indian jujube, ber	India ?	India, China, Mainland SE Asia	H	Pareek (2001)

Sources: Burkill (1966), Corner (1988), Verheij and Coronel (1992), McKee (1994), Fernandez (1997), Walter and Sam (1999), Tate (2000), Dy Phon (2000), Puri (2001), Jensen (2001)

Table 2: Sources of fruits currently grown in the Indo-Pacific region. The codes are also used in Table 1.

Region of origin	Code	No.
Indo-Pacific	A	4
Moluccas to Vanuatu	B	10
New Guinea	C	6
Fiji	D	2
Micronesia	E	0
Malesia	F	36
Indochina	G	6
India	H	6
China	I	4
New World	J	16
Africa	K	1
Europe/Central Asia	L	1
Unknown	M	6
		98

Oceanic, although related lexemes in Philippines languages refer to *Palaequium spp.* (Reid n.d.). The corynocarps, almost all of which are eaten in times of famine, have been studied by Wagstaff and Dawson (2000). *Corynocarpus cribbianus* (42) is recorded in the Bismarcks at 3200 BP (Kirch 1989:234). Although found 'wild' throughout Melanesian lowland forests, the corynocarps are rarely cultivated today and their presence may be a record of a period when they were once more intensively exploited.

The New Guinea walnut, *Dracontomelon dao* (47), might have been domesticated anywhere in Malesia, but is recorded in the Bismarcks 3200 BP (Kirch 1989:229). Intriguingly, given its previous importance, it is hardly used in Mussau today (Lepofsky 1992:209). Blust has proposed a proto-Austronesian reconstruction **daqu*, which has a proto-Oceanic reflex **raqu(p)* (Ross 1996:213), and is transferred to the dragon plum, *Dracontomelon vitiense* (49), native to Vanuatu, Fiji and Samoa (Walter and Sam 1999:274). The chrysocarp, *Finschia chloroxantha* (53), seems to be indigenous to the Moluccas-Vanuatu region (including the Aru islands), but has also been recorded from Palau. The sterculia, *Sterculia vitiensis* (89), is confined to Vanuatu and Fiji.

The Spanish joint fir, *Gnetum gnemon* (56), is spread from Assam to Fiji and introduced in Java and Sumatra. Ross (1996:191) notes a rather local reconstruction in Western Oceanic **wayu*. The edible *Gnetums* are also very widespread across Africa and have been carried by human groups throughout the equatorial rainforest, so it is conceivable that the present-day wide distribution in the Indo-Pacific region is partly anthropic.

Tree species with extensive archaeobotanical remains and considerable problems attached to their precise identification are the *Canarium* spp. Yen (1994, 1995:839) shows the distribution of six domesticated and additional large-seeded edible wild *Canarium* species in the southwest Pacific (Table 3).

Two of the most widespread species, the pili nut, *Canarium harveyi* (26) and the Java almond, *Canarium indicum* (27), occur across a wide area from the Moluccas to Vanuatu, and many related species also occur in Southeast Asia (Walter, Sam and Bourdy 1994). The earliest dates are c.15,000 BP on Morotai (Bellwood et al. 1998:244) and in the Sepik-Ramu area, but it is not possible to distinguish between species (Yen 1994). The Java almond (27), *Canarium indicum*, appears to be indigenous to the region from Northern Sulawesi to Vanuatu. Ross (1996:213) cites proto-PCEMP **kanaRi* and proto-Oceanic **[ka]ŋari* also noting reflexes in Central Malayo-Polynesian. Kirch (1989:234) makes the interesting observation that the cultivated forms of the Java almond correspond closely with the geographic distribution of the Lapita dispersal. Ross (1996:214) notes two other terms for *Canarium* spp., proto-Oceanic **qalip* and proto-West-Oceanic **pinuaq*, but does not propose particular species as the referents.

New Guinea

The breadfruit, *Artocarpus altilis* (11), was probably domesticated in New Guinea. Seeded breadfruit appears to occur wild only in New Guinea where, along with breadnut, it is a dominant member of secondary forests in lowland areas (Ragone 1997:18). It was carried to many regions of the Pacific in pre-European times, but only introduced to the Philippines from Guam in the historical era (Barrau 1957; Ragone 1991). Tryon (1994:486) quotes a reconstruction for proto-Austronesian, **kama(n)si*, but this is evidently suspect if the breadfruit was so recent in the Philippines and Taiwan. More probably the Philippines name *kamansi*

originally applied to another *Artocarpus* sp., shifted to the breadfruit and was then taken to Taiwan. Blust (n.d.) suggests a quite different form for proto-Malayo-Polynesian, **kulu(R)*, but even this is problematic since it implies a spurious antiquity in the Philippines. These issues can only be resolved with more detailed ethnobotanical data on the near relatives of the breadfruit. There are several other *Artocarpus* spp. in the Malesian area, for example shiny tampang, *A. nitidus*, monkey jackfruit, *A. rigidus* and marang, *A. odoratissimus*, cultivated locally for their fruits (Puri 2001:98-100).

Ross (1996:205) gives proto-Oceanic **padran* for 'coastal pandanus' which, he observes, usually applies to *Pandanus tectorius* (73), but is also a generic for *Pandanus* spp. in the Pacific. A second proto-Oceanic form, **kiRe*, also applies to *P. tectorius* and is also attested at proto-Malayo-Polynesian level. The red pandanus, *Pandanus conoideus* (70), and the highland pandanus, *Pandanus julianettii* (72), are confined to New Guinea and parts of the Moluccas. Ross (1996:206-7) gives **pakum* as proto-Oceanic for *Pandanus dubius* and **m'aga*, probably for the red pandanus, *P. conoideus*. *Parartocarpus venenosus* (75), which occurs widely throughout the region and is often compared to breadfruit, has a reconstruction in proto-Western Oceanic, **lapuka* (Ross 1996:187). The okari nut, *Terminalia kaernbachii* (96), occurs between the Moluccas and New Guinea and has been carried to the Solomons in recent times.

Fiji

The tortoise-pear, *Burckella fijiensis* (24), is the most significant domesticate in Fiji and still confined to the Fijian islands and Futuna. However, the Fiji persimmon, *Diospyros major* (46), seems also to originate in Fiji and has subsequently spread to Tonga, Uvea and Futuna (Whistler 1991:52).

Table 3: Wild and domesticated *Canarium* spp. in the Indo-Pacific region (Source: Adapted from Yen 1995:839)

Status	Section	Group	Species	Distribution
Domestic	Canarium	Vulgare	<i>C. indicum</i>	Moluccas to Vanuatu
			<i>C. ovatum</i>	Northern Philippines
			<i>C. vulgare</i>	Eastern Indonesia
		Maluense	<i>C. lamii</i>	North coast of New Guinea
			<i>C. salomonense</i>	Solomons, SE New Guinea, New Britain
Wild	Pimela		<i>C. harveyi</i>	Solomons to Tonga
Wild	Canariellum		six species	wild and cultivated species in insular and mainland SE Asia, with <i>C. australianum</i> in SE New Guinea and Australia NE Australia, New Caledonia, Loyalty Islands

Malesia

The coral pea, *Adenanthera pavonina* (1), is apparently native to the Malesian region but was carried to much of Melanesia in an unknown past era, although its introduction to Fiji, Polynesia and Micronesia is apparently post-European (Walter and Sam 1999:80). Tryon (1994:485) proposes a reconstruction for proto-North Central Vanuatu, **bisa*. Walter and Sam (1999:83) claim that the candlenut, *Aleurites moluccana* (3), only occurs wild in India, but evidence for candlenuts in Timor at 13,000 BP and on Morotai at 15,000 BP rather suggests it is indigenous to a wider area. Archaeobotanical dates for the betel palm, *Areca catechu* (10), are extremely old, although whether the nut was in use for chewing at 13,000 BP is open to question. Mahdi (1998:405) has a useful discussion of the linguistic sources for betel chewing, noting that terms for 'fruit' in Austronesian (PAN **Buaq*) are intertwined with those for areca nut, suggesting that it was perceived as the fruit *par excellence*. He also notes that a term for betel pepper (*Piper betle*) appears to have been borrowed into Austronesian from Austroasiatic. The durian, *Durio zibethinus* (50), perhaps originating in insular SE Asia, has only recently become a major traded fruit both east and west of its core area and most mainland names reflect the Malay term *durian*. Other durians of more limited distribution are the Kutai durian, *D. kutejensis*, confined to Borneo, and the leaf durian, *D. oxleyanus*, found in Malaysia and western Indonesia (Puri 2001:23).

The mangos, *Mangifera* spp. (60, 61, 62, 63, 64), constitute an interesting problem. The mango proper, *Mangifera indica*, originates in India or Burma but probably spread to Southeast Asia during the last two millennia, and was subsequently carried around the Pacific in the post-European era (Ross 1996:210). One of the Malay names, *mempelam*, is from Sanskrit via Tamil and etymologises as *maha pahala*, the 'great fruit' (Tate 2000:68). The English name 'mango' is from a Sundanese word *mangga*, which in turn probably derives from Sanskrit via Tamil and this suggests that India was the source of the domestic plant (Mukherjee 1972). Li (1994:246) shows that the mango must have been brought to Taiwan from the Philippines, along with the persimmon. The reconstruction **pau(q)* in proto-Oceanic, cognate with PMP **pahuq* for *Mangifera* sp. (Blust n.d.), probably applies to the *paho*, *Mangifera altissima* (60), and not *M. indica*, as this would place it in the Austronesian region too early. Other reconstructions for proto-Oceanic are **wai(wai)* as 'generic' for *Mangifera* spp. and **koRa*, given as 'wild' mango, *M. minor* (63) (Ross 1996:209). The fourth mango, *M. foetida*, seems to be confined to Southeast Asia and virtually no linguistic data are available. The origin of the kuwini, *M. odorata* (64), is disputed, but may be Malaysia; it is now distributed widely

throughout the mainland and islands of SE Asia. Other highly local cultivated mangoes in this region include *M. quadrifida* and *M. pajang*, the sherbert mango (Puri 2001:5,7).

The Tahiti chestnut, *Inocarpus fagifer* (57), is one of the most widespread fruits in the Pacific and was probably carried from the Moluccas and Eastern Indonesia throughout Polynesia and Melanesia, with post-European introductions to Micronesia and the Philippines. Ross (1996:215) cites proto-Oceanic *(*q*)*ipi*, and the Philippines cognates *(*ipi*)(*l*) appear to refer to another plant, *Intsia bijugata* (Reid in press). The names for Tahiti chestnut in Polynesian languages also suggest some crossover with the Tahiti apple, *Spondias cytherea* (88). The twin apple, *Neisosperma oppositifolium* (68) occurs from the Seychelles to the Marquesas, but it has been shown to float on ocean currents, so this may be the explanation for its broad distribution.

The exact origin of the Malay apple, *Syzygium malaccense* (93), is unknown, but it is now found from Indochina to the Austral islands, and was presumably carried through the region at a very early period. Captain Bligh was responsible for transporting it to Jamaica. Weisler (1991) records its use in house construction in Hawai'i in the proto-historic period. Ross (1996:211) reconstructs **kapika* for proto-Oceanic and some of these forms look cognate with those in Philippine languages (Reid in press). However, the names in Thai, *chompoo*, and Khmer, *chumpu krâhâ:m*, are transparently borrowed from Malay *jambu*, suggesting that it has only recently been traded and grown in the interior of the mainland. The forms for the rose apple, *Syzygium jambos* (92), are quite distinct in the Philippines, suggesting that both reconstructions will separate out when the data are more complete. The sea almond, *Terminalia catappa* (95), probably originated in Malaysia and has been carried to all tropical regions in post-contact times (Morton 1985; Whistler 1991:51). Linguistic evidence suggests it was well-known to the early Austronesians. Ross (1996:215) cites proto-Oceanic **talise*, and Dempwolff (1938) **talisay* for proto-Malayo-Polynesian, a form with extensive Philippines cognates (Reid in press).

The Indian plum, *Flacourtia rukam* (54) is native to the region from Malaysia to the Solomons but has been widely distributed to both the Southeast Asian mainland, India, China and the Polynesian islands, west of the Solomons. The knob-fruited screwpine, *Pandanus dubius* (71), occurs from the east coast of Malaysia to Vanuatu, but curiously, was never carried to Polynesia and is only cultivated on Vanuatu. The most widespread pandanus is the Pacific pandanus, *P. tectorius* (73), whose exact taxonomy remains debated. At the western end of its range it shades into *P. odoratissima*. Its many subtypes are probably the result of widespread and ancient cultivation, although the cultivars are most diverse at the extreme end of its range in the

Marshall Islands and Kiribati. Blust (n.d.) reconstructs a form **pajdan* for proto-Malayo-Polynesian and Ross (1996:205) gives proto-Oceanic **padran*. Cognates occur on Taiwan, but in Formosan languages the term is now applied to 'pineapple' in most languages, implying a recent transfer of the referent. The pangi, *Pangium edule* (74), occurs from Indochina to Vanuatu and was carried to Micronesia in the post-European era. Blust (n.d.) quotes a PMP reconstruction **pa'i*.

The taun, *Pometia pinnata* (82), is indigenous to a broad zone from Sri Lanka to Vanuatu with outliers in South China and Indochina, and was later carried to further Polynesia in the post-European era. Kirch (1989:236) who recorded the taun in the Mussau islands at 3200 BP notes its coincident distribution with the Lapita area, like the Java almond (27). Ross (1996:212) reconstructs **tawan* for proto-Oceanic (hence the name of the tree) and this clearly has cognates in Philippines languages. Li (1994:264) proposes a proto-Austronesian reconstruction for the taun, **cayi*, but some of Li's forms, such as Amis *kowawi*, are cognate with Philippines witnesses such as Tagalog *kayawi*, warranting a different reconstruction. The sea-trumpet, *Cordia subcordata* (40), is apparently native to Malesia but has been spread throughout the Pacific and along Indian Ocean seashores and adjacent lowlands from east Africa to Polynesia.

India

Fruits seem to have been transmitted from India both at an early period and in the historical era. The Indian jujube, *Ziziphus mauritiana* (102), may have reached Southeast Asia earlier than the main period of Indian influence. Although cultivated in many places, it is now regarded as 'wild' fruit in Yunnan, for example (Jin *et al.* 1999). Archaeological evidence for trade between India and the Southeast Asian region dates from the fourth century BC, and Indian pottery has been found on Bali from the 1st century BC onwards (Bellwood 1997: 294). The Hindu religious influence on the Southeast Asian region dates from the sixth century and fruits brought at this time include the bael, *Aegle marmelos* (2), the bignay, *Antidesma bunius* (9), the jackfruit, *Artocarpus heterophyllus* (12) and the mango, *Mangifera indica* (62). These fruits often bear some recognisable version of a Sanskrit name; the bael, for example, is known in Java as *majapahit* (Sanskrit 'great' + 'bitter'), a term later applied to the 14th century Javanese Empire. The Malay name of the bignay, *berunai*, may be the origin of the names of both Brunei and Borneo (Tate 2000:24). The candlenut (3) grows wild in South India and seems to have been spread from there to Pakistan, China, north-eastern Australia, the Philippines, Malaysia, and all the islands from Sumatra to

Tonga, including New Caledonia (Walter and Sam 1999:84). Whistler (1991:52) claims that it was spread into Polynesia at an early period. Although the sugar palm, *Borassus flabellifer* (22), is probably indigenous to Malesia as well as India, the Malay name, *lontar*, derives from Sanskrit (*pala* 'palm' + *ron* 'leaf') because the dried leaves of this species were preferred for writing (Tate 2000:36). It must also have been carried to Africa at a very early period, as it has long been regarded as indigenous under its synonym, *B. aethiopum*. The red dye fig (52) is only eaten in certain locations, but seems to have been introduced into Tokelau for its edible fruits (Whistler 1991:55). Although the tamarind, *Tamarindus indica* (94), was domesticated in Africa, it was carried to India prior to 1300 BC, to judge from charcoal analyses and literary references (Blench 2003:284). Literary references suggest that it only spread to Java and the rest of Southeast Asia in the medieval period (Gunasena and Hughes 2000).

China

Given its size and the overall importance of agriculture, China has domesticated few fruits overall and even fewer that have had a major impact on the arboriculture of regions further south. One fruit in particular, the sweet orange (39), has become of world significance, but others, such as the longan, *Dimocarpus longan* (43) and the litchi, *Litchi chinensis* (59), have recently begun to enter world trade on a significant scale. Morton (1987:249–259) observes that the litchi was first mentioned in Chinese literature in the 11th century and was carried around the region in the later Middle Ages. The persimmon, *Diospyros kaki* (45) is native to Japan, China, Burma and the Himalayas and Khasi Hills of northern India. Ng (1978) argued that it arose from *D. roxburghii* on the China/Burman borderland, but Yonemori *et al.* (1998) show that the persimmon is monophyletic with the subtropical species, *D. ehretioides*.

New World

A significant number of fruits that are important today in the Indo-Pacific region are of New World origin. The great majority were brought by the Portuguese and Spanish in the sixteenth and seventeenth centuries. The Spanish connection to the Philippines brought a number of species which were then subsequently distributed around Southeast Asia, such as the aratiles, *Muntingia calabura* (67). The sapodilla, *Manilkara zapote* (65), from Central America, came with Amerindian names, so that Aztec *chiki* became Malay *chiku* (and also *chiclet* for chewing-gum). The custard apple group, *Annona* spp. (6, 7, 8), is known in the Philippines as *anonas*, which suggests some confusion with the pineapple, *ananas*. The Malay names for soursop, *Annona muricata*

(6), are *durian belanda* and *durian mekah* (i.e. Dutch or Meccan durian), but also *nangka manila* (Manila jackfruit), suggesting that the soursop arrived in Malaya from two directions. The guava, *Psidium guajava* (84), seems to have been brought separately by the Portuguese and Spanish. One Malay name, *jambu portugis*, compares the guava to the rose apple, *Syzygium jambos* (92), and also points to the Portuguese connection, although the guava was also introduced by the Spanish to the Philippines. Table 4 shows some names of Southeast Asian fruits that derive from Amerindian languages.

A wide variety of fruits were introduced in the twentieth century through missionaries, and latterly agricultural projects. One of the most notable of these is the avocado, *Persea americana* (78), which might have been brought by the Spanish but seems to be recent, to judge by vernacular names. In the Philippines, present-day varieties derive from the United States Bureau of Agriculture and were brought in 1903 (Fernandez 1997:8). The caimito, *Chrysophyllum caimito* (33), is of similar origin and date. The pomegranate, *Punica granatum* (85), ancient in Central Asia, is a twentieth century introduction in Southeast Asia.

Unknown

The origin of the coconut, *Cocos nucifera* (40) is much disputed; it was formerly claimed that it originated in the New World because its nearest botanical relatives are located there. Harries (1990, Website 3) argues that its origin lies in Malesia and the distribution of *Cocos* spp. is a relic of the splitting-up of Gondwanaland. Zizumbo-Villareal and Quero (1998) in a re-examination of the earliest Spanish sources, argue that it was definitely present on the west coast of Central America in the pre-Spanish era, although they remain agnostic about whether this was a result of human intervention or simply transport by ocean currents. The very early dates for coconut in the Sepik (see Table 1) show that it had been distributed much prior to Austronesian expansion, although whether by human transport or chance floatation is unclear. Ross (1996:195) quotes a reconstruction **niuR* for coconut in proto-Oceanic, Wolff (1994:533)

proposes **niyu* and Mahdi (1998:395) **niəuR* for proto-Philippines. There are also many local reconstructions for stages of coconuts growing or being processed. Mahdi (1998:396) argues that the coconut was carried to Sri Lanka and India prior to the 2nd century BC and that by the 5th century it was known to the Greeks, who borrowed the name *argellia* from Sanskrit *nārikela*.

The leech-lime, *Citrus hystrix* (35), is found throughout the region and may be the referent of the proto-Oceanic **molis* (Ross 1996:210), although this could also be the ghost-lime, *C. macroptera* (36). The vernacular terms for the ghost-lime are highly diverse in the Philippines, suggesting it is a more recent introduction there (Reid in press). The ghost-lime (36) presently occurs from Thailand to Micronesia and Polynesia (Walter and Sam 1999:134). It has clearly been carried by human action throughout much of its range but its precise origin remains unknown. Mahdi (1998:409) sees the widespread forms in Malayo-Polynesian of the type *limaw* as metathesising in Oceanic to produce **moli* but it is still unclear exactly to which *Citrus* sp. this might refer. Not all linguists would accept such a metathesis without a mechanism to explain it. The shaddock, *C. maxima* (37), is also referred to by the term **moli*, but this reached only as far as Tonga in pre-European times. Blust (n.d.) quotes a reconstruction of **muntay* for PMP 'kind of citrus tree and its fruit', which could be either of these.

The Tahiti apple, *Spondias cytherea* (88), is presently spread from Malaysia to the Marquesas and was carried to Hawai'i and elsewhere in the world in post-European times. Ross (1996:210) gives a reconstruction of **quRis* for proto-Oceanic. Its origin is much disputed, with Whistler (1991:50) giving Indo-Malaysia, while Walter and Sam (1999:223) canvas a range of other possibilities but conclude that it is unknown. In Melanesia, it is generally a gathered forest species, but it was cultivated in Polynesia, and its names, *wi/vi* and variants thereof, mark its transport from island to island as the expansion took place.

Fruits that originate in Australia are rare, partly because fruit culture was of limited interest to the inhabitants. However, one of the most widespread fruits in the Pacific,

Table 4. Southeast Asian fruit names derived from Amerindian languages

Southeast Asian name				Amerindian name	
Species	No.	Language	Term	Language	Term
pineapple	5	Portuguese	ananas	Tupi-Guarani	<i>nanas</i> 'pleasant-smelling'
sweetsop	8	Tagalog	atis	Aztec	ahate
sapodilla	69	Malay	chiku	Aztec	chiki
avocado	82	Thai	avocado	Aztec	ahuacatl
Madras thorn fruit	85	Tagalog	kamatsili	Nahuatl	cuaumochitl
guava	90	Tagalog	bayaba	?	

and which has spread to India, the Seychelles and the Caribbean, was the noni or Indian mulberry, *Morinda citrifolia* (66), which Walter and Sam (1999:193) claim originated in Northern Australia, the home of many related species. However, Morton (1992:241) points out that the noni can spread on ocean currents and has become established along sea-coasts in many parts of the world and it may also originate in Southeast Asia (Morton 1992; Websites 1, 2). Its importance as fruit, dye and medicinal plant clearly made it a priority with early navigators (Dittmar 1993). Two reconstructions to proto-Oceanic exist, **ñoñum* and **kurat* (Ross 1996:211), possibly referring separately to the fruit and the red dye obtained from its roots. A quite different root has been reconstructed in proto-Philippines, **baṅkudu* (cf. Reid in press), arguing that the tree must have been of interest early in the expansion of the Austronesians.

A minor mystery in this region worth noting is the distribution of the baobab or boab (*Adansonia* spp.). Baobabs are members of the Bombacaceae, a pantropical family containing a number of better-known economically important plants like kapok, balsa wood and durian. Six of the eight species of baobabs are restricted to western and southern Madagascar, a seventh is endemic to northwestern Australia, and the eighth is widespread in sub-Saharan Africa but now introduced by humans throughout the warm tropics (Armstrong 1983). It has been speculated that the Australian boab may have originated from seed pods carried for food by seafarers from Madagascar or Africa, although at what period this might have been and why the baobab remains isolated in Australia is unclear (Blench in press).

WHO WAS MOVING FRUIT TREES AROUND?

The linguistic data cited in this paper are far from complete, but they do suggest that the expanding Austronesians encountered a large number of fruiting trees that had *already* been translocated from their area of origin. Remarkably, many species seem to have travelled in a contrary direction, especially in insular Southeast Asia. By this I mean that they seem not to follow the usually accepted direction of demographic expansion of early Austronesian, south and east from Taiwan; indeed a surprising number of species appear to have moved in the opposite direction. A significant number of economic trees can be reconstructed to quite a high level in Austronesian, but this does not mean that they were domesticated by, for example, speakers of proto-North Philippines. Many species domesticated in the Moluccas to Vanuatu region and were apparently effectively distributed throughout much of the Austronesian zone prior to its expansion. Recent ethnographic evidence for the importance attached to fruit culture suggests that popular species spread extremely quickly; the New World imports,

such as pineapple, guava and sweetsop are all well-established throughout the region and are now regarded as 'indigenous'.

One explanation is that many species were not initially spread by the Austronesians but by the former inhabitants of insular Southeast Asia. Promising fruiting and other useful trees were moved from one island to another, just as animals were translocated (Flannery and White 1991), to provide low-management food sources. This is not only the case with trees; yams seem to have undergone a parallel movement. Spriggs (1997) has discussed the surprisingly early settlement of island Melanesia and the movement of likely food resources using still unknown maritime technology. The evidence from fruit trees suggest that the Pleistocene and early Holocene populations were very active long before the Austronesian expansion (Spriggs 1993; Yen 1995).

CONCLUSIONS

SUMMARY

This paper has focused on the very large number of fruit trees found in the East Asian/Pacific region which are not just exploited in the wild, but intentionally planted and cultivated, though often not domesticated to the point where morphological change becomes evident. Particularly in the Pacific, where island floras tend to be very depauperate, human intervention has moved numerous species from island to island, often allowing unfashionable species to become wild, making it difficult to determine the 'natural' range of such species. Although fruit trees are the focus of this paper, trees and indeed many other plants were moved for a wide variety of other reasons, including flowers, perfumes, medicines, barkcloth and timber.

Biogeography is presently the main means to determine the area of origin of particular species, but this is an uncertain tool at best, partly because post-European vegetation change has been so marked in certain places, but also because naturalisation of many species makes their 'wild' status difficult to determine. No doubt, DNA studies in the future will improve the quality of the database; in the meantime assertions as to the region of origin of fruit species should be treated with appropriate scepticism.

Approaching the study of fruit trees from an ethnographic standpoint also underlines the divide with archaeobotany. Ethnographic accounts of the identity, distribution and uses of plant species in the present or recent past can be meshed with biogeography to explore the likelihood that particular species were translocated, as opposed to being indigenous. Such ethnographic mapping should also correlate with the evidence from vernacular names, as there is a strong relationship between cultural salience and the

persistence of specific roots across a wide geographic and linguistic space. To date, archaeobotanical confirmation for the hypotheses that underlie biogeographical assertions remains slight; identified species are few and dates are sometimes late. No doubt more evidence will gradually come to light, but in the mean time, careful descriptive work on plant use has a substantial contribution to make to the reconstruction of prehistoric subsistence.

AN EXPANDED ROLE FOR ARBORICULTURE?

Although difficult to substantiate on a quantitative basis, in comparison to Europe and Africa, the role of arboriculture in the Indo-Pacific region is exceptional in global terms. This in turn argues that we should be rewriting the history of agriculture, balancing useful trees against the cereals and tubers that normally dominate the textbooks. At present, evidence for the scale of human activity in moving economic trees comes mainly from biogeography. Linguistic studies have made some contribution, especially in the Austronesian area, but richer hypotheses might be derived from existing information.

There is something else, however, more speculative, but worth noting. Some areas inhabited by large language groupings do seem to exhibit cultural biases for or against fruit cultivation. Africa is a good example of a whole region, where, except for Ethiopia, fruit plays little or no role in either eating preferences or cultural life. In most areas of West-Central Africa, fruit-eating is regarded as a low-status activity fit only for children; only very recently have introduced crops such as oranges and mangoes begun to be widely consumed. This cultural bias shows up persistently in agronomic research; cereals and tubers are heavily emphasised and trees largely ignored. This situation contrasts strongly with, say, South America, where fruiting trees play a major role in the subsistence and ceremonial life of many Amerindian groups. In the Indo-Pacific region, arboriculture is a central activity and its peoples attribute high cultural value to fruit and the pattern of adoption and domestication in the area is striking enough to need an explanatory framework rather richer than those at present available.

This synthesis points to one very obvious imbalance; the significant body of work on island Southeast Asia and the Pacific and the relative absence of studies of the mainland, whether linguistic, ethnographic or archaeobotanical. This partly results from the very different political histories of these regions since the 1950s and partly because of different scholarly traditions. Archaeology has tended to direct resources to monuments, anthropologists are engaged in slow suicide and linguists have concentrated on languages with scripts. It is to be hoped that the coming decades will see a significant re-orientation in these areas.

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