



Bananas and People in the Homeland of Genus *Musa*: Not just pretty fruit

Jean Kennedy

Research

Abstract

Bananas, perhaps the most recognizable of fruits, are nowhere more genetically diverse than in the southwest Pacific, where parthenocarpic fruit originated according to recent biomolecular evidence. In the wider Indo-Malesian area, homeland of the genus *Musa* L., understanding the domestication of bananas must include consideration of a much greater range of *Musa* species than just the few implicated in the parentage of the modern cultivars with seedless fruit.

Despite ethnobotanical evidence that the genus has been valued for many more products than the edible fruit, the role of other products in the process of domestication is seldom considered. As well as documenting the development and spread of seedless cultivars, we need to develop models of the fundamental Indo-Malesian practices through which the greater range of species and products, seeds and all, were managed in diverse socio-cultural and environmental circumstances.

Introduction

The natural range of the genus *Musa* L. extends throughout the Indo-Malesian region, in tropical and subtropical areas from Sri Lanka and eastern India, across south China and Southeast Asia to the southwest Pacific and northern Australia (Figure 1). There are more than 50 *Musa* species (Constantine 1999-2008, Häkkinen & Väre 2008), most of which are large perennial tropical herbs, mainly of lowland areas with high temperature and humidity.

The edibility of traditional and modern fruit cultivars traces back to parthenocarpic forms that arose in one or two subspecies of *Musa acuminata* Colla in the southwest Pacific, at the eastern extremity of the range of that species and of the genus (Carreel *et al.* 2002, Perrier *et al.* 2009). Parthenocarpy in bananas entails the development of ed-

ible pulp without pollination; it does not guarantee seedlessness, which depends on additional mechanisms that are at least partly independent of parthenocarpy (Argent 1979, Simmonds 1959: 28-9, 1962). As vegetatively propagated parthenocarpic land races spread west through the area of other *Musa* species, they were involved in complex hybridizations that produced many new land races with virtually seedless fruit (see Perrier *et al.* 2009). While some of these have been transmitted to the rest of the tropical and subtropical world, Malesia retains the highest diversity of land races, and nowhere are these more diverse than in Papua New Guinea (see Kennedy 2008, n.d. for further discussion and references).

Understandably, a great deal of attention has been given to explicating the genetics and biogeography of the process by which bananas with seedless fruit were domesticated (Kennedy 2008, n.d.; Perrier *et al.* 2009, Simmonds 1962). My argument here elaborates on points I (and others) have previously made only in passing: we need to recontextualize understanding of the domestication of bananas within the frameworks of historical ecology for the Malesian region that are emerging from multidisci-

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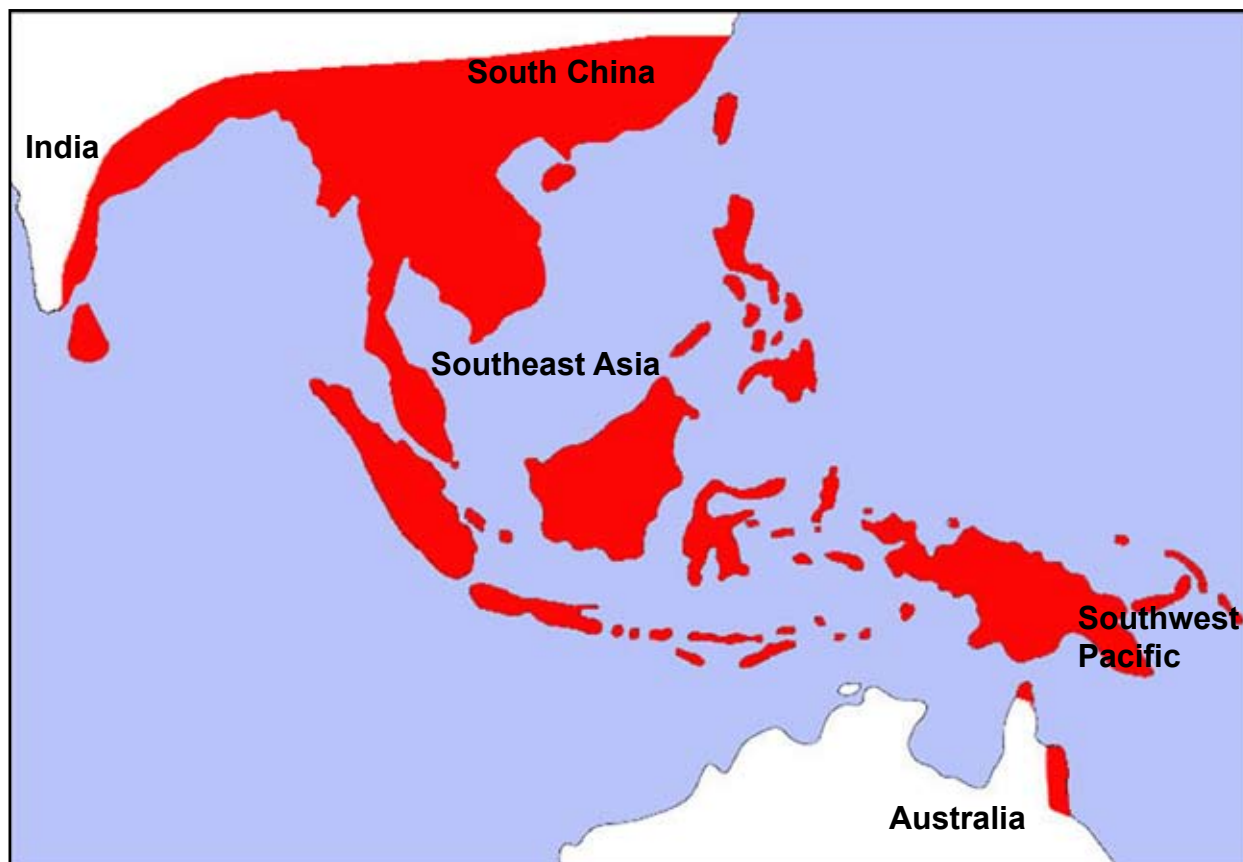


Figure 1. Distribution of genus *Musa* L. in the Indo-Malesian region.

plinary studies of environmental and cultural changes in the late Pleistocene and Holocene, and to take a broader view of banana domestication than is usual. Documenting the development of the familiar edible bananas of today has been the main focus of studies of the interactions of humans and bananas, and this focus is still reflected in most current archaeobotanical discussion. But the utility of a phylogenetic outline of the development of edible bananas for the project of improved breeding does not necessarily give it power to guide prehistoric research. We need to know more about bananas than how the fruits were made succulent and seedless.

The basic proposition of this paper is that the Musaceae as a whole, like 'cassowaries and kiwis, and big bouquets of roses' (Hays 1991:113), have high ethnobiological salience, independent of forms with edible fruit. In support of this proposition, I explore examples of the very wide range of uses documented throughout Indo-Malesia. Given that such uses are widespread and probably reflect ancient practices, it is likely that human selective pressures have affected other aspects of the plants besides the edibility of fruit. If this is correct, then the tendency to equate seediness with wildness is very misleading. In my hypothetical encounters of early humans and bananas, seediness did not matter, and the fruit was probably not the main focus of attention. To assume otherwise is teleological.

It follows that the vegetatively propagated parthenocarpic bananas from the eastern edge of Malesia spread west into a world in which other *Musa* species had already been subject to the manipulations of humans, for uses including medicine, fiber, wrapping material and ritual, as well as food. All such uses entail the possibility of selective pressures that have little or nothing to do with edibility of the fruit. These humanly modified plant populations are termed 'cultiwild' by De Langhe *et al.* (2009). As we develop better archaeobotanical tools for investigating the prehistoric world of tropical plants, we should keep these possibilities in mind.

Ecology and Ethnobotany of Indo-Malesian Musaceae

Simmonds (1962:34) described wild *Musa* species as 'jungle weeds' of disturbed habitats, such as talus slopes, unstable hillsides or forest gaps. Disturbance is an integral part of the dynamic growth cycle of the rainforest, providing niches for understory plants such as Musaceae (Argent 1979, Whitmore 1984). When *Homo sapiens* entered the world of wild *Musa* species c. 60,000 years ago, the niches of these plants and people must have overlapped substantially. A growing body of archaeological evidence shows Pleistocene human presence in forested environ-

ments of Island Southeast Asian and the New Guinea region (Barker 2005, Barker *et al.* 2005, Barker *et al.* 2007, Kealhofer 2003, Latinis 2000, Mercader 2003, Pavlides & Gosden 1994). It is highly likely that early humans were especially drawn to forest gaps and may have increased their extent (Groube 1989). The stately and often spectacular Musaceae are far too conspicuous to have been overlooked (Figures 2 and 3). Thus began a long period of interaction with humans that continues to the present.

It is well known that Musaceae are very useful. Leaves and inflorescences are prominent in many Southeast Asian food markets (Figures 4 and 5), and increasingly in metropolitan markets of the First World. The multiplicity of

uses is manifest in compilations of tropical products, such as the invaluable colonial works of Burkill (1935), Heyne (1950), Ochse (1977) and Watt (1972), as well as in more specialist literature on botanical and agronomic aspects of bananas, such as Purseglove (1975), Simmonds (1959 and 1962) and publications of the International Network for the Improvement of Banana and Plantain (INIBAP) (e.g., Sharrock 1996).

All parts of the plant are useful, including seedy fruit, inflorescence, leaf, pseudostem, corm and rhizome; they furnish food, fodder, medicine, domestic materials and shelter. Plants also have ritual and ceremonial significance. Table 1 lists miscellaneous uses, other than consump-



Figure 2. Many *Musa* species grow to statuesque proportions and dominate the landscape. **A, B.** The largest is *Musa ingens* Simmonds, a New Guinea Highlands endemic; **C.** *Ensete glaucum* (Roxb.) Cheesman has a wide but scattered distribution from the Eastern Himalayan fringe to New Guinea. (Photos **A, B.** by Jeff Daniells, Queensland DPI; **C.** by Shu Suehiro, Kamisu-shi, Japan.)



Figure 3. The flowers and fruit of many *Musa* species are conspicuous and appeal to horticulturally-inclined humans as well as to birds and bats: **A.** *Musa basjoo* von Siebold ex Y. Inuma, University of California Botanical Garden, Berkeley; **B.** *Musa ornata* Roxb., local nursery, rural central Luzon, Philippines; **C.** *Musa velutina* H. Wendl. & Drude, Royal Botanical Gardens, Kew. Photos by the author.

Figure 4 (right). In Thai food markets, many parts of Musaceae species are represented: **A.** Inner core of *Musa* sp pseudostem is eaten cooked, Chiang Mai; **B.** Terminal inflorescences are eaten cooked or raw, Chiang Mai; **C.** Immature fruit of *Musa balbisiana* Colla eaten as salad, Nong Khai; **D.** Ripe fruit of *Ensete glaucum* (Roxb.) Cheesman, also eaten raw, Udon Thani. Photos by Gianni Bertossa and Christiane Jacquat, Institute of Plant Biology & Department of Pre- and Protohistory, University of Zurich.



tion of seedless fruit, of Indo-Malesian Musaceae. Given the labyrinthine complexity of literary genres which might refer to bananas, I make no claim that this list is comprehensive in terms of uses or references; it is intended to be exemplary. I have revised the nomenclature, where possible, using the extensive cross-referencing of species names compiled by Constantine (1999-2008). For the sake of brevity, I have somewhat arbitrarily excluded African uses of Musaceae (genus *Ensete* Horan. is native there, but not genus *Musa*), while Polynesia and Micronesia are included because their cultural connec-



Figure 5. Leaves are widely used for packaging, especially for food, as in these examples of Thai takeaways. Photos by Gianni Bertossa and Christiane Jacquat, Institute of Plant Biology & Department of Pre- and Protohistory, University of Zurich.

Table 1. Miscellaneous uses of banana plants (family Musaceae) in the Indo-Malesian region.

Category				
Part used	Use	Genus/species	Location(s)	Citations
Food				
terminal inflorescence/ male bud	salad/cooked	many spp/cvs, especially <i>Musa balbisiana</i> Colla, also <i>Ensete glaucum</i> (Roxb.) Cheesman, <i>Musa acuminata</i> ssp <i>microcarpa</i> (Becc.) Simmonds and var <i>zebrina</i> (Van Houtte ex Planch.) R.E.Nasution, <i>Musa campestris</i> Becc., <i>Musa hirta</i> Becc., <i>Musa itinerans</i> Cheesman, <i>Musa lawitiensis</i> Nasution & Supard., <i>Musa nagensium</i> Prain, <i>Musa ornata</i> Roxb., <i>Musa peekelii</i> Lauterb., <i>Musa salaccensis</i> Zoll., <i>Musa velutina</i> H. Wendl. & Drude, <i>Musa violascens</i> Ridl.	widespread	Arnaud & Horry 1997, Burkill 1935, Christensen 2002, Dassanayake & Clayton 2000, De Langhe <i>et al.</i> 2000, Heyne 1950, Jacquat 1990, Lentfer 2003, Noweg <i>et al.</i> 2003, Ochse 1977, Rumphius 1747, Simmonds 1956, 1959, Uma 2006, Uphof 1968, Watt 1972
male flowers	cooked	edible hybrid cvs	PNG	Argent 1979
nectar from male flowers	baby-food	Pacific plantain cvs	Hawaii	Nelson <i>et al.</i> 2006
dry inflorescence	salt	<i>Musa</i> sp	PNG	Petir <i>et al.</i> 1998

Category				
Part used	Use	Genus/species	Location(s)	Citations
seedy fruit	raw/cooked	many spp, including <i>E. glaucum</i> , <i>M. acuminata</i> ssp, <i>Musa aurantiaca</i> G. Manner ex Baker, <i>M. balbiana</i> , <i>Musa maclayi</i> F. Muell. ex Mikl.-Maclay <i>M. peekelii</i> , <i>Musa sanguinea</i> Hook.f., <i>M. velutina</i> , <i>M. violascens</i>	widespread	Anderson 1993, Burkill 1935, Häkkinen 2006, Jacquat 1990, Lentfer 2003, Nguyen 2006, Noweg <i>et al.</i> 2003, Ochse 1977, Rumphius 1747, Uma 2006, Yen & Gutierrez 1976
	raw, sieved pulp as baby food	<i>M. balbiana</i>	N.E. India	Uma 2006
fruit peels	cooked	edible cvs	Java	Ochse 1977
immature seedy fruit	raw, cooked, pickled	many spp, including <i>M. balbiana</i> , <i>M. lawitiensis</i>	widespread	Christensen 2002, Jacquat 1990, Nguyen 2006, Ochse 1977, Simmonds 1956 & 1959, Uphof 1968
pseudostem	cooked, processed for starch, famine food	many spp/cvs, including <i>M. balbiana</i> , <i>Musa flaviflora</i> Simmonds, <i>Musa ingens</i> Simmonds <i>M. itinerans</i> , <i>Musella lasiocarpa</i> (Franch.) C.Y. Wu ex Li	widespread	Burkill 1935, De Langhe <i>et al.</i> 2000, Hendrickx 2007, Heyne 1950, Jacquat 1990, Lentfer 2003, Liu <i>et al.</i> 2003, Ochse 1977, Powell 1976, Rumphius 1747, Sillitoe 1983, Simmonds 1959, Uma 2006, Watt 1972
young leaf-sheath	cooked	<i>E. glaucum</i>	Java	Ochse 1977
sucker/shoot	cooked	many spp/cvs, including <i>M. acuminata</i> ssp <i>microcarpa</i> and ssp <i>zebrina</i> , <i>M. balbiana</i> , <i>Musa beccarii</i> Simmonds, <i>M. campestris</i> , <i>M. hirta</i> , <i>M. lawitiensis</i> , <i>M. violascens</i> , <i>M. lasiocarpa</i>	Borneo, N E India, Yunnan	Christensen 2002, Häkkinen 2006, Noweg <i>et al.</i> 2003, Ochse 1977, Simmonds 1959, Uma 2006
corm/rhizome	cooked	many spp/cvs, including <i>M. acuminata</i> ssp <i>zebrina</i> , <i>M. balbiana</i>	widespread	Bailey 1900, Burkill 1935, Massal & Barrau 1956, Mogina 2002, Ochse 1977, Rumphius 1747, Simmonds 1959
ash of whole plant	seasoning	edible <i>Musa</i> cvs	India	Watt 1972
Fodder				
whole plant	pig food	<i>M. lasiocarpa</i>	Yunnan	Liu <i>et al.</i> 2003, Long <i>et al.</i> 2008
pseudostem, stalk of inflorescence and fruit, leaf, rhizome	pig and cattle food	edible cvs, <i>E. glaucum</i> , <i>M. acuminata</i> , <i>M. balbiana</i> , <i>M. itinerans</i> , <i>Musa yunnanensis</i> Häkkinen & Wang	widespread	Anderson 1993, Burkill 1935, De Langhe <i>et al.</i> 2000, Häkkinen & Wang 2007, Häkkinen <i>et al.</i> 2008, Heyne 1950, Lentfer 2003, Nelson <i>et al.</i> 2006, Rumphius 1747, Simmonds 1959, Uphof 1968, Watt 1972, Wu & Kress 2000
	food for captive cassowaries	edible <i>Musa</i> cvs	PNG Highlands	Sterly 1997

Category				
Part used	Use	Genus/species	Location(s)	Citations
outer leaf-sheath	elephant food	edible <i>Musa cvs</i>	India	Watt 1972
fruit	food for captive cassowaries	<i>M. ingens</i>	PNG Highlands	Sterly 1997
	food for piglets	<i>M. nagensium</i>	N E India	Uma 2006
corm/rhizome	cattle food	<i>M. acuminata</i> , <i>M. aurantiaca</i> , <i>M. balbisiana</i> , <i>Musa laterita</i> Cheesman, <i>M. nagensium</i> , <i>M. ornata</i>	N E India	Uma 2006
Medicine				
juice/sap of pseudostem, stalk of inflorescence, roots and flowers	astringent, styptic, mouthwash, gargle, antipyretic, wound dressing, burns, tonic, internal complaints, treatment/antidote for diabetes, gonorrhoea, kidney inflammation, mercury poisoning, drunkenness, abortifacient, hair tonic	many spp/cvs, including <i>E. glaucum</i> , <i>M. balbisiana</i> , <i>Musa basjoo</i> von Siebold ex Y. linuma, <i>M. nagensium</i> , <i>M. lasiocarpa</i>	widespread	Burkill 1935, Christensen 2002, Hendrickx 2007, Heyne 1950, Jacquat 1990, Liu <i>et al.</i> 2003, Nelson <i>et al.</i> 2006, Perry 1980, Powell 1976, Reynolds & Fang 1940, Rumphius 1747, Sterly 1997, Uma 2006, Uphof 1968, Watt 1972, Whistler 1992
decoctions/ infusions of leaves, flowers, roots, pseudostem	various internal complaints, internal hemorrhage, burns, swellings	many spp/cvs, including <i>Musella lasiocarpa</i>	widespread	Anderson 1993, Burkill 1935, Heyne 1950, Jacquat 1990, Liu <i>et al.</i> 2003, Nelson <i>et al.</i> 2006, Reynolds & Fang 1940, Rumphius 1747, Watt 1972, WHO 1998
root	ayurvedic preparations	<i>M. acuminata</i> , <i>M. aurantiaca</i> , <i>M. balbisiana</i> , <i>M. laterita</i> , <i>M. nagensium</i> , <i>M. ornata</i>	N E India	Uma 2006
skin of pseudostem	insect bites	edible cvs	PNG	Powell 1976
	tonic for humans and pigs	<i>M. ingens</i>	PNG Highlands	Sterly 1997
fruit pulp and pounded skin	poultice	edible <i>Musa cvs</i>	Malaysia, PNG, Polynesia, Thailand	Burkill 1935, Jacquat 1990, Nelson <i>et al.</i> 2006, Sterly 1997, Whistler 1992
ripe fruit	diarrhoea, dysentery	edible <i>Musa cvs</i>	India	Watt 1972
seedy fruit, ripe	diarrhoea, dysentery	<i>Musa sp</i>	Mindanao	Dampier 1927
roasted fruit	diarrhoea, dysentery	edible <i>Musa cvs</i>	Indonesia, PNG Highlands	Heyne 1950, Sterly 1997
immature seedy fruit, roasted	diarrhoea, dysentery	<i>M. balbisiana</i>	Indonesia	Heyne 1950

Category				
Part used	Use	Genus/species	Location(s)	Citations
fruit skin	tincture for internal complaints	<i>M. balbisiana</i>	Cambodia	Kham 2004
young flower buds	respiratory complaints	<i>Musa</i> sp	PNG Highlands	Powell 1976
leaves	dressings	many spp/cvs, including <i>M. aurantiaca</i> , <i>M. balbisiana</i> , <i>M. nagensium</i> , <i>M. ornata</i>	widespread	Burkill 1935, Perry 1980, Sterly 1997, Uma 2006, Watt 1972
	elephant medicine	<i>Musa acuminata</i> ssp <i>malaccensis</i> (Ridl.) Simmonds	Malaysia, Indonesia	Burkill 1935
	eaten as abortifacient	<i>Musa</i> spp	PNG	Powell 1976
powdered leaves	boils		China	Reynolds & Fang 1940
ash of pseudostem, corm, fruiting stalk and fruit peel	anti-scorbutic, digestive, tonic	edible cvs, <i>M. ornata</i>	N E India	Uma 2006, Watt 1972
Stimulant				
dry leaves	cigarette papers, cigars	many spp/cvs, including Fe'i cvs, <i>M. campestris</i> , <i>M. hirta</i>	widespread	Christensen 2002, Heyne 1950, Jacquat 1990, Lentfer 2003, MacDaniels 1947
Domestic Uses				
leaves	wrapping material	many spp/cvs, including <i>M. balbisiana</i> , <i>M. maclayi</i> , <i>Musa schizocarpa</i> Simmonds	widespread	Burkill 1935, Jacquat 1990, Lentfer 2003, Nelson <i>et al.</i> 2006, Powell 1976, Rajah 2008, Simmonds 1959, Sterly 1997, Watt 1972
	lining and covering cooking vessels and earth ovens	many spp/cvs, including <i>M. ingens</i> , <i>M. peekelii</i>	widespread	Burkill 1935, Jacquat 1990, Lentfer 2003, Nelson <i>et al.</i> 2006, Powell 1976, Simmonds 1959, Sterly 1997, Uma 2006
leaves, midribs and bracts	plates, dishes and mats	many spp/cvs	widespread	Burkill 1935, Heyne 1950, Jacquat 1990, MacDaniels 1947, Nelson <i>et al.</i> 2006, Powell 1976, Simmonds 1959, Sterly 1997
pseudostem	raft, canoe rollers	<i>Musa</i> spp, Fe'i cvs	N E India, Micronesia, PNG, Polynesia	MacDaniels 1947, Nelson <i>et al.</i> 2006, Powell 1976, Uma 2006, Williams 1930
	children's toy, toboggan	edible <i>Musa</i> cvs	PNG Highlands	Sterly 1997
outer skin of pseudostem	containers	many spp/cvs	PNG, Mindanao	Kocher Schmid 1991, Sterly 1997, Yen & Gutierrez 1976
seedy fruit	beer additive	<i>Eumusa</i> spp	N E India	Uma 2006
ash from burnt pseudostem, leaves, corm	laundry/mordant	many spp/cvs	India, Malaysia, Thailand	Burkill 1935, Simmonds 1959, Uma 2006, Watt 1972

Category				
Part used	Use	Genus/species	Location(s)	Citations
juice of fruit	ink			Burkill 1935
juice/sap from pseudostem	dye/stain for bamboo/rattan, matting	edible <i>Musa cvs</i>	Indonesia, Polynesia	Heyne 1950, Nelson <i>et al.</i> 2006, Simmonds 1959, Uphof 1968
	cleaning knives	edible <i>Musa cvs</i>	PNG	Kocher Schmid 1991
Shelter				
leaves	roofing and walls, insulation and draft-proofing	many spp/cvs, including <i>M. ingens</i> , <i>M. schizocarpa</i>	widespread	Burkill 1935, Lentfer 2003, Nelson <i>et al.</i> 2006, Powell 1976, Simmonds 1959, Sterly 1997, Watt 1972
	temporary shelters	<i>M. ingens</i>	PNG Highlands	Lentfer 2003, Sterly 1997
	umbrella/raincoat	many spp/cvs	widespread	Burkill 1935, Simmonds 1959
petiole fiber	thatch	edible <i>Musa cvs</i>	Hawaii	Neal 1965
Cordage				
petiole and pseudostem	traditional cordage and string	many spp/cvs, including <i>Musa alinsanaya</i> R.V.Valmayor, <i>M. balbisiana</i> , <i>Musa textilis</i> Née, <i>E. glaucum</i>	widespread	Burkill 1935, Heyne 1950, Powell 1976, Rumphius 1747, Simmonds 1959, Sterly 1997, Uphof 1968, Valmayor 2001, Watt 1972, Yen & Gutierrez 1976
pseudostem	industrial rope	<i>M. textilis</i>	Philippines	Burkill 1935, Purseglove 1975, Watt 1972
leaves	rope	<i>M. lasiocarpa</i>	Yunnan	Liu <i>et al.</i> 2003
	string	<i>Musa sp</i>	Borneo	Christensen 2002
Clothing				
leaves	dried, shredded for skirts, capes, loin-cloths	many spp/cvs	PNG, Vanuatu	Deacon 1934, Malinowski 1935, Powell 1976, Weiner 1976
pseudostem	fiber for skirts, skin for belts	many spp/cvs	Hawaii, PNG	Nelson <i>et al.</i> 2006, Powell 1976
Textiles				
pseudostem, petiole	fiber for cloth production	many spp/cvs, especially <i>M. textilis</i> and <i>M. balbisiana</i>	Batanes, Borneo, S. China, Luzon, Micronesia, Mindanao, Ryukyus, Sangihe/Talaud, Solomon Islands, Vietnam, Visayas	Dampier 1927, Evans 1922, Fraser-Lu 1988, Hendrickx 2007, Kuhn 1988, Lu & Huang 1986, Reynolds & Fang 1940, Rubinstein & Limol 2007, Rumphius 1747, Stinchecum 2007
juice/sap from stalk of inflorescence, pseudostem and suckers	dye/stain for yarn/cloth	edible <i>Musa cvs</i>	India, Indonesia, Micronesia	Heyne 1950, Rubinstein & Limol 2007, Rumphius 1747, Watt 1972
	dye/stain for tapa cloth	Fe'i cvs	PNG, Samoa	Burkill 1935, Whistler 2000

Category				
Part used	Use	Genus/species	Location(s)	Citations
pseudostem/ petiole fiber, skin of petiole	resist in tie-dying	edible <i>Musa cvs</i>	E. Indonesia, Malaysia, Ryukyus, Thailand	Burkill 1935, Fraser-Lu 1988, Hendrickx 2007
skin of pseudostem	decorative element in matting	Fe`i and other edible cvs	Indonesia, Polynesia	Heyne 1950, MacDaniels 1947, Neal 1965, Nelson <i>et al.</i> 2006, Whistler 2000
ash from burnt pseudostem, leaves, corm	mordant	edible <i>Musa cvs</i>	India	Burkill 1935
wax from bract and leaf	resist in batik cloth production	<i>M. acuminata ssp/var</i>	Java	Burkill 1935, Heyne 1950, Nakai 1948, Simmonds 1959
Paper-making				
pseudostem	fine and coarse paper, industrial filters, tea bags	many spp/cvs	widespread	Burkill 1935, Hendrickx 2007, Sharrock 1996, Watt 1972
juice/sap of corm	varnish for paper	<i>M. balbisiana</i>	Ryukyus	Hendrickx 2007
Ornamental				
whole plant	horticultural	many spp/cvs	widespread	Constantine 1999-2008
inflorescence	horticultural	many spp/cvs	widespread	Constantine 1999-2008
flowers	garnish for food	<i>M. peekelii</i>	PNG	Lentfer 2003
leaves	body decoration	many spp/cvs	PNG, Polynesia	Lentfer 2003, Powell 1976, Whistler 2000
dried leaves	garlands	many spp/cvs	widespread	Burkill 1935
seeds	strung as beads, ornaments	<i>Musa and Ensete spp</i>	Philippines, PNG, N. Thailand	Anderson 1993, Burkill 1935, Lentfer 2003, Powell 1976, Simmonds 1959, Williams 1930
ash	tattooing	edible <i>Musa cvs</i>	Polynesia	Nelson <i>et al.</i> 2006
Ceremonial, Magic and Ritual				
whole plant	object of veneration, symbol of plenty, metaphor for human mortality, totem	edible <i>Musa cvs</i>	India, Madagascar, Malaysia, New Caledonia, PNG,	Endicott 1979, Kagy 1998, Keller 2008, Watt 1972, Williams 1936, Williams 1941
	marker of graves	<i>M. ingens</i>	PNG	Argent 1979
	many rituals, exorcism, garden magic, planted as hunting decoy, protective	edible <i>Musa cvs</i>	Malaysia, PNG, Polynesia	Burkill 1935, Kocher Schmid 1991, Malinowski 1935, Nelson <i>et al.</i> 2006, Powell 1976, Sterly 1997
fruiting stalk	ceremonial display	edible <i>Musa cvs</i>	India, Bali, Malaysia	Burkill 1935, Watt 1972

Category				
Part used	Use	Genus/species	Location(s)	Citations
pseudostem	peace making ceremony	edible <i>Musa</i> cvs	PNG Highlands	Sterly 1997
	funerary effigy	edible <i>Musa</i> cvs	New Ireland, PNG	Denner 2006, Peltier 2006
leaves	rituals, chewed in funeral rites, worn during dance performance, rain magic	edible <i>Musa</i> cvs	PNG	Malinowski 1935, Powell 1976, Sterly 1997
	ceremonies and offerings	<i>M. acuminata</i> , <i>M. hirta</i>	N. Thailand, Borneo	Anderson 1993, Christensen 2002, Rajah 2008
	scraped, dried bundles produced and exchanged as women's wealth	edible <i>Musa</i> cv	Trobriand Islands, PNG	Weiner 1976
leaf sheath	divination	edible <i>Musa</i> cv	PNG	Kocher Schmid 1991
fruit	offerings, in rites of passage	edible <i>Musa</i> cvs	widespread	Burkill 1935, Hla Pe 1978, Kocher Schmid 1991, Rajah 2008, Simmonds 1959, Sterly 1997, Watt 1972
stalk	surrogate human	edible <i>Musa</i> cvs	Hawaii, Tahiti	Neal 1965, Nelson <i>et al.</i> 2006
juice/sap of pseudostem	cleansing ritual for brides	edible <i>Musa</i> cvs	PNG Highlands	Sterly 1997
	paint/dye for funerary masks	Fe'i cvs	PNG	Lentfer 2003
skin of pseudostem	magic to strengthen pigs and children	<i>M. ingens</i>	PNG Highlands	Sterly 1997
shoot	magic	<i>M. ingens</i>	PNG Highlands	Sterly 1997

tions are unequivocally with the Indo-Malesian homeland. There is an extensive literature on African uses of *Ensete* (see Brandt *et al.* 1997, Constantine 1999-2008, Shigeta 1996, Tsehaye & Kebebew 2006 for references).

Recognition of the usefulness of Musaceae was part of the basis of Sauer's (1952) hypothesis that agriculture in Southeast Asia began with the vegetative propagation of fiber and dye plants, followed by perennial food plants. Simmonds, accepting this part of Sauer's proposal, saw the recognition of the useful properties of translocated wild bananas by early Southeast Asians as the context in which 'the first signs of parthenocarpy and sterility [were seized upon] as providing a useful addition to an already considerable repertoire of virtues', during which 'the plants were transformed from jungle weeds into a highly productive crop' (Simmonds 1962:132).

The problem with this formulation is the shift of attention away from all useful aspects of Musaceae except edible

fruit. The distortion is completely explicable, given that Simmonds' enormous contribution to cytogenetic research on banana edibility was aimed at the improvement of fruiting bananas. Nevertheless, it encourages ignorance, or amnesia, about other important aspects of the long history of entanglement of people and Musaceae. When Simmonds was considering such matters, the study of Southeast Asian prehistory had neither the tools to investigate past interrelationships of people and plants, nor any expectation of the great time depth involved.

The very widespread use of *Musa* species for fiber has certainly led in some places in directions that parallel those of fruiting bananas, with clonal reproduction of selected forms as well as planting from seed. In the Philippines, production of *Musa textilis* Née (Manila hemp, **abacá**), almost certainly a complex cultigen rather than a genuine wild species, was increased by Spanish decree in the mid-eighteenth century, and developed to industrial scale under later American and Japanese occupations,

with production spreading to other countries (Hendrickx 2007, Purselglove 1975, Simmonds 1962). In the Philippines, production continues, despite the competition from synthetic fibers (Figure 6).

Production of other species for fiber has also been notable. For example, **bashōfu** cloth produced in Okinawa Prefecture was sent as tribute to China in the late sixteenth century, and is now a strong marker of a resurgent Okinawan

identity (Figure 7). Popularized in Japan by a Japanese craft movement as an emblem of an idealized Okinawan past, the finest **bashōfu** cloth produced in Okinawa now commands high prices in mainland Japan — more than US\$20,000 for a kimono length. The plant is not *Musa basjoo* von Siebold ex Y. linuma as is commonly claimed (though that species does produce fiber), but *Musa balbiana* Colla (Hendrickx 2007, Stinchecum 2007).



Figure 6. Production of **abacá** from *Musa textilis* Née, Aklan, Panay, Philippines: **A.** Harvesting in a cultivation area; **B.** Separating layers of pseudostem; **C.** Drying fiber. Photos by Juergen Steger, SachsenLeinen, Waldenburg, Germany.



Figure 7. Winding thread of **bashō** fibre (from the inner pseudostem of *Musa balbisiana* Colla), the Okinawan weaver Yonemori Tokuko poses wearing a kimono of the same fibre, Maezato village, Ishigaki Island, Okinawa, 1983. Photo by Amanda Mayer Stinchecum, New York.

In the Trobriand Islands, Milne Bay Province, Papua New Guinea, women manufacture bundles and skirts from banana leaves by a laborious process involving scraping over carved wooden boards, producing distinctive decorative imprints, followed by sun-bleaching, drying and storage (K. Lepani pers. comm.) (Figure 8). These valuables are produced and exchanged only by women, and their labour in turning banana leaves into 'women's wealth' is central to women's control of the timeless cosmological domain which ensures the continuation of Trobriand social identity. Their role counterbalances the power of men in the quotidian world, to seek renown through the famous **kula** exchanges (Weiner 1976, 1980). The use of banana fiber in textile production is widespread in the Asia-Pacific region, and such textiles are often highly valued (Figure 9) (Fraser-Lu 1988, Hamilton 2007, Hendrickx 2007, Jolly 1992, Rubinstein & Limol 2007, Weiner 1986).

Conclusion

These examples show that Indo-Malesian uses of Musaceae other than edible fruit are neither minor, nor necessarily secondary to production of the fruit. They have not

dwindled into insignificance as the fruit became globally important. In the Philippines, **abacá** production, no longer important for rope, supports a burgeoning craft industry. In India, banana stems are processed for fiber and exported to Nepal, where knitting yarn is spun for sale in the West, marketed in craft shops as 'banana silk'. The cost of Okinawan **bashōfu** escalates. In the Trobriands, women continue to produce banana leaf bundles, and young women of Fais learn to weave **machi**.

Modern industries, whether on a huge scale, like the growing of Cavendish bananas for world trade, or the high value but small-scale production of **bashōfu** cloth in Okinawa, have grown from very deep roots. The industrial separation of fruit and fiber production should not blind us to the likelihood that particular *Musa* species in the past have furnished multiple products. Nevertheless, some specialization or differentiation is also likely, and this implies that selection may have taken different directions in different places and times. The example of the Ethiopian *Ensete ventricosum* (Welw.) Cheesman, domesticated as a starch staple, is well known (Brandt *et al.* 1997, Pursglove 1975). We should not rule out the possibility that



Figure 8. Banana leaf fiber is central to women's wealth (**doba**) in the Trobriand Islands, Milne Bay Province, PNG: **A.** The strips show decorative imprints; **B.** Tying prepared banana leaf strips into bundles; **C.** Close-up of piled bundles; **D.** Preparing bundles in readiness for a ceremony; **E.** Piles of **doba** in front of a yam house during a ceremonial exchange; **F.** Young women's skirts are also produced from banana leaf strips. Photos by Mark Mosko, Anthropology Department, Research School of Pacific and Asian Studies, Australian National University.

parallel selection for starch production in the corm and pseudostem of Malesian *Musa* species may also have occurred in the past. There is at least one example of selection for enhanced starch storage in the rhizome of a

New Caledonian *Musa* plant, described as having a 'glaucous, violet stem and a turnip-like rhizome which, when cooked, resembles a yam in taste' (Simmonds 1959:267 citing Baker 1894).



Figure 9. On Fais, in the western Caroline Islands of Micronesia, prestigious traditional textiles called **machi** are still woven. Fiber from *Musa* cultivars forms the warp and weft, with decorative supplementary weft of *Hibiscus* sp. fiber. The ritual value of **machi** derives from their association with chieftainship. **A.** Weaving on a back-strap loom; **B.** **Machi**. Photos by Michiko Intoh, National Museum of Ethnology, Osaka, Japan.

We should not, therefore, interpret archaeobotanical discoveries of banana parts by reference solely to what we know of the development of edibility in fruit. The cultivation of *M. textilis* and *M. balbisiana* for fiber show that seedy fruit is not necessarily an indication of 'wildness'. While parthenocarpy is the key to edibility of fruit, and its reproduction and transmission certainly depended upon vegetative propagation, other desirable characteristics of

Musa species may also have been vegetatively propagated. There is no reason to suppose that parthenocarpic fruit alone called forth propagation by vegetative planting. Although parthenocarpy could not have spread without the reinforcement of vegetative propagation, other desirable characteristics which did not interfere so directly with fertility could also be propagated in the same way. Thus, parthenocarpic forms of *Musa* species that on present evi-

dence arose only on the eastern edge of Malesia may have spread west into areas where other useful *Musa* species were already well established in the domain of humans. The new fruit cultivars, and those that then developed from interspecific and intersubspecific hybridization, may thus have been an addition to the repertoire of banana cultivation, rather than an innovation or replacement.

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