



# THAT GLORIOUS FOREST

*Exploring the Plants and Their Indigenous Uses in Amazonia*

**GILLEAN T. PRANCE**





MEMOIRS OF THE NEW YORK BOTANICAL GARDEN, VOLUME 113

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*Exploring the Plants and Their Indigenous Uses in Amazonia*

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FRONT COVER: Brazil nut (*Bertholletia excelsa*), in Carl Friedrich Philipp von Martius, *Flora Brasiliensis*, Monachii, Lipsiae: Apud R. Oldenbourg in comm., 1857–1858, vol. XIV, part 1, plate 61. Image courtesy of the LuEsther T. Mertz Library of The New York Botanical Garden. BACK COVER: Brazil nut (*Bertholletia excelsa*) fruit and seeds, by Pierre Jean François Turpin, in Alexander von Humboldt and Aimé Bonpland, *Plantes équinoxiales*, Lutetiae Parisiorum: Apud F. Schoell, 1808, vol. 1, tab 36. Image courtesy of the LuEsther T. Mertz Library of The New York Botanical Garden. FRONTISPIECE: The author showing the spiny undersurface of the *Victoria* water lily (*Victoria amazonica*). Photo by S. A. Mori. TABLE OF CONTENTS: The *genipapo* in fruit (*Genipa americana*). Photo by the author. FOREWORD: An Amazonian Passion flower (*Passiflora*). Photo by the author. The art above each chapter number is a flower of *Rhabdodendron macrophyllum* from the family Rhabdodendraceae. This illustration, by Charles C. Claire, was previously published in *Rhabdodendraceae*, Flora Neotropica Monograph 11 in 1972. *Rhabdodendraceae* was written by the author. BOOK DESIGN: Matthew Papa

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# Foreword

It is now almost 50 years since I first went to the tropics to explore for plants. I have often been asked to write up my experiences, but it took eight weeks laid up with my leg in plaster to put some of them down in writing. My broken Achilles tendon occurred, appropriately, in Brazil, but in spite of all of the hazards I went through on expeditions, some of which are related here, it was not tramping out in the field but dancing the samba with the tour group that I was leading in 2010 that the injury occurred.

As I began my work, I noted that in my Curriculum Vitae and in *Who's Who* I have entered the number of Amazon expeditions in which I have participated as 16, but as I was preparing this account of them I found that the actual number is 39. What I have written about here is a selection of these expeditions that are sufficiently different from one another to be of some interest, as well as some thoughts on this lifetime of work surveying the Amazon flora.

Over the years, my own understanding of my role as a botanist has evolved from simply discovering and classifying the world's flora to preserving habitats, understanding local uses, and educating the next generation in conservation. Botany is one of the world's oldest sciences, and early herbalists' efforts to develop a plant taxonomy eventually led to a worldwide system of partnerships between botanical gardens, natural history museums, universities, and conservation organizations. Despite the rapid advancement of technology, including molecular and genetic studies, botanists must still go out into the field and visit the plants they study in their native settings and gather material on which to do their research. Both the fieldwork and the resulting academic work are vital to the scientific process. In this book I have concentrated mainly on the process and the running of the expeditions and collecting specimens rather than on the resulting scientific findings. Details of the extensive science resulting from this work in the field is written up elsewhere in many publications of mine and other collaborators, some of which are cited in the references at the end of the text. I have included at the end of each chapter the plant collection numbers made on the expeditions described, as well as a list of new species discovered. Standard practice is for any collector to have a progressive number series. These numbers are assigned in the field when a plant is first collected and remain the main reference to the collection in the herbarium and in any publication referring to it.

The main goal of these and the other expeditions described in this book was to collect, press, and dry plants to create herbarium specimens to make an inventory of the Amazon flora. Also, on an expedition one gathers many other observations about the habitats and vegetation types, insect and other animal visitors to flowers and fruit, and much specific and detailed information about the plant families in which one specializes. In my case this began with the Chrysobalanaceae, which I studied for my doctoral thesis, but soon expanded to the Dichapetalaceae, Caryocaraceae, and Lecythidaceae, all of which are trees or vines widely distributed in the Amazon region and elsewhere. A herbarium is a collection of dried plant specimens for study, which is the basis of all plant taxonomy that determines the groupings and classification of plants. Basically, it is the plant library, and though they may exist as part of botanical gardens, herbaria are the academic core that many universities and museums also possess. The New York Botanical Garden (NYBG)

has the largest herbarium in the Western Hemisphere. On expeditions to remote places it is standard practice to collect more than one herbarium specimen of each plant where possible in order that it be available in different herbaria. The first one is always left in the country of origin and others are distributed, both to make the collection readily available and for security if one herbarium burns down or has another accident. A specimen of each collection is sent to the taxonomist who specializes in that family so that he or she can study it for their research and also provide an accurate identification to the collector.

I have written this book not as an autobiography but as a tribute to the many people who have helped me survey the Amazon region over the last five decades, most of whom feature somewhere in this book.

This book's title, *That Glorious Forest*, derives from how 19th-century British naturalist Henry Walter Bates termed the region in his classic, *The Naturalist on the River Amazons*. It is indeed to Bates, and other early pioneers in Amazonian exploration, that I, as with so many other tropical biologists of my generation, owe a huge debt of gratitude for their inspirational discoveries and eloquent writings about this enduringly fascinating region.



In a long career of exploration there are many people to thank. First of all must be my wife, Anne, who tolerated my long absences and lived in primitive circumstances in Manaus with our two small daughters, Rachel and Sarah. Anne often ran the expedition headquarters, and her tasks varied from driving the expedition jeep around Manaus to collect supplies to arguing with customs officials and administrators to nursing sick expedition members in our home.

It would be nearly impossible to list all of the field helpers that have accompanied me on these expeditions, but a few do stand out. The first is José Ramos, who joined me on my 1965 expedition as the 16-year-old cook. He soon began to climb trees, and this useful skill resulted in him becoming my field assistant for more than 20 years until I was able to see him safely and permanently employed as a *mateiro* at the National Amazon Research Institute (INPA) in Manaus, where he is now a fine parobotanist. Other field helpers whom I especially remember are the Coêlho brothers, Luiz and Dionisio; Osmarino Monteiro; Bento Pena; and Nilo T. da Silva. On later expeditions as I became more involved in ethnobotany, I could not have done without the help of the many indigenous peoples who passed on to me so much of their knowledge. I hope that, in return, I have been able to do enough to defend their rights to live in the forests of Amazonia.

I am most grateful to INPA and its successive directors, especially Djalma Batista, Paulo Machado, and Warwick Estevam Kerr, for giving me such a good base for my expeditions. A full set of all of my Brazilian collections is deposited in the INPA herbarium<sup>1</sup> and there are duplicates in the herbaria of the Museu Goeldi in Belém and the Museu Nacional in Rio de Janeiro. Much of my fieldwork was financed by grants from the U.S. National Science Foundation (NSF). I feel privileged to have held grants from the NSF for 22 continuous years to support my fieldwork in Amazonia and my research on the taxonomy of tropical plants.

For much of my career in exploration The New York Botanical Garden was my base. I thank Dr. Bassett Maguire for inviting me there on a one-year post-doctoral assignment that turned out to be a stay of 25 years. I am most grateful to Boris Alexander Krukoff,

1. For specimen information see:  
<http://brahms2.inpa.gov.br/>

who endowed the B. A. Krukoff Curatorship in Amazonian Botany, a post that I held for 10 years. My introduction to work in the tropics and to tropical plant families came from Howard Irwin, leader of the 1963 expedition to Suriname that is described in more detail in Chapter 1. When my work in Brazil was expanded to run a broader joint Brazil/U.S. exploration program called Projeto Flora Amazônica (PFA), I could not have done without the help of Bruce Walker Nelson, who ran the field headquarters in Manaus for the duration of the project and who later studied and settled permanently in Manaus.

Special thanks are due to the fun-loving Frances (Mickey) Maroncelli, who started as a part-time typist for the labels of my collections and whose hours increased as the number of collections and manuscripts grew until she became my full-time secretary. She often held down the fort during my long absences from New York.

I benefited over the years from the knowledge and companionship of many fellow botanists and students. Three of my graduate students were heavily involved with my expeditions: Enrique Forero and Eduardo Lleras, who worked hard and were good companions, and Douglas Daly in PFA. Many Brazilian botanists helped me over the years, especially João Murça Pires, mentor for my first expedition to Brazil, and Marlene Freitas da Silva and William Rodrigues of INPA in Manaus. I have enjoyed the company of many colleagues from different institutions who have joined me on expeditions: from New York—Scott Mori, my partner in research on Lecythydaceae, the Brazil nut family, and David Campbell—and from other places, especially Terry Pennington, Kees Berg, Klaus Kubitzki, and Paul Maas. My thanks to Michael Hopkins for taking on the coordination of the Flora of the Ducke Forest Reserve near Manaus. I would not have gotten into tropical botany without the encouragement and help of the supervisor of my D.Phil. at Oxford University, Frank White, with whom I had many good times. Bill Steward, who first came with me as an undergraduate, was a key member of many expeditions and also trained with me as an outboard-motor mechanic.

My travels in Amazonia were made easier by the friendship and fellowship of many missionaries in the region, especially Janelle and Lonnie Doyle, Paul Bellington, Tom and Mary Halsell, Fritz Herter, Fred Orr, Paul Moran, and pilot Lyn Entz, all of whom helped expeditions in some way.

I am grateful to my daughter Rachel for making many helpful comments on an earlier draft of the manuscript and to Lucinda Bartley for a thorough editing and for making many good suggestions to improve the text. I am particularly grateful to William (Bill) Buck, Michael Brown, and Brian Boom who moved my book through the publishing process and made many helpful contributions along the way.

Many good conversations take place in the field on expeditions. I am grateful to Klaus Kubitzki, who discussed my work on taxonomic monographs as we were pressing plants together one evening. He suggested that from this work and all of the collections I had made that I had many more possibilities for research than just monographs of plant families. In particular he encouraged me to do more with the biogeographic implications of my research. This eventually led to many papers on this subject and analysis of centers of diversity in the Amazon region and their implications for conservation.

These people and many other colleagues have made possible a lifetime of work in the Amazonian forest, and without their help and encouragement I would not have been able to carry out all of the expeditions described herein.





## CHAPTER 11

# The *Alpha Helix* Expedition

FEBRUARY 3–MARCH 8, 1977

**T**oward the end of my two-year time in Manaus directing the INPA botany course, I was invited to attend various planning meetings at the Brazilian Research Council (Conselho Nacional de Pesquisas, or CNPq). They wanted Projeto Flora Amazônica (PFA), as it was called, to become a binational program with the U.S. and appointed Dr. Alcides Teixeira, an old friend and the former director of the São Paulo Botanical Institute, as coordinator. The CNPq invited the U.S. National Science Foundation (NSF) to participate in the program, and I was commissioned by the Brazilians to return to the U.S. and investigate the possibility. The overall goal was to conduct an extensive survey of the flora of the Amazon region. Their intent was to begin with the digitization of the herbaria of INPA and the Museu Goeldi in Belém.

At about the same time, on my return to New York in 1975, I had been appointed Director of Botany at The New York Botanical Garden so this began my life of botanical administration. I made it a condition that this promotion would not altogether stop my work in Amazonia, so from then on, my career was a juggling act between running the science program at the Garden, helping to launch Projeto Flora Amazônica, and continuing my own taxonomic research.

A meeting of 20 of the leading botanists in the U.S. was held in 1977 in Washington, D.C., organized by the NSF, to discuss the project. At this meeting, I was appointed to chair the U.S. side and to develop the grant proposals to fund it. We were able to get a series of grants from the NSF, and so for the next 10 years, I coordinated a much larger expedition program in the Brazilian Amazon than I'd previously headed at NYBG. I took

part in a few of these expeditions, but there were many others, all with teams of Brazilian and U.S. participants working together<sup>14</sup>.

One of the essentials for this binational program to run smoothly was for me to have an assistant based in Manaus, and funding for this position was included in the NSF grant budget. I was fortunate that Bruce Walker Nelson agreed to fill this post. Bruce had been with me on two previous expeditions and so he knew the ropes well. Bruce was the logistics person involved with all aspects of the programs. He had to deal with the many problems of receiving a large number of U.S. botanists to participate in the PFA expeditions, such as meeting them on arrival at the airport or taking them to the police station to register their presence in Brazil. He had to help process all of the collections for distribution to Brazilian herbaria and to New York. He later completed his Ph.D. in the Manaus graduate program, joined the staff of INPA, and settled permanently with his family in Brazil.



While I was attending preliminary meetings about PFA in Washington in 1976, I learned that the *Alpha Helix* oceanographic vessel of the Scripps Institute of Oceanography in La Jolla, California, was to spend a year in Amazonia. The NSF was asking for proposals by people who wanted to use the ship on the Amazon River. A floating laboratory in Amazonia seemed like too good an opportunity to miss, so I discussed the possibilities with colleagues at the Garden, particularly with Scott Mori, who started his work there on a post-doctoral fellowship and was by then a well-established staff member working with me on the taxonomy of the Lecythydaceae or Brazil nut family<sup>15</sup>. This family of trees is abundant throughout Amazonia and, early on in my expeditions, I became interested in the family and began to make special collections of the flowers pickled in alcohol. I was then able to bring Scott to The New York Botanical Garden as a post-doc on one of my NSF grants. Scott's arrival at the Garden began a long collaboration that has resulted in many scientific papers and a two-volume monograph of the Lecythydaceae<sup>16</sup>. Scott also has carried out extensive field work in places as different as Panama, Bahia in Brazil, and French Guiana, and so our work on the Lecythydaceae has been based on our extensive field studies and collections and continues today.

Scott and I came up with an idea to study the genetic variation of some species along the length of the river using the technique of gel electrophoresis. This is a method for separation and analysis of DNA or RNA and their fragments, based on their size and charge, so that one can look at the genetic variation between individuals of a species. Our hypothesis was that there should be an increase in genetic variation near each major tributary where there would be an influx of new genes from the dispersal of seeds into the



**11.1**  
M. V. *Alpha Helix*,  
the oceanographic  
vessel used for the  
1977 expedition.

14. Details of the first 25 PFA expeditions and 13 scientific papers of some results were published in Suplemento 14(1/2) of INPA's journal, *Acta Amazonia* (Prance et al., 1986).

15. For up-to-date details on this research, see Mori et al., 2010 onward.

16. Prance & Mori, 1979; Mori & Prance, 1990

main river from plants growing in the tributary. We applied for a month's use of the ship in February 1977, and were awarded the grant.

We enlisted Bob Hill, who had been with me the previous year on the Rio Javari expedition, to do the laboratory work because he was experienced in electrophoresis methods. In addition to the laboratory research, this seemed like a good opportunity to do some plant collecting and study the Brazil nut relatives along the Amazon River with Scott. We also enlisted two young Brazilian botanists from INPA as counterparts, João C. Bernardi and Darcy Shimabukuru. The final member of our team was João Ferraroni, the medical doctor and close friend from Manaus who had been with me to investigate paralysis among the Paumari Indians in 1975. He wanted to study the health of the Tikuna Indians in the upper reaches of the Amazon. (Ferraroni had made particular friends with our daughter Sarah when we lived in Manaus and, even at that young age, she knew that she wanted to be a doctor. I am sure that Ferraroni was one of the people who stimulated her to follow that career path.) Apart from our group, there was also an independent team of three North American limnologists on board to study the river waters.

After short stops in Tegucigalpa in Honduras to give a lecture and in Bogotá, Colombia, to visit their botanical garden, I arrived in Manaus on the day the ship was to depart. I knew at once that this would be an expedition of a different class because of the well-resourced ship with equipment superior to any we had used on previous expeditions. I was met at Manaus airport by the agent for the *Alpha Helix* and found that another passenger on my flight had been the ship's electrician. We were taken directly to the dock and onto the ship, where I found Scott and Bob already on board. The *Alpha Helix* was built as an oceanographic research vessel for the National Science Foundation and, at that time, was operated

by the Scripps Institute of Oceanography in La Jolla, California. It is 40.53 m (133 feet) long and has a draft of 4.2 m (13.8 feet), much larger than any launch I'd ever used in the Amazon River, and contained both a wet and a dry laboratory. The crew of eight, all from the U.S., were experienced and helpful to us, and there was plenty of room as it was fitted out to house 19 to 21 scientists or supernumeraries.

The ship was also well equipped with aluminum speed boats and, eager to get started, the botanical team quickly departed for an excursion to the Rio Tatumã just above Manaus. Scott and I wanted to study a Lecythidaceae species (*Eschweilera tenuifolia*), the seeds of which were remarkably different from all other species of Lecythidaceae. The trees grow in the flooded forests, and we were able to make detailed collections of them and study the fruit and bark characteristics. Because the seeds of this species are so unusual, we were questioning whether or not it belonged in the genus. The seeds germinate from the sides rather than the ends unlike all other species of the genus. A circular cap falls off of the fruit and, while the base remains on the tree, the hard, peg-like seeds



11.2

**11.2**  
Scott Mori using a clipper pole to collect a sample from a tree.

drop off into the river where they float and are dispersed by the water currents. I once kept some seeds in a bowl for a year and they were still floating. This short field trip got us off to a good start in our studies of the Lecythydaceae on this expedition.

Once we had settled on board to leave Manaus, we were given a briefing on how to use the impressive laboratory by Denis Popp, the ship's resident technician. The three of us botanists, who were all hardened expeditionaries, could not believe the luxury of life on this vessel, and not just of the technical equipment. The first day we were served frog legs, shrimp, and clam chowder for lunch. The extravagant food was all imported from the U.S. Toward the end of the trip, we did persuade the reluctant chef to buy some local fish. It seemed so strange to us to travel on the Amazon River and not eat the wonderful array of local fish such as *tambaqui*, *tucunare*, or *piraracu*. My diary constantly notes that we had steak or salmon or some other luxury food for dinner. Scott and I particularly enjoyed the desserts with lots of whipped cream out of spray cans. This was the only expedition on which I gained weight. Another feature of life on board was that they showed a film every night for the crew and scientists. We watched a few but had much work to do with specimens, and spent most evenings in the laboratory.

We left Manaus, but stayed nearby for the first two days because Bob had found that one of the essential chemicals for his research was not on board. This was no problem for the organization of the *Alpha Helix*. The missing chemical was flown in to us from the U.S. within 48 hours. That was the easy part, but Bob and Dr. Ferraroni had to spend the whole of the next day with the ship's agent trying to release the chemical from customs. They finally got the small packet out at 9 P.M.! The delay near Manaus was useful as Scott and I, together with the Brazilians, spent a day studying another Brazil nut relative, the *sapucaia* nut (*Lecythis pisonis*). The large fruit of this species also loses its cap, and the seeds hang out on fleshy stalks. In this case it is bats that come to the fruit and remove the seeds. They eat the fleshy stalk and discard the seeds, thus dispersing them around the forest. Finally, after a three-day delay, we set out upstream on the main Amazon River, which is called the Rio Solimões for this stretch between Manaus and the frontier with Peru.

Scott and I went out collecting every day with the Brazilians, except for Darcy, who stayed with Bob in the laboratory doing the analysis of some of the collections that we brought back. For Bob's laboratory work we needed species that we knew grew along the whole stretch of the river that we would travel from Manaus to Iquitos in Peru. We selected two weedy members of the legume family that grew on the muddy river banks, *Aeschynomene sensitiva* and *Mimosa pigra*. The latter species belongs to the same genus as the sensitive plant and has become a serious invasive in many parts of the tropics, but here we were studying it in its native habitat. Every day when we were out collecting, we



### 11.3

The large fruits of the well-named cannonball tree (*Couroupita subsessilis*) which are borne on the trunk and along the branches.

would bring back seeds of these two species for the laboratory work. In the evenings we all helped prepare the seeds for analysis by manually removing them from the pods, ready to be ground up.

Once we were certain that we had collected enough of these seeds each day, we were free to do general collecting and to study the Brazil nut and its relatives. One of the common trees along the river is a species of cannonball tree (*Couroupita subsessilis*), another member of the Lecythidaceae. This tree is well named,

because the large round fruit are produced from the trunk and main branches and are about the size of or larger than a cannonball. They have a thin, crusty outer shell and are full of seeds embedded in a fleshy pulp. The fruits fall to the ground entire and are often picked up by locals to feed their pigs or chickens on the foul-smelling pulp. In nature, it is peccaries or wild pigs that eat the fruit and thereby disperse the seeds. One of the interesting things about the Brazil nut family is that there is a large variation in the fruit's form and structure, or morphology, linked to the different ways the seeds are dispersed. In the Brazil nut (*Bertholletia excelsa*), like the cannonball tree, the whole fruit falls from the tree. It is a round fruit a bit larger than a baseball with a very hard, woody outer shell; the seeds or nuts also have a very hard shell and are not surrounded by pulp. The outer shell can only be opened by agoutis or squirrels, who remove the nuts and often bury them in caches some distance away from the tree.

In addition to studying the morphological variation in the cannonball trees for the length of the river that we traveled, we were also able to observe various insects acting as pollinators. During my time teaching in Manaus in 1975, I had studied the pollination of the cannonball tree by wasps. We were on the *Alpha Helix* trip the same year that Africanized honey bees arrived in the Manaus region, and were

interested to note that the flowers of the cannonball tree were now visited mainly by these more aggressive insects, which seemed to have excluded the wasps. One day, I was able to study the pollination of a member of the Chrysobalanaceae, *Hirtella elongata*. We discovered several small trees of this species scattered through the forest and being visited by a large number of butterflies, and it helped to confirm what I had concluded in my doctoral thesis from the morphology alone, that this genus is pollinated predominantly by butterflies. The day-flowering *Hirtella* is closely related to the genus *Couepia*, which is predominantly night-flowering and pollinated mainly by moths. These field observations about the function of the different structures of the flower and fruit of plants are an invaluable aid to working on the taxonomy of a group.

One of the advantages of traveling up the main Amazon River with a river pilot on board was that we could travel by night and spend all of each day anchored to carry out our work. Each day an agreement was made between the botanists and the limnologists as to where would be a good place to stop based on the possible habitats for our study plants



11.4

**11.4**  
A young fruit of the calabash (*Crescentia cujete*), showing the ants that are feeding from the many external nectaries on the fruit.

and the variation in the water types for the limnologists. As we continued upriver, our collections grew and the laboratory analysis by Bob and Darcy seemed to be progressing well. They had one minor disaster when a centrifuge head flew off at 16,000 rpm and destroyed several flasks. Fortunately, we had duplicate material so they could repeat the analysis.

While we were not particularly interested in watching the after-dinner films, what we did enjoy was when one of the scientists on board gave a seminar about their work. One evening limnologist Bob Naiman gave a most interesting talk on the hydrology of the Amazon River. Another night Ferraroni gave an excellent seminar on his research on malaria, and Scott and I gave a talk on our botanical work. Sometimes one of the limnologists would join us in the field, providing a useful cross-disciplinary interaction. Bruce Wallace came out on a day that we were collecting along a small stream and he collected a lot of caddis flies and told us all about their life history. It is always fascinating to learn the natural history of other organisms.

By now we were well up the river and anchored near the town of Santo Antônio de Itã, where we moved west into a new time zone and put the clock back by an hour. We did our collecting in a lake near the town and found our first Tikuna Indian village called Betânia. The residents were most friendly and we spent two days there to learn from them and for Ferraroni to take some blood samples from them. Since he explained that it was to study to help them control malaria, they seemed most willing to donate their blood. We bought many bead necklaces and other crafts from them. We hired one Tikuna named Manfredo to work for us and climb trees to get the specimens, which was a relief for Scott. One of his great talents is tree climbing, and since we did not have any *mateiros* on this trip, Scott did most of the climbing, except for the one day that we had Manfredo with us. While we were at this stop, Scott climbed a tree of *Eschweilera* near the ship as a demonstration to the crew and the limnologists, who were duly impressed by his skill. He was using griffes, the spikes used by French telephone repairmen that grip into the tree trunk, and a belt that goes around the tree and holds one safely. It was near here that we brought a quantity of Brazil nut fruits on board for the crew to make souvenirs in the ship's workshop. I still have the one in which they cut vertical open slits so that the nuts inside, arranged rather like the segments of an orange, could be seen.

As we got further upriver, Bob had more and more material to process in the laboratory, so each of us had to take turns to help with that work. When we got to the town of São Paulo de Olivença, we had to stop to find more drying paper for our plant presses. There was no newspaper to be found in the town, but we were able to get a lot of sheets of wrapping paper, which served the purpose well. One day I took three members of the crew out into the forest along the Rio Canatiá, and they thoroughly enjoyed a lesson in the basic natural history of Amazonia. We stopped at a *caboclo* house and were given coffee and then presents of eggs and tapioca. This hospitality is so typical of the riverside *caboclos*, who have little in the way of food or possessions yet always give generously. I returned to



**11.5**  
Tikuna children  
in their canoes at  
Vendaval.

the ship to get some canned food and rice for them. They also showed the crew how they made their staple of *farina* from the cassava plant, so the crew had at least a little glimpse of local life, which they often missed by staying on the well-supplied ship.

Above the town of São Paulo de Olivença, we stopped at another Tikuna village, Vendaval, which is situated on the banks of the main river. Again, they were friendly to us and, while Ferraroni was drawing blood, Scott and I were amusing the Indians with a

spray can of whipped cream. First Scott sprayed some onto me and I was quick to reciprocate. The Indians got the idea and liked this body paint that, as they quickly learned, you could lick off. On that trip we made good friends with both the village school teacher and Pedro, the chief.

Some years later, I would get to know them much better when I was lecturing about the Amazon and its peoples on the expedition ship the *World Discoverer* and we anchored at Vendaval. Anne and I landed there with some of the Indonesian crew to ask permission to show the village to our passengers. The Tikuna were much more interested in the Indonesians, and because of their similar physiognomy, they regarded the Indonesians as long-lost brothers who had forgotten their language. The teacher remembered me and soon we had permission to show the 60 passengers around the village. The Tikuna brought out various crafts to sell, but Pedro took me to his house and showed me some really fine choice artifacts, including splendid carvings of animals, a drum, string hammocks and bags, and many types of necklaces. When I saw the quality of these crafts, I encouraged Pedro not to get them out now, but instead he trusted me when I said that I could get more money for them if I sold them on board the ship and paid him on our return journey downriver. He said that he would meet with the village leaders to decide how the money should be spent.



11.6

**11.6**  
A tree where wood to make a canoe paddle has been removed from the buttress on the trunk.

On board that night at cocktail time, I produced the crafts and announced that we were going to have an auction in support of the Tikuna. We raised nearly \$1000! I returned to the village on the downstream cruise as promised and informed Pedro of my success as an auctioneer. Pedro announced that the council of chiefs had decided that they wanted to use the money to install an electric generator in the village. He explained that all of the Brazilian towns along the river had lights, but none of the boats that passed at night knew that Vendaval was there because the town had no electric lights. I was somewhat surprised at this choice, having expected that he would want tools or outboard motors, but one must let the indigenous peoples decide for themselves what to do. I asked if he had any more of the high-quality crafts, because it would cost more than what I had collected to have the community lighting installed. He had been busy gathering more from other villages, so I was able to have an auction on the downstream cruise as well, which raised over \$2000. One of the passengers, Mr. Grice, was an electrical engineer from Texas, and he offered to return to Brazil in two months to install a generator and street lights as a

volunteer. Pedro and his team entrusted me to take all of the money raised to Manaus, and I deputized my assistant in Manaus, Bruce Nelson, to purchase a generator, wire, and all of the other equipment that Mr. Grice had requested. The end result was that, within three months of our cruise, the lights were installed and burning at Vendaval.

I passed this village many other times on the *World Discoverer* and each time I was able to hold an auction in aid of the Tikunas. The Tikuna leaders always decided how they wanted to use the funds that we raised. These cruises built a new classroom on the school, trained a Tikuna man in Manaus as a parodontist, and brought in a team of doctors to the village when there was an epidemic of malaria, arranged by Dr. Ferraroni. Our first contact with the Tikunas of Vendaval on the *Alpha Helix* expedition led to a long-lasting friendship with them and some interesting ethnobotanical studies about their uses of plants. One of the crafts I most liked was their bags and hammocks made of cord prepared from the leaf of the *chambira* palm (*Astrocaryum chambira*), from which they extract the fiber from the pinnae of the young leaves. Both the men and the women twist the fibers on their bare legs to make a strong fine cord. This cord is often dyed and then used to make hammocks, bags, and nets. These products always sold well at the on-board auctions on the *World Discoverer*. They are also long-lived, as I still have a number of Tikuna *chambira* artifacts collected in the 1970s.

After 20 days of travel working our way upriver on the *Alpha Helix*, we reached the frontier town of Tabatinga. The captain had already obtained permission for the ship to travel upstream into Peru, but it still took a whole day and several bottles of whiskey to clear the Brazilian authorities. At Tabatinga, though, we had to say a sad farewell to our three Brazilian companions Darcy, João, and Ferraroni, as they did not have authorization to work in Peru. To facilitate the specimen processing, we dispatched with them on the plane to Manaus all of the collections that we had made up to that time.

On the first day in Peru, Scott was out collecting plants on a small tributary of the main river, the Río Atacay, with the technician Denis Popp, when they were arrested by the Peruvian border police. They were taken to a police station to be questioned and the officers came to the ship to look at our documents. After a few drinks and supper on board, we had established the most cordial relationship with the police and had no more trouble the entire trip.

As we headed west toward Iquitos, the weather got much wetter as it was the height of the rainy season in the upper Amazon region. This was much less of a problem on board a ship than on our usual type of expeditions and, when the rain was heavy, Scott and I could help Bob in the laboratory. Holed up in the lab we realized that most days Bob was working under the water level, as the laboratory was situated low in the ship.

One night, we had just listened to the second seminar from Bob Naiman, the limnologist, when Leonard Bell, the second mate of the ship, came into the room to announce that



**11.7**

Tikunas at Vendaval dressed up for one of the rites of passage.

there was a very hard rainstorm and that, as we had zero visibility in a storm like this, we might have to anchor. Too late! Five minutes later the ship came to a sudden halt. We had run hard aground on a sandbar. Chaos ensued in the laboratory because the sudden stop threw all of the loose glassware and our electrophoresis unit and gels off of the shelves onto the deck. We lost some experiments and had to spend the next day cleaning up glassware and starting these experiments over again. The crew spent an hour in the dark and rain sounding the water depth around the ship, following which the captain decided that we would be able to get off the next day and that we should all go to bed.

Getting the ship off of the sandbar proved not to be so easy. We were all assigned tasks. Scott was to drive one of the tenders with some of the crew on board to push against the bow to turn the ship around. My assignment put me into a tense situation on the bridge, interpreting between the Portuguese-speaking pilot and the English-speaking and highly distressed captain. Fortunately, after the various maneuvers by the captain and his crew, in 45 minutes the ship moved off of the sandbar under its own power. We were soon back to work collecting plants in the field and running gels in the laboratory.

Two days later, we reached our destination, the city of Iquitos, where we left the ship and flew back to Manaus. Our four weeks of comfort on the *Alpha Helix* had ended, but we had a lot of scientific results to show from our travels in this, the most luxurious of all of my expeditions.



The results of this expedition were many. We did get some evidence of increased genetic diversity in *Aeschynomene* and *Mimosa* near the entrance of the major tributaries, and so endorsed our hypothesis. Scott and I, working together, collected many members of the Brazil nut family, which proved very useful for our monographic studies of the family that we published in 1990. One of the interesting new species that we collected was a passion-flower, which was named as *Passiflora cordistipulata* on account of its heart-shaped stipules. These are small leaflike outgrowths at the base of a leaf or its stalk and their shape and position is often a useful diagnostic character in identification of a species. Ferraroni collected 1583 blood samples along the river to study the incidence of malaria in both the *caboclos* and the Tikuna Indians. We were saddened to hear shortly after the trip of the death of one of our Brazilian companions, João Bernardi, who suffered from leukemia. We lost an enthusiastic young botanist who certainly worked hard on this expedition and had much unrealized potential.

#### COLLECTION NUMBERS:

*Alpha Helix*: 24354–24705

#### NEW SPECIES:

24598 *Passiflora cordistipulata* Cervi