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Palm Resources at the Centre for Economic Botany at The Royal Botanic Gardens, Kew

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The Centre for Economic Botany at Kew

Research into useful and potentially useful plants has been undertaken at the Royal Botanic Gardens, Kew since its earliest days. Indeed, it could be argued that the initial establishment and growth of Kew were as much thanks to an economic interest in useful plants as it was a desire to create a beautiful garden. The first official Director of Kew, Sir William J. Hooker, understood only too well the importance of plants to society and in 1847 established the Economic Botany Collections to “render great service, not only to the scientific botanist, but to the merchant, the manufacturer, the physician, the chemist, the druggist, the dyer, the carpenter and the cabinet maker and artisans of every description, who might here find the raw materials employed in their several professions correctly named.”

The collections were originally on display in the world's first Museum of Economic Botany, which opened in 1847. In the mid-1980s the collections, comprising nearly 75 000 specimens, were removed from display and stored in the newly constructed Sir Joseph Banks Building, named after Kew's most famous economic botanist and its (unofficial) director from 1773 to 1820. The Banks Building also houses the Centre for Economic Botany (CEB), which was formed in 1994 to co-ordinate all Kew's scientific efforts relating to plant use. The collections include a wide variety of material ranging from unprocessed, herbarium-type specimens, to processed items and artefacts, and from wood samples to plant material preserved in spirit. Hours are easily spent browsing through the collections, which include 1 676 palm accessions, in the discovery of all manner of weird and wonderful plant products and artefacts from around the world. One cannot fail but to be amazed by

the diversity of uses to which plants are put, and the cultural diversity and human ingenuity that underlie this creativity and inventiveness.

From the earliest days of the collections details of each new accession were painstakingly written out in large, leather-bound ledgers, which together made the Museums Catalogue. Although all information included in the Museums Catalogue was transferred in 1986 to the computerized Economic Botany Collections Database (which records details of the origin, manufacture, taxonomy, geography, uses, and vernacular names of new accessions), the dusty, hand-written ledgers are still a useful resource, not to mention a fascinating insight into the history and spirit of the first days of economic botany and plant-hunting. These catalogues are filled with descriptions of palm artefacts given to Kew by famous plantsmen such as Joseph and William Hooker, Richard Spruce, J. W. H. Trail, and William Griffith. The first catalogue begins with a description of the donation of “the extensive private collection of Sir W. J. Hooker which he has presented to the Garden consisting of fruits dry and in spirits; seeds; specimens of woods; stems of palms and tree ferns; drugs; resins; specimens of Proteacea; collection of fungi; and a collection of drawings etc.”

Opening another catalogue at random to the year of 1852 shows accessions given by Price's Patent Candle Company of “samples of palm (carnauba palm, *Copernicia prunifera*) and cocoa nut oil in a raw state and in different stages of preparation for the manufacture of candles....” and by Richard Spruce of “mat made at Myobamba in the Peruvian Andes of the young fronds of the Muriti palm (*Mauritia* sp.) and a magueira (hammock) made by Indians on the Rio ?Mapo, of the young fronds of the Tucúm palm (*Astrocaryum aculeatum*).” An entry from December

1874 records the accession of palm artefacts from India donated by a Dr. Thwaites including a "squeezer made of *Calamus rudentum* used by native doctors to extract oil from medicinal seeds, a stand for curry and rice pot made of *Calamus tenuis*, a bag for extra fish hooks made of the leaves of *Borassus flabelliformis* and a broom made of strips of the leaves of *Corypha umbraculifera*."

Complementary to the Museums Catalogue is the CEB's Economic Botany Bibliographic Database, which contains over 150 000 literature references to uses of plants from around the world (excluding major crop species). Each new bibliographic reference is included with selected key words (relating to geography, taxonomy, use, and/or properties), which act as pointers to that reference in the future. Key words help to make the database a unique resource by enabling instant and flexible access to detailed information using a range of identifiers. A general enquiry using the key words "palmae" identifies 1235 bibliographic references dating back to the late 19th century, many of which are found in the Economic Botany Library in the CEB. A search using the key word "*Hyphaene*" generates a list of 88 references relating to *Hyphaene* taxonomy, ecology, and utilization.

The CEB is also the home of the Survey of Economic Plants for Arid and Semi-Arid Lands (SEPASAL), which is a major database focusing on the uses of over 6000 dryland species, mainly from the tropics and subtropics. The database records scientific and vernacular names, distribution, environmental tolerances, uses, plant descriptions, cultivation and production details, and reference sources and palm species, such as *Phoenix dactylifera*, *Borassus flabellifer*, *Livistona carinensis* and *Sabal uresana*.

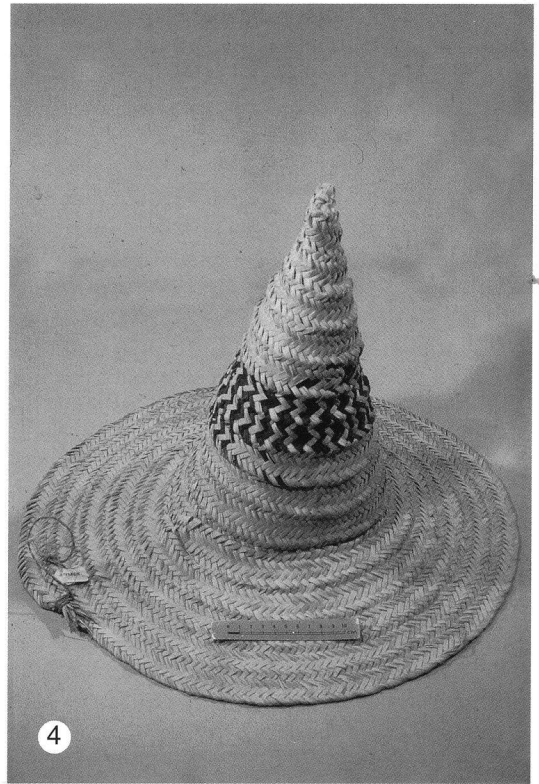
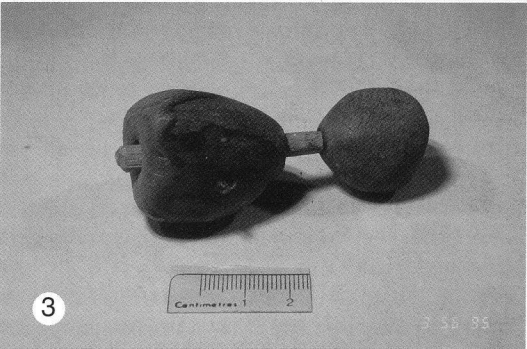
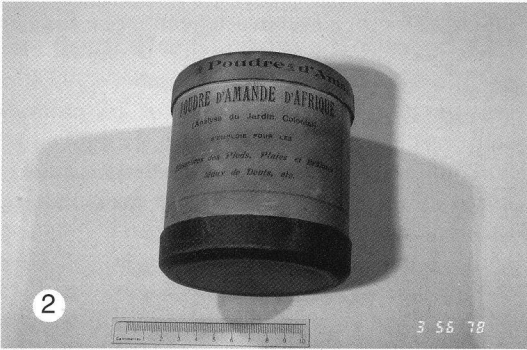
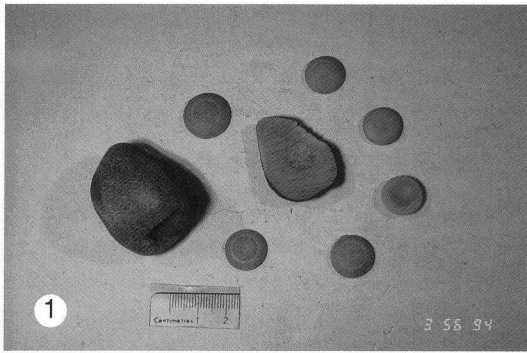
Given the unique collections and information resources at CEB it is not surprising that it is able to provide comprehensive and authoritative answers to all manner of questions concerning economically important plants. On average, 700 enquiries are answered each year from botanists, economic botanists/ethnobotanists, archaeologists, anthropologists, NGOs, commercial companies, and members of the public. By running the enquiry service the CEB is encouraging dissemination of useful information to those who most need it. The service also increases CEB awareness of new projects and ventures (academic, commercial or development-oriented) in-

volving plant use, and this knowledge can be useful in directing economic botany research objectives. For example, a spate of totally unrelated enquiries on African *Hyphaene* has highlighted the need for a taxonomic revision of the genus for which funding is currently being sought.

Update and Review of Palms in the Economic Botany Collections at the CEB

As with all museum collections the Economic Botany Collections must be regularly reviewed and updated in a systematic manner so as to enhance their intrinsic value and maximize their usefulness. From June to September 1997 I undertook a review and update of all palm resources at the CEB, including the collections and related databases, to ensure that all palm information is in line with modern taxonomic understanding of the family. By working systematically through all these palm resources, I was afforded a unique opportunity to evaluate the palm collections with the intention of improving the accuracy and accessibility of all palm information and identifying any important gaps in the Collections and associated data.

Over the 150 years of their existence new accessions to the collections have been accumulated in an eclectic and nonsystematic manner. As botanists and others travelled the world in search of new plants, they collected artefacts and other economic botanical data alongside herbarium material and therefore it is not surprising that palm species across the family are unevenly represented by specimens in the collections. Certain genera and species are well represented, in some cases excessively so, but others are conspicuous by their absence. Typically, species with a long history of utilization and economic importance have been repeatedly collected. For example, there are many (very similar) specimens of *Areca catechu* (the betel nut), *Metroxylon* spp. (producing sago), *Demonorops* spp. (producing dragon's blood resin), *Elaeis guineensis* (oil palm), *Cocos nucifera* (coconut), and *Phoenix dactylifera* (date palm). Similarly, unusual, eccentric, or rare species are also well represented. For example, there are multiple accessions of the huge fruit and woven artefacts from the leaves of the double coconut (*Lodoicea maldivica*) from the Seychelles. However, the degree to which palm species are represented in the collections does not always reflect



1–4. A variety of uses of *Hyphaene* (douw palms). *H. thebaica* (1) buttons made in Sudan from sliced endosperm used as vegetable ivory (donated 1924), (2) a medicinal powder made in Africa from ground doum nuts used to treat foot and tooth ailments (donated in 1915), (3) a toy made in Nubia (Egypt) from two doum fruit (donated in 1927); and *H. petersiana*, (4) a hat made in Yemen from the split leaves (donated in 1997).

their economic importance relative to other species. Most notably, species of the rattan genera are poorly represented by artefacts, despite their immense importance throughout southeast Asia. In general, rattan species are represented in the collections by lengths of raw cane with little associated ancillary information. Many of these specimens are of doubtful importance because they cannot be identified to species. The collections in no way reflect the wide range of rattan products in existence, nor the diverse technical and cultural knowledge associated with their manufacture.

Nevertheless, of the 189 palm genera currently accepted (J. Dransfield, personal communica-

tion), 125 are represented by specimens in the collections. The absence of some of the 65 genera is explained by the fact that uses have not yet been recorded for them; however, there are other genera for which uses are well-known but no representative specimens have ever been collected. This is a reflection of the manner in which the economic botany specimens have been collected over the years.

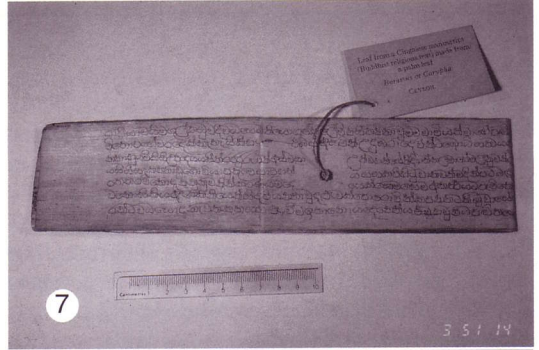
Collection of Economic Botany Specimens

Traditionally, specimen collection at Kew has been determined by taxonomic criteria rather than those of economic botany, such that eco-



5. A vegetable ivory model of a temple (donated in 1865 and of unknown origin) carved out of the nuts of *Phytalephas macrocarpa*.

conomic botany accessions have been seen as “extras” rather than primary research foci in their own right. Recent years have seen a massive increase in economic and ethnobotanical research, perhaps due in part to the increased global awareness of the importance of, and links between, biological and cultural diversity. This shift in focus may herald changes in the specimen collection criteria such that the specific collection of economic botany specimens is given the important status it deserves. Limited resources dictate that all new accessions are specifically collected to satisfy criteria as defined by research foci. The recent review of the palm collections in the CEB has identified taxonomic and geographical gaps in the collections and there now exists a “collection hit list” of those genera and species not represented in the collections by artefacts. This list will be of use to



6–8. 6. A box (donated in 1873) woven in the Seychelles from the finely split petiole of the leaves of *Lodoicea maldivica*. 7. Leaflet strips of the palmyra palm (*Borassus flabellifer*) used as the pages of a Hindu book from India. 8. A necklace made of date palm (*Phoenix dactylifera*) flowers strung on thin strips of date palm leaflets, excavated from a grave at Hawara in Egypt and dating to the Graeco-Roman period (donated in 1888).

any palm botanist or ethnobotanist on future collecting trips.

Before advocating an increase in the collection of economic botany specimens, there are two key issues that must be raised. First, it is important that collection criteria and methods are defined and standardized to ensure that all new

artefact collections are accompanied by notes, photographs or drawings, vernacular names, and details of utilization. This kind of information markedly increases the research value of an artefact. Second, herbarium specimens acting as identification vouchers are, ideally, collected with new artefact items. Voucher specimens can be used to check the taxonomic identity of those plants used to make an artefact and they both validate and add research value to any collection. Where the collection of herbarium voucher

specimens is not possible then identification of the plants used to make an artefact is dependent entirely on the quality of information gathered at the time of collection.

[Hew Prendergast, the leader of the CEB at Kew, is currently formulating a collecting policy for the Economic Botany Collections at Kew (of which palms are only a small but significant part) and would welcome comments on this paper.]

PALM LITERATURE *(Continued from p. 139)*

Certain other species of palm are affected lethally by LY-like diseases, although the sequence of symptoms may be different from those seen in coconut; particularly susceptible are *Veitchia merrillii* and most species of *Pritchardia* which have been used in LY research, notably determination of the vector, and should be considered for inclusion in resistance trials.

The host range is not the same for all the LY-like diseases. In particular, the Malayan Dwarf, which has been shown to have high resistance against Caribbean LY, appears to be fairly susceptible to LY-like diseases in Africa. In fact, Eden-Green states, "Strains of the pathogen may vary in their virulence to different palm species and host range studies would be a useful way to characterize them." It is also of interest that the Tanzanian Tall coconut appears to have geographic strains that show some disease tolerance, whereas other strains are very susceptible.

The phytoplasma cannot be cultured outside the palm. If phytoplasmas can exist in the osmotic pressure of palm phloem, it is hardly strange that they cannot be cultured at ambient pressure. I happily remember an ICLY conference where Harries issued each participant with an inflated balloon to demonstrate this. Axenic culture of LY-like phytoplasmas would enable us, among other things, to test routinely the resistance of young plants by inoculation, with great advantage to farmers. This might be expensive but surely warranted for palms that may live and produce for 50 years or more.

Large-scale multiplication of resistant palms for eventual planting by farmers would also be possible if cloning of the coconut could be achieved. The research at London University,

which has been proceeding for some years, has made progress recently, although only with zygotic tissue, and "it is unlikely that commercial production could be developed within at least five years."

DNA probes and polymerase chain reaction assays have rendered our knowledge of LY-like diseases much more specific. LY in different Caribbean countries has been shown to be caused by the same phytoplasma, which is different from the phytoplasmas in LY-like diseases in Africa; phytoplasmas from East Africa appear to be similar to those in West Africa. Non-LY phytoplasmas in putative insect vectors can be distinguished from LY phytoplasmas. We may assume for the moment that host susceptibility is the same for the same phytoplasma. If local environmental influences resistance levels of different coconut strains differently, it seems that this can at present be determined only by field exposure to the disease.

Control of LY-like diseases means reducing the percentage of palms affected on a permanent basis since there is no recovery as there might be from a leaf-spot, although Harries noted a small number of Panama Tall palms and their hybrids in Jamaica, which temporarily partially recovered. Removal of palms with symptoms has been tried as a disease control in some countries without any clear effect, probably because of the long incubation period. Tetracycline has been used in several countries to implicate phytoplasmas as the cause of LY-like diseases, but only in Florida as on-going protection of amenity plants by licensed operators. Insecticidal control of the vector also is to some extent effective but not practical. Current research in Florida seeks lawn

(Continued on p. 148)