

Alfred Russel Wallace and the Palms of the Amazon

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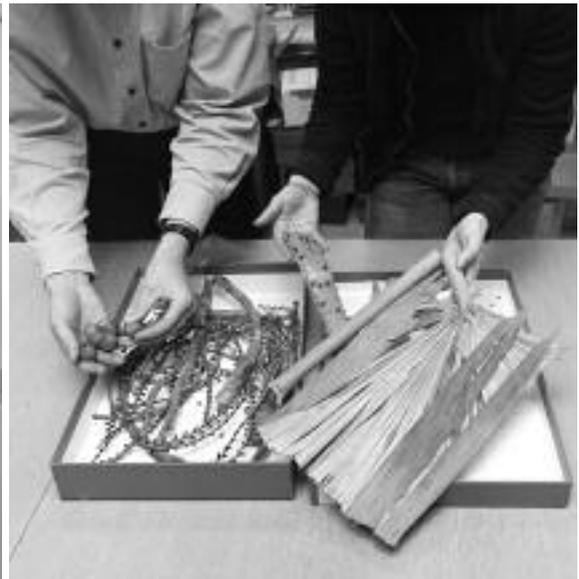
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Alfred Russel Wallace went to South America with Henry Walter Bates in 1848; both men intended to collect plants, but both rapidly chose to focus on insects and birds. Wallace returned to England in 1852; however, a fire on his ship destroyed all of his collections en route. Upon his return he published a small book on palms, based upon the few drawings he had rescued from the burning ship. We here demonstrate that Wallace also successfully dispatched a few specimens of Amazonian palms to Sir William Jackson Hooker at the Royal Botanic Gardens, Kew, for use in the Museum of Economic Botany, where they have lain largely unnoticed for many years. These specimens are not only the important physical evidence of Wallace's interest in palms, but are also exciting clues to his early development as a field naturalist.

Alfred Russel Wallace is best known for his meticulous collecting in the Malay Archipelago (Camerini 1996, Raby, 1996), for the eponymous Wallace Line (Camerini 1993, van Oosterzee 1997), and for his bombshell of a letter from the tiny island of Ternate outlining his theory of the origin of species that galvanized Charles Darwin into finally publishing his seminal masterpiece *Origin of Species* (Desmond & Moore 1991). While in Southeast Asia, Wallace collected zoological material, and his wonderful specimens of birdwing butterflies and birds of paradise were among the first to be available to enthusiasts and museums in Europe. Wallace's essay contained in the letter to Darwin was read at the Linnean Society of London on Thursday, July 1st, 1858, in

conjunction with a contribution on the same subject from Darwin, but neither man was physically present at the meeting. Darwin never strayed far from his home in Downe, Kent, and Wallace was still engaged in fieldwork in Southeast Asia.

Wallace was a first class observer and collector. His descriptions of bird and butterfly behaviour are without parallel, and his book about his experiences in Southeast Asia, *The Malay Archipelago* (Wallace 1869), is compulsive reading. But he did not jump straight from his profession as a surveyor in Middle England to being one of the great collectors of all time in the wilds of Borneo without practice – he had been in the field



1A (upper left). All of the palm specimens collected by Wallace and Bates laid out on table, with the authors and Kate Davis consulting *Palm Trees of the Amazon*; 1B (upper right). *Bactris maraja* Mart. (Kew # 38748); 1C (lower left). *Mauritella armata* (Mart.) Burret (Kew # 38782); 1D (lower right). A modern specimen of *Mauritella armata* (Mart.) Burret from the Kew Herbarium.

before, in Amazonia. In 1848, Wallace and his friend Henry Walter Bates decided to set off to explore the Amazon and to investigate the question of “the origin of species,” intending to collect and sell specimens in order to finance their adventure (Bates 1863, Wallace 1905). Before they left, they consulted widely in the scientific community of London, making frequent trips to the British Museum (today’s Natural History Museum) for advice on collecting butterflies, beetles and birds, and to the Royal Botanic Gardens at Kew for advice from the director, Sir

William Jackson Hooker, on the collection of plants. Hooker wrote a letter of introduction for both men to use in Brazil (Bates & Wallace 1848), which would be useful for opening doors that would otherwise be closed to two impecunious young Englishmen.

Wallace explored the Amazon and upper Rio Negro and Rio Uaupes for four years, reaching places where no European had ever been. Bates stayed for another seven years after Wallace had returned to England (Bates 1863, Beddell 1969), travelling as far as Rio Solimões while mainly

collecting butterflies and beetles. Many of Bates' collections are in the Entomology Department of the Natural History Museum in London; they remain among the first and finest from those parts of the world. Wallace too collected many insects and also birds, but the bulk of his collections met a quite different and regrettable fate.

After four years of collecting, largely alone or in the company of hired guides, Wallace decided to return to his family. He discovered that all of his collections had been impounded by Customs in Barra (present-day Manaus) and had not been sent on to be sold in England as he had wished. He reclaimed them, and quite ill with what was probably malaria, made his way down the Amazon to Pará (present-day Belem). He booked passage on the trading ship *Helen*, which was carrying a cargo of balsam of capivi, tree sap used in the manufacture of varnish. He was ready to return home, and hoped to see his friends and family before long. Halfway across the Atlantic, however, disaster struck. The *Helen* caught fire, probably due to irresponsible packing of the highly flammable balsam, and was beyond saving. All hands, including Wallace, evacuated to lifeboats and were eventually picked up many days afterwards – nearly out of drinking water and close to death. All Wallace's specimens and diaries were packed in the *Helen's* hold and so were lost.

As the ship was sinking, Wallace raced back to his cabin and grabbed a small tin box containing some drawings he was working on during the voyage, together with his watch and a few shirts. He left a large portfolio of sketches and most of his clothes – something he had trouble explaining to himself and others later (Wallace 1852, 1853b). The small drawings he saved were of fishes, native implements and of palms, with which he had become fascinated while in the forests of the Rio Negro. Once back in England, Wallace had to recover something more than the insurance his agent Samuel Stevens had taken out on his behalf, so he set about publishing some of his experiences (Sanders & Knapp in prep.). His book about his voyage, *Travels on the Amazon and Rio Negro* (Wallace 1853b), was written from memory – he had no notes to remind him of daily happenings. He published a few papers on the geography of the Rio Negro (Wallace 1853c), electric eels (Wallace 1853d), insects (Wallace 1854a, b) and, at his own expense, a small book about the palms of the Amazon and their uses (Wallace 1853a). The book was illustrated with lithographs prepared from his pencil sketches saved from the sinking of the *Helen*, and rather than complicated Latin botanical diagnoses, contained broad descriptions of each palm, focusing on the aspects of the plant easily

seen and appreciated by the non-specialist, along with accounts of their native uses and ecology. Whether or not Wallace collected botanical specimens in the Amazon has always been in doubt, partly because the loss of most of his Amazonian collections destroyed any possible evidence. However, he did collect some plants – but not specimens as botanists know them today.

In this paper, we catalogue the palm specimens held at the Royal Botanic Gardens, Kew. These palm specimens are among the very few plants Wallace collected either in the Amazon or in Southeast Asia (although the relatively small, but still incompletely documented, fern collections he made in Borneo are held both at Kew and the NHM), and as such are of considerable historical importance. The material sent to Hooker differs radically from today's typical palm herbarium specimens, but is the only solid evidence of Wallace's plant collecting in the Amazon. These specimens also comprise evidence upon which Wallace based his *Palm Trees of the Amazon*, in addition to his drawings rescued from the sinking *Helen*. Wallace's contribution to knowledge of the palms of the Amazon has occasionally been overlooked (but see Balick 1980, Henderson 1995, Kahn 1997). We hope that by elucidating the material he used to produce the book, his contribution can be properly appreciated.

Wallace the botanist

Natural historians have assumed that Wallace did collect specimens of palms, in the manner of a trained botanist (Henderson 1995, Prance 1999, G. Nelson pers. comm. 1999), and that they were of course all lost in the sinking of the *Helen*. However, there is ample evidence that Wallace and Bates soon gave up trying to collect plants (see below), collecting only a few specimens for Hooker's Museum of Economic Botany.

Wallace and Bates arrived in Pará in late May of 1848. They spent about a year together, travelling in the vicinity of Pará and up the Rio Tocantins, during which time they sent specimens back both to their agent Samuel Stevens, and to Sir William Hooker at Kew. In a letter dated August 20th, 1848, sent from Pará, Wallace told Hooker, "we send to you by the "Windson" from hence to Liverpool a box of dried specimens, principally palms & we trust they will arrive in good order & prove acceptable." These specimens were destined for use in the Museum and Hooker apparently had agreed to pay £10 plus freight costs for the specimens. The Museum's entry book at Kew records their arrival on 28th December 1848, as entry number 77-1848; "A box containing stems and leaves of palms as per list. also some pods and



2. Some of Wallace's drawings of palms (courtesy of the Council of the Linnean Society of London). A (upper left) *Leopoldinia major* Wallace; B (upper right). *Euterpe catinga* Wallace; C (lower left) *Leopoldinia piassaba* Wallace; D (lower right) *Mauritia carana* Wallace.

leaves." The term "pods" most likely refers to the large pod-like peduncular bract, which is present in one of the nine surviving specimens (Table 1).

Although leaf sheaths are present in some of the specimens, none of the specimens includes full leaf material. Perhaps the reference to "leaves" in

Table 1. Palm specimens collected by Wallace and Bates in Brazil now held in the Herbarium of the Royal Botanic Gardens, Kew.

Kew Catalog No.	Current Name	Description
38854	<i>Acrocomia aculeata</i> (Jacq.) Lodd. ex Mart.	Peduncular bract enclosing juvenile inflorescence
35050	<i>Acrocomia aculeata</i> (Jacq.) Lodd. ex Mart.	Inflorescence
35069	<i>Astrocaryum aculeatum</i> G.Mey.	Inflorescences
34981	<i>Astrocaryum gynacanthum</i> Mart.	Fruits
38748	<i>Bactris maraja</i> Mart.	Petiole
38868	<i>Bactris maraja</i> Mart.	Stem apex with leaf sheaths
35170	<i>Bactris maraja</i> Mart.	Stem apex with leaf sheaths
38749	<i>Euterpe oleracea</i> Mart.	Stem apex with leaf sheaths and inflorescences
38782	<i>Mauritiella armata</i> (Mart.) Burret	Stem apex with leaf sheaths and inflorescences

the Catalogue note refers to material that has perished in the century and a half since the specimens arrived at Kew. Alternatively, the "leaves" of the Museum entry could have been not palms, but ferns. In a postscript to his August letter Wallace wrote, "I send the few dried plants (a few hundred specimens) principally ferns. – You can perhaps dispose of them or allow what you consider them to be worth." Nothing is known of the fate of the fern specimens, as we have been unable to locate them in the collections at Kew. It is tempting to think that Hooker did exactly as Wallace suggested and disposed of them, although we have no evidence for this.

Hooker had opened his Museum of Economic Botany in 1847, and was actively accessioning material of economic value and interest for public display from all over the world. At that time he also maintained a private herbarium, which may have been the logical destination for Wallace's fern specimens. The public herbarium at Kew was not founded until 1852, and even then Hooker's herbarium was not incorporated until 1866, when it was purchased by the British Government after Hooker's death in 1865. Thus, Wallace's palms survived perhaps by being intended for public display, rather than being specimens of purely "scientific" value.

Later in his August 1848 letter to Hooker, Wallace stated, "We have hitherto found quite enough to do attending almost entirely to Insects only. – we are now commencing also at Birds so that it will be quite impossible to find time to make any thing of a general collection of plants," and again, "I fear I shall find no time to collect plants but shld I meet with any thing very curious I will endeavor to preserve it." It seems quite clear from this letter that Wallace did not intend to collect plants in any

comprehensive or coherent way during his four-year stay in Brazil, whatever his intentions may have been before leaving England. Yet, despite this concentration on birds and insects, Wallace's interest and imagination was quickly captured by the beauty and magnificence of the "virgin forest" (Wallace 1905), and the palms in particular drew his admiration:

"everywhere too rise the graceful Palms, true denizens of the tropics, of which they are the most striking and characteristic feature. In the districts which I visited they were everywhere abundant, and I soon became interested in them, from their great variety and beauty of form and the many uses to which they are applied." (Wallace 1853a, p. iii)

The collections made by Wallace and Bates and sent to Hooker are far from conventional in comparison to modern botanical specimens (Fig. 1A, B, C). To understand how they differ, we must provide some details of current herbarium methods. A herbarium is a botanical museum which houses preserved plant specimens for scientific purposes. A typical specimen consists of representative plant parts (e.g. leaves, stems and, ideally, both flowers and fruit) which are pressed and dried over a gentle heat source shortly after they have been collected. When a specimen is brought to a herbarium, it is usually mounted on a rectangular sheet of card which provides support to the specimen, space to attach both field notes and annotations, and which is readily filed away in a herbarium cupboard. There is some variation among institutions in the size of the sheets but in general, the size of the sheet limits the size of the specimen itself. Palms defy the standard herbarium method on account of their bulk and complexity. A palm specimen must be collected very carefully



3. The lithographs of Wallace's palms prepared by Walter Fitch for *Palm Trees of the Amazon*. As these plates are the only botanical elements specifically associated with the new names Wallace coined for his palms, they remain the type "specimens" of Wallace's names and thus of enduring importance to palm taxonomists. A (left). *Leopoldinia major* Wallace; B (right). *Euterpe catinga* Wallace.

and with copious notes to be both useful to botanists and compact enough for storage in a herbarium (Dransfield 1986). However, even the highest quality palm specimens can present herbarium staff with severe curatorial problems. Although many botanical institutions continue to mount palm specimens on their standard-sized sheets, others use extra-large sheets for some specimens. The sheet mounting of palm specimens has been abandoned altogether at Kew, in favour of loose storage in standard-size boxes of assorted depths (Fig. 1D), a technique developed at Cornell University by Liberty Hyde Bailey (1933). This method suits well the awkward shapes and sizes of such material and avoids the need to mount the individual components of a single complex

specimen on numerous sheets. Nevertheless, the specimens collected by Wallace and Bates do not even submit to this sort of treatment. Some are up to 100 cm in length and include large portions of stem, complete inflorescences, leaf sheaths, spiny petioles and bracts (Fig. 1A, B, C). They are far too cumbersome to be curated by any method described above and are now stored in large plastic bags with fragile parts protected with padding.

In addition to their curatorial peculiarities, all the specimens are very incomplete, consisting of very few organs in each case. This begs the question: are the specimens of Wallace and Bates of any scientific significance at all? Before judging the specimens too harshly, however, we should reflect



3 (continued), C (left). *Leopoldinia piassaba* Wallace; D (right). *Mauritia carana* Wallace.

on the motivation of the collectors so as to understand why the specimens are the way they are. Wallace and Bates primarily collected animal specimens and, as indicated above, they were more than occupied by that task.

In fact, neither of the two had any particular plant collecting expertise; despite Wallace's early interest in the British flora, he had not collected specimens, preferring instead to identify plants in the field (Wallace 1905). In this light, their collecting decisions are not surprising if one imagines the dismay that they might have felt when confronted by a monumental palm from which they planned to make a specimen. It is also possible that they selected only bulky parts for collection, knowing that they would survive rough handling during the expedition and journey home better than fragile specimens. Furthermore, in his

letter to Hooker, Wallace is clearly aware that their specimens were destined for the Museum of Economic Botany and possible public display, rather than Hooker's herbarium. They may well have chosen large pieces which would make striking curiosities for a museum display cabinet. Wallace's own interest in economic botany is very evident in his *Palm Trees of the Amazon* (Wallace 1853a) which contains numerous references to local uses of palms. In the book, Wallace lists local uses for four of the six species represented by the nine specimens known today (Tables 1, 2).

The entire holdings of palms in the Economic Botany collections at Kew were the subject of a recent review by Dr. Sasha Barrow. The study revealed a total of more than 1600 accessions, ranging from specimens through raw materials to processed products (Barrow 1998). During the

Table 2. Comparison of the palm names used by Wallace in his *Palm Trees of the Amazon* and their currently accepted names according to Henderson (1995). Taxa described by Wallace and still known by those names are in bold.

Wallace 1853

Leopoldinia pulchra Martius
Leopoldinia major, n. sp.
Leopoldinia piassaba, n. sp.
Euterpe oleracea Martius
Euterpe catinga, n. sp.
Cenocarpus baccába Martius
Cenocarpus batawá Martius
Cenocarpus minor Martius
Cenocarpus distichus Martius
Iriartea exorrhiza Martius
Iriartea ventricosa Martius
Iriartea setigera Martius
Raphia tædigera Martius
Mauritia flexuosa Linnæus
Mauritia carana, n. sp.
Mauritia aculeata Humboldt
Mauritia gracilis, n. sp.
Mauritia pumila, n. sp.
Lepidocaryum tenue Martius
Geonoma multiflora Martius
Geonoma paniculigera Martius
Geonoma rectifolia, n. sp.
Manicaria saccifera Gærtner
Desmoncus macroacanthus Martius
Bactris pectinata Martius
Bactris ____, n. sp.
Bactris elatior, n. sp.
Bactris ____, n. sp.
Bactris macrocarpa, n. sp.
Bactris tenuis, n. sp.
Bactris simplicifrons Martius
Bactris maraja Martius
Bactris integrifolia, n. sp.
Guilielma speciosa Martius
Acrocomia lasiospatha Martius
Astrocaryum murumurú Martius
Astrocaryum gynacanthum Martius
Astrocaryum vulgare Martius
Astrocaryum tucuma Martius
Astrocaryum jauari Martius
Astrocaryum aculeatum ? Meyer.
Astrocaryum acaule Martius
Astrocaryum humile, n. sp.
Attalea speciosa Martius
Attalea excelsa (as mention in section about *A. speciosa*)
Attalea spectabilis (as mention in section about *A. speciosa*)
Maximiliana regia Martius
Cocos nucifera Linnæus.

Henderson 1995

Leopoldinia pulchra Mart.
***Leopoldinia major* Wallace**
***Leopoldinia piassaba* Wallace**
Euterpe oleracea Mart.
***Euterpe catinga* Wallace**
Oenocarpus bacaba Mart.
Oenocarpus bataua Mart.
Oenocarpus minor Mart.
Oenocarpus distichus Mart.
Socratea exorrhiza (Mart.) H.Wendl.
Iriartea deltoidea Ruiz & Pav.
Iriartella setigera (Mart.) H.Wendl.
Raphia taedigera (Mart.) Mart.
Mauritia flexuosa L.f.
***Mauritia carana* Wallace**
Mauritiella aculeata (Kunth) Burret
Mauritiella aculeata (Kunth) Burret
Mauritella armata (Mart.) Burret
Lepidocaryum tenue Mart.
Geonoma maxima Mart.
Geonoma deversa (Poit.) Kunth
Geonoma deversa (Poit.) Kunth
Manicaria saccifera Gaertn.
Desmoncus polyacanthos Mart.
Bactris hirta Mart.

Bactris maraja Mart.

Bactris maraja Mart.
Bactris simplicifrons Mart.
Bactris simplicifrons Mart.
Bactris maraja Mart.
Bactris hirta Mart.
Bactris gasipaes Kunth
Acrocomia aculeata (Jacq.) Lodd.
Astrocaryum murumuru Mart.
Astrocaryum gynacanthum Mart.
Astrocaryum vulgare Mart.
Astrocaryum aculeatum G.Mey.
Astrocaryum jauari Mart.
Astrocaryum aculeatum G.Mey.
Astrocaryum acaule Mart.
Bactris acanthocarpa Mart.
Attalea speciosa Mart.
Attalea phalerata Mart. ex Spreng.

Attalea spectabilis Mart.

Attalea maripa (Aubl.) Mart.
Cocos nucifera L.

review, some herbarium-type specimens, including the Wallace and Bates collections, were transferred to the Herbarium at Kew. Many of these specimens are very large and are not easy to store, but all are invaluable scientific specimens. At times, even the best modern palm specimen does not contain all the information that a botanist might require because relevant parts have been trimmed to fit the curatorial method. Important features are often preserved in oversized specimens. For example, the Wallace and Bates specimens include entire inflorescences and large bracts, parts which would be otherwise unobservable without access to living material.

Wallace's contribution to knowledge of palms of the Amazon

It has been suggested that Wallace contributed little to the scientific study of Amazonian palms (Hooker 1854, Spruce 1855, Balick 1980). However, his contributions can be judged substantial in two areas; firstly, in the identification and naming of palm species new to science, and secondly, in the production of the first field guide to tropical palms.

In *Palm Trees of the Amazon*, Wallace identified 14 species as new to science and coined names for 12 of these (Table 2, column 1). Four of these names are still in use today, indicating that Wallace was the first scientist to name the species (Table 2, column 2). In the naming of plants, botanists adhere to the *International Code of Botanical Nomenclature* (Greuter et al. 2000), one of whose rules is that the scientific names coined first takes priority and takes precedence over names coined later – one reason for name changes in plants can be the finding of an older name. That four of Wallace's new species are still known by the names he gave them testifies to his more than superficial knowledge of palm taxonomy. He was the first "botanist" to correctly identify the source of piassaba fibre, commonly used in brooms in Wallace's day. He commemorated the palm's native name in the scientific name he gave it – *Leopoldinia piassaba*.

Wallace relied heavily on the works of two German noblemen, Alexander von Humboldt (1818) and Carl von Martius (1823–1853). Humboldt, who with his companion Aimé de Bonpland, was the first great European explorer of the Rio Negro, and was fascinated by palms, though he never described any botanically. Martius was a Prussian botanist who explored Brazil at the behest of the Brazilian government (for an account of Martius' importance to palm taxonomy see Henderson 1995); in his monumental work on Brazilian palms he described 85 species as new, 54 of which are still

known by his names today (Henderson 1995). While in the Amazon, Wallace may have had a copy of Martius' work, or at least had access to a copy – some of Wallace's pencil sketches held at the Linnean Society of London have identifications in pencil, perhaps done in the field.

Wallace clearly knew about the details of palm identification, otherwise he would not have been able to accurately and correctly place species in genera. Today, when botanists describe new species, the rules of the Code (Greuter et al. 2000) say that a Latin diagnosis (distinguishing the new species from all others in the genus) and a type specimen designation must be provided. Thus, a single collection serves as the point of reference for the name, allowing all future botanists to examine unequivocally authentic material. In Wallace's day, however, the International Code of Botanical Nomenclature did not exist (it came into being formally in 1905), and so type specimens were not required. Thus, the names he coined must be typified using authentic material, which in the case of these sorts of older names can either be an illustration or a specimen. Consequently, in the absence of any specimens directly named by Wallace, the illustrations in his *Palm Trees of the Amazon* (1853a) are the types of the names he coined. Palm taxonomists have usually referred to the lithographs in Wallace's book as the types of his names (Henderson 1995), thus they become the lectotypes (a type designated by a later botanist, see Articles 8 and 9 of ICBN) and are the reference material tied to the species names (Fig. 3). The lithographs are thus important scientifically as lectotypes, but Wallace's original drawings are more accurate and convey more clearly the palms themselves (see Fig. 2). Unfortunately, none of the palm specimens held at Kew relates to any of the taxa described by Wallace, so cannot serve as type material.

Wallace's book *Palm Trees of the Amazon* (1853a) was not intended as a turgid botanical tome. His interest in palms was sparked in part by his interest in their uses by local peoples, and this relationship between people and palms is at the centre of the book. People then, as now, were interested in far-away cultures and peoples. Wallace was much more interested in ethnobotany than in botanical detail, and his descriptions of the uses of palms bring them alive, even today. In a way, Wallace's little palm book was the first real field guide to palms, a popular book intended for the general public. Unfortunately, only 250 copies of the palm book were ever printed, making it among the rarest of books on Amazonian botany (Ewan 1992). Even though the book was reprinted (Wallace 1971), it is still difficult to obtain. Palms

are ideal organisms for field guides; large and stately, they are easily distinguishable from the rest of the forest foliage, and they have captured the imaginations of botanists and enthusiasts alike for centuries. The tradition of accessible books about palms begun by Wallace has continued, the field guides of Henderson, Galeano & Bernal (1995) and Kahn (1997) being the most recent examples from the Amazon region. The production of field guides for the non-specialist is more important now than ever before, as the biodiversity crisis deepens.

The Wallace and Bates specimens are far more than oversized museum curios. They are undeniably important as scientific specimens, but perhaps more significantly, they are rare physical remains of Wallace's early development as one of the premier natural historian and biological thinkers of his age. His admittedly somewhat anecdotal account of the palms of the Amazon and their uses, written from memory due to the loss of his collections, can be considered to have begun a tradition of producing field guides to palms. Rather than being an amateur with little knowledge of the niceties of palm taxonomy, Wallace was ahead of his time in using palms to convey the importance and beauty of the Amazon forests themselves, something for which all palm enthusiasts can be grateful.

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LITERATURE CITED

- BAILEY, L.H. 1933. Palms and their characteristics. *Gentes Herbarum* 3: 1–29.
- BALICK, M.J. 1980. Wallace, Spruce and *Palm Trees of the Amazon*: an historical perspective. *Botanical Museum Leaflets* 28(3): 263–269.
- BARROW, S.C. 1998. Palm resources at the Centre for Economic Botany at the Royal Botanic Gardens, Kew. *Principes* 42: 140–144.
- BATES, H.W. AND A.R. WALLACE. 1848. Manuscript letter to Sir William J. Hooker dated 3 April 1848 [housed in the Archives of the Royal Botanic Gardens, Kew].
- BATES, H.W. 1863. *The naturalist on the river Amazons*. 2 vols. John Murray, London.
- BEDDELL, B. G. (ed.) 1969. *Wallace and Bates in the Tropics: an introduction to the theory of natural selection*. Collier-MacMillan Ltd., London.
- CAMERINI, J.R. 1993. Evolution, biogeography and maps: an early history of Wallace's Line. *Isis* 84: 700–727.
- CAMERINI, J.R. 1996. Wallace in the field. *Osiris*, second series 11: 44–66.
- DESMOND, A. and J. MOORE. 1991. *Darwin*. Michael Joseph, London.
- DRANSFIELD, J. 1986. A guide to collecting palms. *Ann. Missouri Bot. Gard.* 73: 166–176.
- EWAN, J. 1992. Through the jungle of Amazon travel narratives of naturalists. *Archives Nat. Hist.* 19: 185–207.
- GREUTER, W., J. MCNEILL, F.R. BARRIE, H.M. BURDET, V. DEMOULIN, T.S. FILGUEIRAS, D.H. NICOLSON, P.C. SILVA, J.E. SKOG, P. TREHANE, N.J. TURLAND AND D.L. HAWKSWORTH. (members of the editorial committee). 2000. *International Code of Botanical Nomenclature*. *Regnum vegetabile* 138. Koeltz Scientific Books, Königstein.
- HENDERSON, A. 1995. *The palms of the Amazon*. Oxford University Press, New York, Oxford.
- HENDERSON, A., G. GALEANO AND R. BERNAL. 1995. *Field guide to the palms of the Americas*. Princeton University Press, Princeton, New Jersey.
- HUMBOLDT, A. von. 1818. Personal narrative of travels to the equinoctial region of the new continent during the years 1799 to 1804. [originally published as *Voyage aux régions équinoxiales du nouveau continent...*]. English translation by H.M. Williams, 5 vols. Longman, Hurst, Rees, Orme & Browne, London.
- KAHN, F. 1997. *The palms of El Dorado*. ORSTOM, Editions Champflour, Marly-le-Roi, France.
- MARTIUS, C.F.P. von. 1823–1853. *Historia naturalis palmarum*. 3 vols. Munich.
- OOSTERZEE, P. van. 1997. *Where worlds collide: the Wallace Line*. Cornell University Press, Ithaca and London.
- PRANCE, G.T. 1999. Alfred Russel Wallace (presidential address at the unveiling of the portrait of ARW at Linnean Society in 1998). *The Linnean* 15(1): 18–36.
- RABY, P. 1996. *Bright paradise: Victorian scientific travellers*. Chatto & Windus, London.

- SPRUCE, R. 1855. manuscript letter to Sir W.J. Hooker dated 1855 [held in the archives of the Royal Botanic Gardens Kew].
- WALLACE, A.R. 1848. manuscript letter to Sir. W.J. Hooker dated Pará, 20 August 1848 [held in the archives of the Royal Botanic Gardens Kew].
- WALLACE, A.R. 1852. On the monkeys of the Amazon. *Proc. Zool. Soc. London* 20: 107–110. [read at meeting of 14 Dec 1852]
- WALLACE, A.R. 1852. [letter concerning loss of collections], dated 19 Oct 1852. *The Zoologist* 10: 3641–3642.
- WALLACE, A.R. 1853a. Palm trees of the Amazon and their uses. Van Voorst, London.
- WALLACE, A.R. 1853b. A narrative of travels on the Amazon and Rio Negro, with an account of the native tribes and observations on the climate, geology, and natural history of the Amazon Valley. Reeve & Co., London.
- WALLACE, A.R. 1853c. On the Rio Negro. *J. Roy. Geog. Soc.* 23: 212–217. [read at meeting of 13 June 1853]
- WALLACE, A.R. 1853d. On some fishes allied to *Gymnotus*. *Proc. Zool. Soc. London* 21: 75–76. [read at meeting of 12 July 1853]
- WALLACE, A.R. 1854a. On the insects used for food by the indians of the Amazon. *Trans. Entomol. Soc. London* 2, n.s. part 8: 241–244. [read at meeting 6 June 1853]
- WALLACE, A.R. 1854b. On the habits of the butterflies of the Amazon Valley. *Trans. Entomol. Soc. London* 2, n.s. part 8: 253–264. [read at meeting 7 Nov. & 5 Dec. 1853]
- WALLACE, A.R. 1869. *The Malay Archipelago: the land of the orang-utan and the bird of paradise, a narrative of travel with studies of man and nature.* MacMillan & Co., London.
- WALLACE, A.R. 1905. *My life: a record of events and opinions.* 2 vols. Chapman & Hall, Ltd. London.
- WALLACE, A.R. 1971. *Palm trees of the Amazon.* Facsimile reprint with an introduction by H. Lewis McKinney. Coronado Press, Lawrence, Kansas.

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