Brittonia, 34(4), 1982, pp. 463–477.

PALM TAXONOMY IN BRAZILIAN AMAZÔNIA: THE STATE OF SYSTEMATIC COLLECTIONS IN REGIONAL HERBARIA[1]

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Balick, Michael J. (New York Botanical Garden, Bronx, NY 10458), Anthony B. Anderson, and Marlene Freitas da Silva (Instituto Nacional de Pesquisas da Amazônia, 69.000 Manaus, AM, Brazil). Palm taxonomy in Brazilian Amazônia: The state of systematic collections in regional herbaria. Brittonia 34: 463–477. 1982.—Despite their economic and ecological importance, Amazonian palms have been largely neglected by contemporary taxonomists. The resulting confusion at the specific level is a serious impediment to research efforts by specialists in other fields. To assess the state of systematic collections presently available in Amazônia, we conducted a survey of the palm specimens in three Brazilian herbaria (MG, IAN and INPA). Twelve criteria were utilized to measure the quality of the specimens. We found that most of the 897 specimens are reasonably complete in a physical sense, but a large proportion lack crucial information on their labels. Curating facilities are in serious need of improvement, as is evident from the significant (26%) percentage of specimens found to be in an unreasonable state of preservation. A checklist of the 232 currently recognized palm species in Brazilian Amazônia shows that 145 (62.5%) are not represented by identified specimens, and that the representation which does exist lacks depth. To improve the quality and representativeness of collections in regional herbaria, we suggest procedures for collecting and storing palms as well as policies designed to intensify collecting efforts in Amazônia.

Palms are a characteristic feature of the Amazonian landscape. Swamp forests dominated by palms cover large areas of the Amazon delta and occur along rivers and streams throughout the region. In the upland rain forests, palms exhibit their greatest diversity and are almost invariably abundant, especially in the lower strata. Many species serve as sensitive indicators of soil conditions. Although most palms disappear as primary forests are cleared, a number of fire-resistant species invade secondary sites, forming monospecific stands which are currently spreading over extensive areas of Amazônia.

Largely as a result of their predominance in regional ecosystems, palms play an integral, often crucial role in the lives of people throughout Amazônia. An astonishing array of subsistence products are provided by palms, including shelter, clothing, foods, beverages, oils, protein from palm-feeding larvae, charcoal, kitchen utensils, tools, weapons, bait, hammocks, baskets, fishing nets, brooms, ornaments, cosmetics, toys, medicines, and magic (Moore, 1973). In addition to their role in subsistence economies, palms provide commercial products such as fibers, vegetable oils, edible fruits, beverages, palm hearts, and flavorings.

Yet when one considers the vast and highly diversified resource base that palms represent, the impact of Amazonian palms on the regional economy is surprisingly small. Few of the most promising economic species (Table I) are actually domesticated, and virtually none has been introduced into large-scale plantations. Palm products continue to be gathered from wild sources, resulting in low yields at relatively high costs. As population increases throughout Amazônia, extractive types of agricultural production are becoming less viable. For example, in many

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[1] In accordance with the agreement made with the "Conselho Nacional de Desenvolvimento Científico & Tecnológico—CNPq," covering scientific research in Brazil, a report of this research, in Portuguese, will be published in *Acta Amazonica*.

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TABLE I
UNDEREXPLOITED AMAZONIAN PALMS WITH PROMISING ECONOMIC POTENTIAL

Scientific name	Vernacular name	Chief economic uses
Astrocaryum jauari	jauarí	oil, palm heart
Astrocaryum murumuru	murumurú	oil, oily fruit
Astrocaryum tucuma	tucumã	oil, oily fruit
Astrocaryum vulgare	tucumã	oil
Bactris gasipaes	pupunha	starchy fruit, palm heart
Elaeis oleifera	caiaué	oil, useful for hybridization with *Elaeis guineensis*
Euterpe oleracea	açaí do Pará	oil-rich beverage, sherbet, palm heart
Jessenia bataua	patauá	oil, oil-rich beverage, high quality protein pulp
Leopoldinia piassaba	piaçava	fiber
Mauritia flexuosa	burití	fiber, oil, oil-rich beverage, sherbet
Oenocarpus bacaba	bacaba	oil, oil-rich beverage
Oenocarpus distichus	bacaba	oil, oil-rich beverage
Orbignya barbosiana	babaçu	oil, fuel, animal feed and many other uses

areas in Amazônia, gatherers of palm heart have eradicated natural stands of *Euterpe oleracea* ("açai") and *Astrocaryum jauari* ("jauarí"), while cattle ranches in Maranhão are presently supplanting forests of the oil-producing "babaçu" palm (one or more species of the genus *Orbignya*).

The first step toward rational utilization of Amazonian palms is a knowledge of what species have economic potential and where they occur. Yet it is precisely at the species and population levels that knowledge of Amazonian palms is most limited. Although a number of classic scientific works concerning palms were produced during the last century (Martius, 1823–50; Wallace, 1853; Spruce, 1871; Drude, 1882, 1887; Barbosa Rodrigues, 1898a, 1898b), Amazonian palms have been generally neglected by contemporary taxonomists and most of the regional genera are currently in drastic need of revision.

The ultimate sources of information on Amazonian palms are represented by botanical specimens contained in herbaria throughout the world. Correctly identified botanical specimens in a herbarium are most frequently utilized to determine the name of an unknown plant species; this provides access to additional information from other herbaria and the literature. From the study of botanical specimens the diagnostic features and variability of a species are defined—both prerequisites for species recognition in the field. Specimens also provide information concerning geographic distribution, habitat requirements, floral biology, and phenology of a species; such information often proves invaluable in locating productive populations and in establishing breeding programs.

Like their representatives in the wild, the palm specimens in Amazonian herbaria constitute a neglected resource of considerable value. This paper assesses the state of palm collections in the major Amazonian herbaria, includes a checklist of species known to occur in the region, and provides suggestions as to how these collections can be improved.

Methods

A survey was made of the palm specimens in the three major herbaria of Brazilian Amazônia:

1. Museu Paraense Emilio Goeldi (MG), Belém. Established in 1895, the herbarium of the Museu Goeldi currently houses ca 75,000 botanical specimens.

2. Empresa Brasileira de Pesquisas Agropecúarias (IAN), Belém. The herbarium of EMBRAPA is located on the grounds of the Centro de Pesquisas Agropecúarias do Trópico Úmido (CPATU). This herbarium was founded in 1940 and contains ca 185,000 botanical specimens. It was formerly known as the Instituto Agronômico do Norte.

3. Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus. The herbarium of INPA was established in 1954 and currently contains ca 107,000 botanical specimens.

A total of 897 palm specimens[3] in the three herbaria were examined. Twelve criteria were utilized to assess the quality of the specimens. A quality index was assigned to each specimen based on the percentage of criteria that were adequately met. The 12 criteria are as follows:

1. *Leaf apex in pinnate-leaved palms; leaf hastula in palmate- or costapalmate-leaved palms.* The apical pinnae can be fused in a distinctive way and have dimensions altogether different from the middle pinnae. The hastula, or ligule as it is sometimes known, often varies in shape and size and can provide some element of distinction at the specific level. Adequate documentation of these materials provides the taxonomist with a more complete picture of the specimen.

2. *Leaf pinnae and at least a portion of the rachis in pinnate-leaved palms; leaf segments in palmate-leaved palms.* These materials are often useful for making generic and specific determinations. For example, presence or absence of peltate trichomes on the pinnae and rachis can be used to separate the closely related genera, *Jessenia* and *Oenocarpus.* Flavonoids and other secondary compounds contained in leaf pinnae and segments are increasingly utilized for deducing taxonomic relationships in palms (cf. Balick, 1980).

3. *Flowers or fruits, or both.* Flowers, and to a lesser degree fruits, usually contain the most essential criteria for systematic identification in palms, both at the generic and specific level. For example, male flowers are crucial for separating the Cocosoid genera *Attalea, Maximiliana, Orbignya, Parascheelea,* and *Scheelea.* Fruit characters are useful in distinguishing the often-confused genera, *Iriartea* and *Socratea.*

4. *Flowering or fruiting axes, or both.* Morphology of the flowering or fruiting axis often provides important criteria for taxonomic identification. For example, Wessels Boer (1968) separated species of *Geonoma* on the basis of whether the inflorescence axis is spicate (*G. acaulis* and *G. piscicauda*) or branched (*G. deversa*).

5. *Supplementary material: bract, sheath, spines, wood sample, stem, and seedling.* These materials may be helpful in identification, depending on the taxa in question. For example, the peduncular bract provides useful criteria for distinguishing generic groups within the Cocosoid palms. At the specific level, characters of the leaf sheath help to distinguish *Thrinax parviflora* and *T. radiata* (Reed,

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[3] All three herbaria maintain separate fruit collections of palms. Many of the samples in these collections are not cross-referenced to corresponding herbarium sheets. Such unaccompanied specimens—which are essentially useless for taxonomic purposes—were excluded from the survey.

1975). In general, such supplementary materials are primarily useful in providing the taxonomist with a more complete picture of the specimen.

6. *Reasonable state of preservation.* This criterion was considered to be fulfilled if the specimen did not suffer from fungal or insect damage.

7. *Quantitative information on vegetative characters not apparent on the specimen.* Quantitative field measurements often preclude the need to collect entire organs. In the case of large palms such as *Manicaria saccifera,* with leaves well over 8 meters in length, the utility of field measurements is obvious.

8. *Quantitative information on reproductive characters not apparent on the specimen.* This information includes measurements of inflorescence and fruit dimensions. Data on reproductive characters are particularly useful in large palms such as *Mauritia flexuosa,* which bears inflorescences up to 2 meters in length. Field measurements of fruit sizes and weights provide valuable information on the range of variation within highly plastic palm species.

9. *Qualitative information on morphological characters not apparent on the specimen.* Colors of leaf, fruit, and indumentum often change upon drying or with chemical preservation. Field observations involving these characters are consequently of value.

10. *Information on habitat.* This includes data on altitude, substrate, vegetation type, and degree of habitat disturbance. Such data are especially useful in palms, as many species are limited to specific habitats and serve as ecological indicators. *Euterpe catinga,* for example, is limited to white-sand caatinga forests of the Rio Negro Basin (Wallace, 1853), and its specific habitat appears to be a useful criterion for distinguishing it from related species.

11. *Reasonably precise locale.* Information on locale is essential, especially if the specimen represents an undiscovered, rare, or endemic species. This criterion can only be evaluated somewhat subjectively: citation of local landmarks (e.g., towns, villages, rivers, or geologic formations), which could serve as reasonable guides for subsequent collectors, was considered sufficient.

12. *Vernacular names and uses.* All Amazonian palms are referred to by vernacular names and many have local uses. Vernacular names are helpful in relocating species populations, while ethnobotanical uses may indicate species of potential economic value.

While photographs are useful in palm taxonomy and often provide information vital for proper identification, their presence or absence in a collection was not considered as one of our criteria for specimen quality. Almost none of the collections had accompanying photographs. If photographs are taken, they are usually kept as separate material by the collector and thus generally unavailable for study. Some recent collectors do include black and white or color photographs with each palm collection in the herbarium, and we strongly recommend this as standard procedure in the future.

To assess how well the palm flora of Brazilian Amazônia is represented in regional herbaria, a checklist of species was compiled by consulting Dahlgren (1936) and Glassman (1972), as well as generic monographs cited in these works. In addition, the following works were consulted: Hawkes (1952), Moore (1969, 1972), Glassman (1970, 1977a, 1977b, 1977c, 1978a, 1978b), and Balick (1980). As most of the palm genera of Brazilian Amazônia require revision, our checklist is tentative and must not be construed as an absolute taxonomic judgment on our part. The checklist is confined to those species reported to occur within the Brazilian Amazon region. The northern and western boundaries of the region are defined by international frontiers; the southern and eastern boundaries are defined by the limits of Amazon forest as determined by Soares (1953) (Fig. 1).

FIG. 1. Map of Brazilian Amazônia. After Soares (1953).

Results

Quality of Collections

Table II summarizes data on the quality of palm specimens in Amazonian herbaria. Frequencies of the first six criteria, which involve physical attributes of the specimens, are relatively high. These data indicate that the formidable obstacle of obtaining reasonably complete palm specimens has been largely overcome. Conversely, frequencies of the final six criteria are relatively low, indicating that the far less demanding task of providing adequate information on specimen labels has often been neglected. However, there is evidence to suspect that this problem is being resolved. Table II shows that the mean index of specimen quality is considerably higher in the INPA herbarium and is largely due to more complete information on the specimen labels. INPA houses a greater proportion of recent specimens than the other two herbaria, which suggests that contemporary botanists

TABLE II

TOTAL NUMBER, NUMBER AND PERCENTAGE IDENTIFIED TO GENUS AND SPECIES, AND SPECIMEN QUALITY OF PALM COLLECTIONS IN AMAZONIAN HERBARIA

Herbarium	Total number of palm specimens	Number of specimens identified to:		Number and percentage of specimens fulfilling each criterion of specimen quality[a]				
		Genus	Species	1	2	3	4	5
MG	220 (100%)	214 (97.3%)	140 (63.6%)	176 (80%)	198 (90%)	188 (85.5%)	190 (86.4%)	154 (70%)
IAN	398 (100%)	349 (87.7%)	134 (33.7%)	317 (79.6%)	349 (87.7%)	316 (79.4%)	324 (81.4%)	271 (68.1%)
INPA	279 (100%)	249 (89.2%)	173 (62%)	195 (70%)	277 (99.3%)	236 (84.6%)	229 (82%)	229 (82%)
Total	897 (100%)	812 (90.5%)	447 (49.8%)	688 (76.7%)	824 (91.9%)	740 (82.5%)	743 (82.8%)	654 (72.9%)

[a] Key to criteria for specimen quality: 1 = leaf apex or ligule; 2 = leaf pinnae and rachis, or leaf segments; 3 = flowers or fruits or both; 4 = flowering or fruiting axes or both; 5 = supplementary material; 6 = reasonable preservation; 7 = quantitative data on vegetative characters; 8 = quantitative data on reproductive characters; 9 = qualitative data on morphological characters; 10 = habitat data; 11 = locale; 12 = name(s) and uses. Further explanation in text.

are increasingly aware of the need for extensive field annotations when collecting palms.

Representativeness of Collections

Appendix I provides a tentative checklist of palm species in Brazilian Amazônia. Of the 232 regional species, only 89 (38.4%) are represented by identified specimens in the major Amazonian herbaria. Probably a much higher percentage of regional species are in fact represented by unidentified specimens: as shown in Table II, only 447 (49.8%) of the 897 palm specimens in Amazonian herbaria are identified to species. This is primarily due to the lack of up-to-date generic revisions within the family. While Amazonian palms remain poorly defined at the specific level, clear-cut generic limits are easily recognized, as indicated by the relatively high proportion (90.5%) of specimens identified to genus (Table II).

The representation which does exist in the regional herbaria lacks depth. Of the 89 species represented by identified specimens (Appendix I), 57 (64%) have three or fewer specimens. Likewise, of the 13 species listed in Table I, nine (69%) are represented by three or fewer specimens, indicating that potentially economic species have been neglected as well.

Discussion

The results of our survey indicate that both the quality and representativeness of palm specimens in Amazonian herbaria could be significantly improved. Because of the physical difficulty in handling palm materials, non-specialists tend to avoid collecting this family. Those that do collect may fail to recognize that palms require special procedures for collecting and storage. Below we present some suggestions for improving the quality and representativeness of palm specimens in Amazonian herbaria.

Collecting Procedures

The best overall strategy for collecting palms is to attempt to capture a "picture" of the specimen which is as complete and biologically accurate as possible. Palms are often bulky plants and for practical purposes only portions of diagnostic

TABLE II
CONTINUED

Herbarium	Number and percentage of specimens fulfilling each criterion of specimen quality (cont.)							Mean index of specimen quality
	6	7	8	9	10	11	12	
MG	63 (28.6%)	61 (27.7%)	2 (0.9%)	49 (22.3%)	102 (46.4%)	99 (45%)	79 (35.9%)	51.6 ± 29.9%
IAN	331 (83.2%)	172 (43.2%)	12 (3%)	178 (44.7%)	223 (56%)	149 (37.4%)	112 (28.1%)	57.6 ± 26.7%
INPA	270 (96.8%)	232 (83.2%)	12 (4.3%)	221 (79.2%)	232 (83.2%)	175 (62.7%)	204 (73.1%)	75.0 ± 24.5%
Total	664 (74%)	465 (51.8%)	26 (2.9%)	448 (49.9%)	557 (62.1%)	423 (47.2%)	395 (44%)	61.6 ± 24.3%

materials such as leaves and reproductive structures should be collected. Lack of material must be compensated by considerable quantitative and qualitative data (including photographs) obtained in the field. In general, as dimensions of the palm increase, greater amounts of field data are required.

Prior to collecting, the entire specimen should be photographed to illustrate distinctive characteristics. Large palms require felling to obtain the best material. One should note the length and diameter of the stem, and whether it is solitary or caespitose. Either a complete section (in the case of small palms) or a quartered section of the stem provides useful information on morphological characters such as the presence and arrangement of prominent internodes, spines, adventitious roots, and persistent sheaths. In the case of heavily armed stems (e.g., *Astrocaryum*), a separate collection of spines should be made and described (i.e., color, size, hardness, and position on stem). Presence, dimensions, and color of aboveground adventitious roots should also be recorded.

Leaves should be counted and the lengths of their component parts (i.e., sheath, petiole, and rachis) measured. The number, color, and texture of pinnae (or segments) should be noted. The best-preserved leaf is then chosen for pressing. A large leaf must be cut into sections. If the leaf is pinnate, this is accomplished by separating sections consisting of the apex, middle, and base of the rachis; to reduce bulk, the pinnae can be removed from one side by clipping just above the point of insertion, and the remainder folded in accordian fashion. If the leaf is palmate or costapalmate, most of the segments should be removed and the remainder folded. A section of the petiole and sheath, with indumentum and spines (if present), should also be included. In the case of smaller palms, the entire leaf can often be collected. Qualitative and quantitative notes should still be made, although usually in less detail than in larger, more fragmentary specimens. Photographs of the entire leaf, with a person or rule for scale, allow the specialist to note such details as pinnae arrangement and angle of their insertion into the rachis.

As juvenile palms rarely possess leaves identical to those of the adult stage (Tomlinson, 1961), collection of seedlings provides useful information on leaf development and growth.

Due to their large dimensions, many palm inflorescences also require special collecting procedures. The complete inflorescence, including accompanying bract(s) and prophyll, should be photographed and described in detail. The description should include the inflorescence's position on the stem in relation to the leaves (i.e., infra-, inter-, or suprafoliar), qualitative data (e.g., color and texture of rachillae), and quantitative data (e.g., length of peduncle and rachis, length and number of secondary axes, etc.). In the case of bulky inflorescences, only repre-

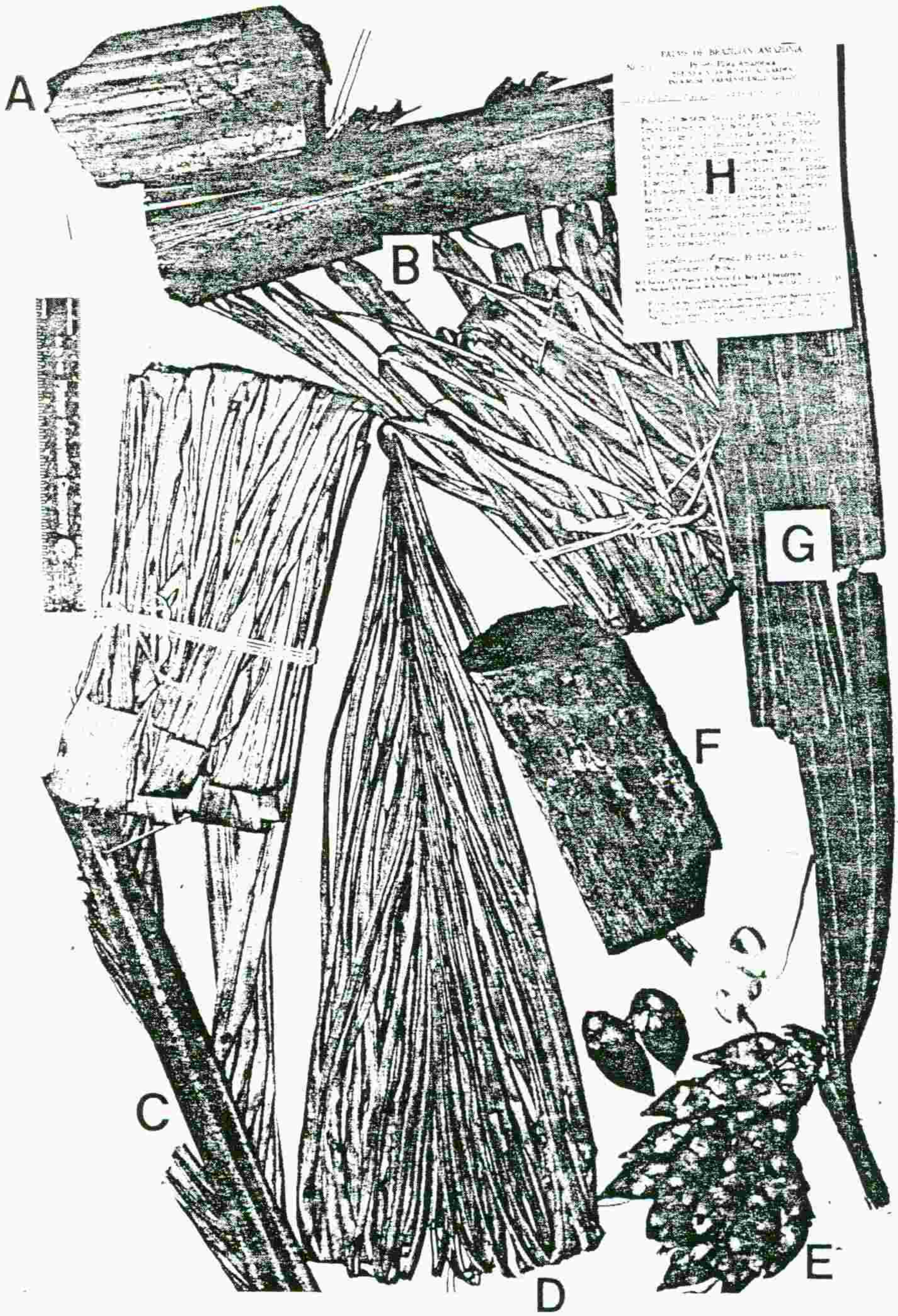

FIG. 2. Example of a complete herbarium collection. Specimen of *Maximiliana maripa* (Corr. Serr.) Drude, collected along the Santarém–Cuiabá Road, BR 163, Km 890 from Santarém, Pará, 10 Nov 1977, *M. J. Balick et al. 920*. Portions represented are: A. Section of petiole. B. Lowermost section of leaf rachis with basal pinnae. C. Midsection of leaf rachis with folded pinnae (note that pinnae on left side of rachis are removed and only their bases remain to indicate position of insertion into the rachis). D. Apex of leaf. E. Section of fruiting panicle, several rachillae and sample of fruit. F. Stem section. G. Inflorescence bracts, sliced along their length. H. Herbarium label.

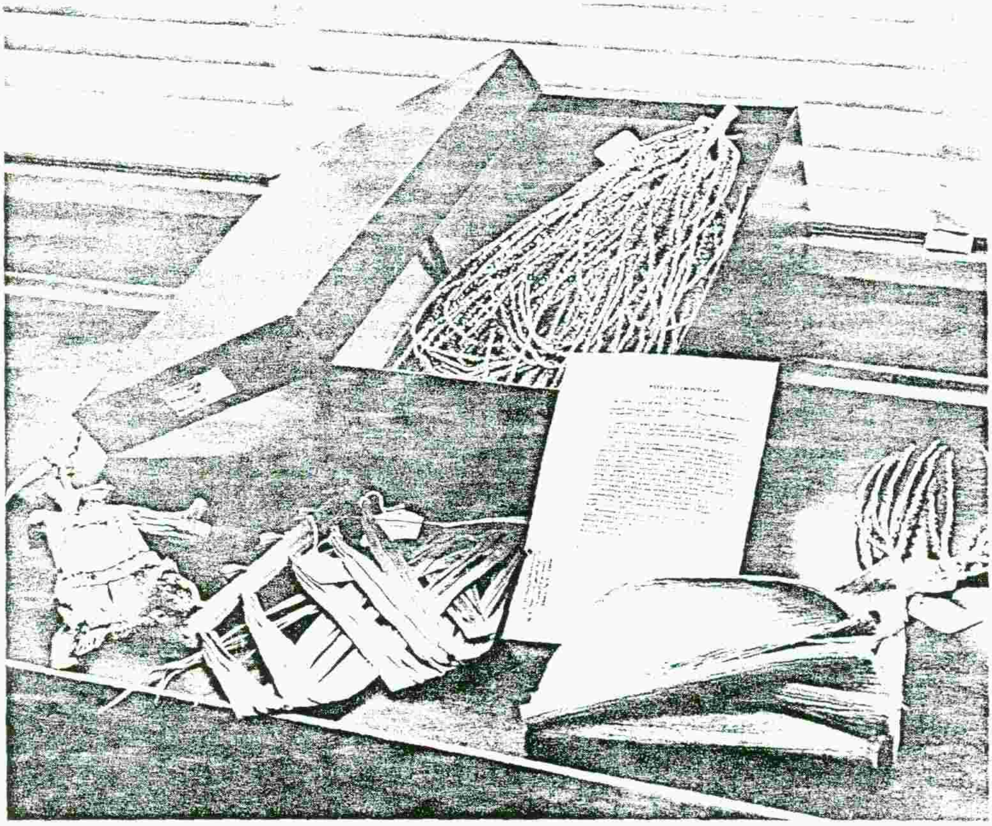

FIG. 3. Individual palm specimen stored in box at the L. H. Bailey Hortorium, Ithaca, New York. Note that each piece is individually ticketed with collector's name to prevent confusion during use. Photo: courtesy of L. H. Bailey Hortorium.

sentative portions of all axes need be collected; the rest may be removed by clipping. Such inflorescences are often impossible to fit into a press, in which case they should be tagged and stored separately until drying. Lengthy sections may require coiling before being dried in order to fit on an herbarium sheet or in a specimen box. Fruits and flowers (including staminate and pistillate, if separate) should also be collected. Color and odor of flowers are noted and, if possible, floral visitors collected and stored separately. As the size, shape, and color of fruits may change upon drying, quantitative data, photographs, and spirit collections of fruits are useful. Inflorescence bracts should be photographed and, if large, cut down to size for pressing or direct drying. As is the case with other organs, the color of inflorescence and bract indumentum can change upon preservation and should be recorded.

Finally, field notes on habitat, population density, local names, and uses make the specimen of multidisciplinary value.

As an aid to future collectors, Figure 2 shows a complete herbarium collection with its various components.

Storage Procedures

Of the 897 palm specimens in Amazonian herbaria, 233 (26.0%) were found to be in a less than reasonable state of preservation (Table II). Many of the specimens in this group were over 50 years old and usually suffered from fungal

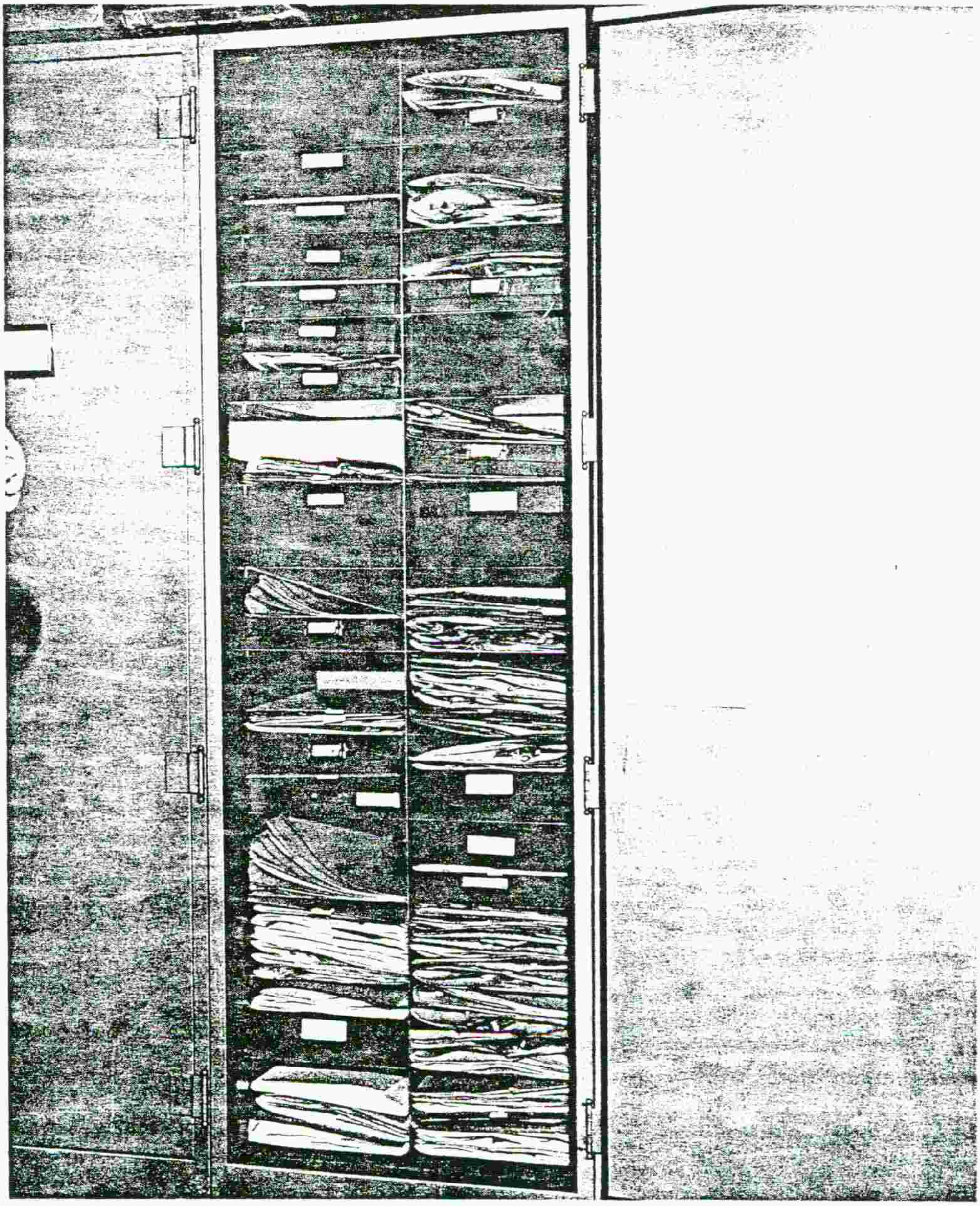

FIG. 4. Method of curating boxed palm collections as well as those in paper folders at the L. H. Bailey Hortorium. Photo: courtesy of L. H. Bailey Hortorium.

attack. The need for maintaining collections in a proper state of preservation cannot be overstressed. Many historically important palm specimens have been damaged or destroyed due to neglect. For example, the type collections made by Barbosa Rodrigues are no longer extant, thus requiring the use of lectotypes to represent numerous species (Prance, 1972). Due to high temperatures and humidity throughout the year, special precautions must be made for storage of specimens in the humid tropics. Suggested procedures for the handling of botanical material (including palms) in these regions are given in *Manual for Tropical Herbaria* (Fosberg & Sachet, 1965).

Virtually all of the palm collections in Amazonian herbaria are mounted on conventional herbarium sheets, in precisely the same fashion as specimens from other families. In the case of bulky palm specimens which require several sheets, this method presents at least two disadvantages: it is comparatively expensive in terms of supplies and labor, and it makes subsequent inspection of the specimen considerably more difficult. A more efficient method for storing bulky palm specimens is to use cardboard boxes. The entire collection is placed loosely in the box, thus eliminating the need for mounting while facilitating access by the specialist. Dried fruits (as well as spirit collections) can also be stored in the box, thus eliminating the expense of maintaining a separate fruit collection, and thereby minimizing the possibility of losing or misplacing portions of a collection. This method has been used most successfully in the world's largest palm herbarium, the L. H. Bailey Hortorium (Figs. 3, 4). Elongated cases, a meter or more wide with flat shelves—such as those used to store pressed animal skins in some natural history museums—can be used for the storage of bulky palm inflorescences and bracts that do not fit into boxes. Alternatively, large pieces of inflorescence should be labelled and stored on top of the cases that contain their vegetative portions.

It is clear that accelerated research on Amazonian palms is desperately needed, especially as the majority of the species are not represented in regional herbaria. Domestication and further utilization of those species with economic potential (Table I) could lead to a declining regional dependence on external sources of food, clothing, shelter, and energy. But Amazonian palms have other potential uses as well. They are able to colonize inhospitable environments (e.g., *Euterpe, Jessenia,* and *Mauritia* spp. on swampy sites; *Maximiliana* and *Orbignya* spp. on abandoned, nutrient-poor sites), thus serving a potentially important function in land management and reforestation. Throughout Amazônia, palms represent an ecologically important component of rain forest ecosystems. Their role in the maintenance and long-term stability of these ecosystems can at present only be guessed: possibilities include year-round maintenance of animal communities (Zacher, 1952; Costa Lima, 1967–68; Janzen, 1971, 1972; Bradford & Smith, 1977; Uhl & Moore, 1977; Vandemeer et al., 1979; Kiltie, 1981) and promotion of nutrient cycling (cf. Furley, 1975). The role of palms is by no means limited to terrestrial ecosystems, as is evident from the nutritional dependence of the economically important "tambaquí" (*Colossoma macropomum*) and other fishes on the fruits of *Astrocaryum jauari* (Goulding, 1980). The central role of palms in the lives of indigenous peoples (cf. Wallace, 1853; Anderson, 1978; Balick, 1979) provides clues as to how stable forms of agriculture can be developed in the humid tropics. Inventorying and providing the correct nomenclature for the species, establishing their limits of variation, and preserving botanical collections for future use are important first steps towards realizing the extraordinary potential of Amazonian palms.

Acknowledgments

This paper, which we hope will serve to initiate other studies in Amazonian palms, is gratefully dedicated to our late mentor Professor Harold E. Moore, Jr., whose lifelong study of palm biology is of great inspiration to all students of this remarkable plant family. Valuable comments on this manuscript have been offered by Scott A. Mori, James L. Luteyn, Natalie W. Uhl, and Elizabeth Taylor. Sidney F. Glassman kindly provided clarification on the localities of some of the Cocosoid palms listed in Appendix I.

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Appendix I

Preliminary Checklist of Palms in the Brazilian Amazon Region[4]

Acrocomia eriocantha Barb. Rodr.
A. microcarpa Barb. Rodr.
A. wallaceana (Drude) Becc. (IAN–4)
Aiphanes ernesti (Burret) Burret
Astrocaryum acaule Mart. (INPA–5)
A. aculeatum Meyer (IAN–1)
A. caudescens Barb. Rodr. (IAN–2)
A. chambira Burret
A. giganteum Barb. Rodr.
A. gynacanthum Mart. (IAN–1; INPA–1)
A. horridum Barb. Rodr. (IAN–1)
A. huebneri Burret
A. jauari Mart. (IAN–1; INPA–1)
A. javarense (Trail) Trail ex Drude
A. macrocarpum Huber (MG–1)
A. manaoense Barb. Rodr.
A. munbaca Mart. (INPA–5)
A. murumuru Mart. (MG–1; IAN–1)
A. paramaca Mart.
A. rodriguessii Trail
A. sciophilum (Miq.) Pulle
A. tucuma Mart. (INPA–1)
A. ulei Burret
A. vulgare Mart.
A. yauaperyense Barb. Rodr.
Attalea ferruginea Burret
Bactris acanthocarpoides Barb. Rodr. (INPA–2)
B. acanthospatha (Trail) Trail ex Drude
B. actinoneura Drude & Trail ex Drude
B. amoena Burret
B. angustifolia Damm.
B. aristata Mart.
B. armata Barb. Rodr.
B. arundinacea (Trail) Drude (INPA–1)
B. atrox Burret
B. balanophora Spruce (INPA–1)
B. bella Burret
B. bicuspidata Spruce
B. bidentula Spruce
B. bifida Mart.
B. bijugata Burret
B. campestris Poepp. ex Mart.
B. capillacea (Trail) Trail ex Drude
B. capinensis Huber
B. chaetochlamys Burret
B. chaetospatha Mart.
B. chloracantha Poepp. ex Mart.
B. chlorocarpa Burret
B. concinna Mart. (MG–2)
B. constanciae Barb. Rodr. (MG–1; IAN–2)
B. curuena (Trail) Drude
B. cuspidata Mart. (INPA–1)
B. dahlgreniana Glassman
B. elatior Wallace
B. elegans Barb. Rodr. & Trail ex Barb. Rodr.
B. ericetina Barb. Rodr.
B. erostrata Burret
B. eumorpha Trail
B. exaltata Barb. Rodr.
B. fissifrons Mart.
B. floccosa Spruce
B. formosa Barb. Rodr.
B. gasipaes H.B.K.[5] (IAN–1; INPA–1)
B. gastoniana Barb. Rodr.
B. gaviona (Trail) Trail ex Drude
B. geonomoides Drude (MG–6)
B. gracilis Barb. Rodr.
B. granariuscarpa Barb. Rodr.
B. hirta Mart.
B. hoppii Burret
B. huebneri Burret
B. humilis (Wallace) Burret (MG–1; IAN–5)
B. hylophila Spruce (IAN–1)
B. incommoda Trail
B. inermis Trail ex Barb. Rodr.
B. integrifolia Wallace (IAN–1)
B. interruptepinnata Barb. Rodr.
B. juruensis Trail
B. kuhlmannii Burret
B. lakoi Burret
B. lanceolata Burret
B. leptospadix Burret
B. littoralis Barb. Rodr.
B. longifrons Mart.
B. longipes Poepp. ex Mart.
B. macroacantha Mart.
B. macrocarpa Wallace (IAN–1)
B. major Jacq. (MG–1)
B. maraja Mart. (IAN–1)
B. maraja-acu Barb. Rodr.
B. megistocarpa Burret
B. microcalyx Burret
B. microcarpa Spruce
B. microspadix Burret
B. mitis Mart.
B. monticola Barb. Rodr.
B. multiramosa Burret
B. nemorosa Barb. Rodr.

[4] The herbarium in which collections are deposited is indicated following the species; numbers represent total collections of a particular species per institution.
[5] Only known in cultivation.

B. oligocarpa Barb. Rodr. & Trail ex Barb. Rodr.
B. ottostapfeana Barb. Rodr.
B. paucijuga Barb. Rodr.
B. pectinata Mart. (IAN–1)
B. penicillata Barb. Rodr.
B. piranga Trail
B. platyacantha Burret
B. platyspina (Barb. Rodr.) Burret
B. pulchella Burret
B. pulchra (Trail) Trail ex Drude
B. riparia Mart.
B. simplex Burret
B. simplicifrons Mart. (MG–1; IAN–12; INPA–10)
B. socialis Mart.
B. sphaerocarpa Trail
B. syagroides Barb. Rodr. & Trail emend. Trail
B. sylvatica Barb. Rodr.
B. tomentosa Mart. (IAN–2)
B. trailiana Barb. Rodr.
B. turbinata Spruce
B. turbinocarpa Barb. Rodr.
B. umbraticola Barb. Rodr.
B. umbrosa Barb. Rodr.
B. unaensis Barb. Rodr.
B. vexans Burret
Barcella odora (Trail) Drude (MG–1; IAN–4; INPA–1)
Catoblastus drudei Cook & Doyle
Chamaedorea depauperata Damm. (MG–1)
C. integrifolia (Trail) Damm. (MG–1; INPA–1)
C. pauciflora Mart. (MG–1)
Chelyocarpus chuco (Mart.) H. Moore (INPA–1)
C. ulei Damm.
Copernicia prunifera (Miller) H. Moore
Desmoncus brevisectus Burret
D. leptospadix Mart. (MG–3; INPA–1)
D. macroacanthos Mart.
D. macrodon Barb. Rodr.
D. mitis Mart.
D. nemorosus Barb. Rodr. (MG–1)
D. oligacanthus Barb. Rodr.
D. orthacanthos Mart.
D. philippianus Barb. Rodr.
D. phoenicocarpus Barb. Rodr.
D. polyacanthos Mart. (MG–2)
D. pumilus Trail
D. riparius Spruce
D. setosus Mart.
D. tenerrimus (Mart. ex Drude) Mart. ex Burret
Elaeis oleifera (H.B.K.) Cortes (IAN–2; INPA–1)
Euterpe catinga Wallace
E. controversa Barb. Rodr. (INPA–3)
E. jatapuensis Barb. Rodr.
E. longibracteata Barb. Rodr.
E. oleracea Mart. (MG–2; IAN–5; INPA–1)
E. precatoria Mart. (INPA–3)
E. roraimae Damm.
Geonoma acaulis Mart. (MG–9; INPA–4)
G. appuniana Spruce (MG–1; IAN–1)
G. arundinacea Mart. (MG–1)
G. aspidiifolia Spruce (MG–3; IAN–2; INPA–1)
G. baculifera (Poit.) Kunth (MG–3; IAN–3; INPA–1)
G. brongniartii Mart. (MG–2; INPA–3)
G. camana Trail
G. densiflora Spruce (INPA–1)
G. deversa (Poit.) Kunth (MG–6; IAN–4; INPA–14)
G. juruana Damm. (MG–1; INPA–1)
G. laxiflora Mart. (MG–4; INPA–3)
G. leptospadix Trail (MG–3; INPA–3)
G. macrostachys Mart. (MG–3; INPA–6)
G. maxima (Poit.) Kunth (MG–7; IAN–4; INPA–3)
G. multiflora Mart. (MG–6; IAN–1)
G. oligoclada Burret
G. oligoclona Trail (INPA–1)
G. pauciflora Mart. (MG–2; INPA–2)
G. piscicauda Damm. (INPA–1)
G. poiteauana Kunth
G. pycnostachys Mart. (MG–2; INPA–4)
G. spixiana Mart.
G. stricta (Poit.) Kunth (MG–1)
G. tamandua Trail (MG–1)
G. triglochin Burret
Hyospathe brevipedunculata Damm.
H. elegans Mart. (MG–3)
H. filiformis H. Wendl. ex Drude
Iriartea ventricosa Mart.
Iriartella setigera (Mart.) H. Wendl. (MG–5; IAN–18; INPA–34)
Jessenia bataua (Mart.) Burret (MG–8; IAN–4; INPA–2)
Leopoldinia insignis Mart.
L. major Wallace (MG–1)
L. piassaba Wallace (IAN–1)
L. pulchra Mart. (MG–5; IAN–9; INPA–4)
Lepidocaryum casiquiarense (Spruce) Drude
L. gracile Mart. (MG–1; INPA–3)
L. guainiensis (Spruce) Drude
L. macrocarpum (Drude) Becc.
L. tenue Mart. (MG–4; IAN–2; INPA–11)
Manicaria atricha Burret
M. martiana Burret (IAN–1; INPA–1)
M. saccifera Gaertn. (MG–3)
Mauritia aculeata H.B.K. (IAN–1; INPA–4)
M. campylostachys (Burret) Balick
M. carana Wallace (INPA–1)
M. duckei (Burret) Balick
M. flexuosa L. f. (IAN–2; INPA–2)
M. huebneri Burret
M. intermedia Burret
M. martiana Spruce (MG–1; IAN–1)
M. nannostachys (Burret) Balick
M. pumila Wallace
Maximiliana maripa (Corr. Serr.) Drude (MG–2; IAN–1; INPA–1)
Oenocarpus bacaba Mart. (IAN–3; INPA–2)
O. discolor Barb. Rodr.
O. distichus Mart. (MG–3)
O. macrocalyx Burret
O. mapora Karst. (MG–1)
O. minor Mart. (MG–4; INPA–3)
O. tarampabo Mart.
Orbignya barbosiana Burret (MG–2; IAN–1)
O. pixuna (Barb. Rodr.) Barb. Rodr. (IAN–1)

O. sabulosa Barb. Rodr.
O. spectabilis (Mart.) Burret (MG–1; INPA–5)
Parascheelea anchistropetala Dugand (IAN–1)
P. luetzelburgii (Burret) Dugand
Pholidostachys synanthera (Mart.) H. Moore
Phytelephas macrocarpa R. & P.
P. microcarpa R. & P.
Raphia taedigera Mart. (IAN–1)
Scheelea huebneri Burret
S. insignis (Mart.) Karst.
Socratea exhorrhiza (Mart.) H. Wendl. (IAN–1; INPA–1)
Syagrus cocoides Mart. (MG–2; INPA–1)
S. comosa (Mart.) Mart. (MG–1)
S. inajai (Spruce) Becc. (MG-4; IAN-3; INPA-4)
S. petraea (Mart.) Becc. (IAN–1)