

**O**CCASIONALLY, the botanist, who is ordinarily wrapped up in investigations of uncertain import in the minds of laymen, gets an assignment that is obviously important to everyone.

It was almost by accident that I received such an assignment in the tropical jungles of South America. The objective was to insure a nearby source of a vitally important strategic material — rubber — and eventually to lay the foundations for large-scale rubber plantations in the Western Hemisphere.

It began in 1941. I had gone to Colombia to penetrate the headwaters of the Putumayo River, where I intended to spend a year studying useful plants—especially narcotics and stimulants—known to the Indians in those far-off forests.

While I was in the interior, the Japanese struck Pearl Harbor. The news filtered in to me about a month after December 7th, but as soon as word reached me I began the trek back to Bogotá. There I found the Rubber Development Corporation, an agency of the U. S. Government, industriously organizing groups of foresters, botanists, and engineers. Our country needed an emergency source of natural rubber (for it was by then certain that the Japanese would seize the plantations of the East Indies), and these specialists were being mobilized to find ways of extracting it from the millions of wild trees in the Amazon Valley.

I was asked to join; agreed to do so, and was promptly sent back into the jungle — this time with much

more than an academic interest in useful plants. My assignment, which occupied me for a full year, was to seek out, map, and count stands of wild rubber trees along little-known rivers of eastern Colombia.

It was planned that, once a flow of rubber from wild trees was assured, attention would be turned to a long-range project. So, in due time, the U. S. Department of Agriculture, along with several Latin American countries, launched an even more ambitious program: establishment of large-scale rubber plantations for the first time in the New World.

A corps of specialists was brought together, each of whom had a special task. Mine, as botanist, was to scrutinize stands of wild rubber growing in the Colombian and Bra-

*A botanist describes his...*

*Twelve Years in a*

**"GREEN HEAVEN"**

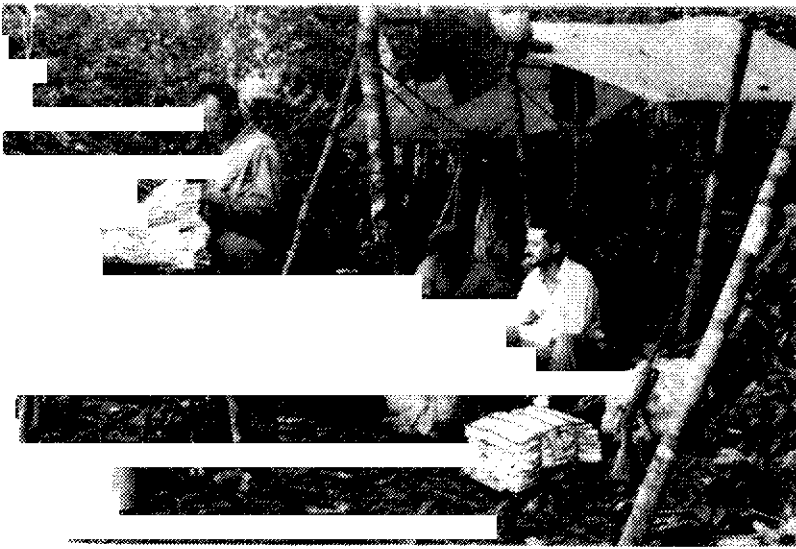
*As told to ARTHUR F. JOY*

*By*

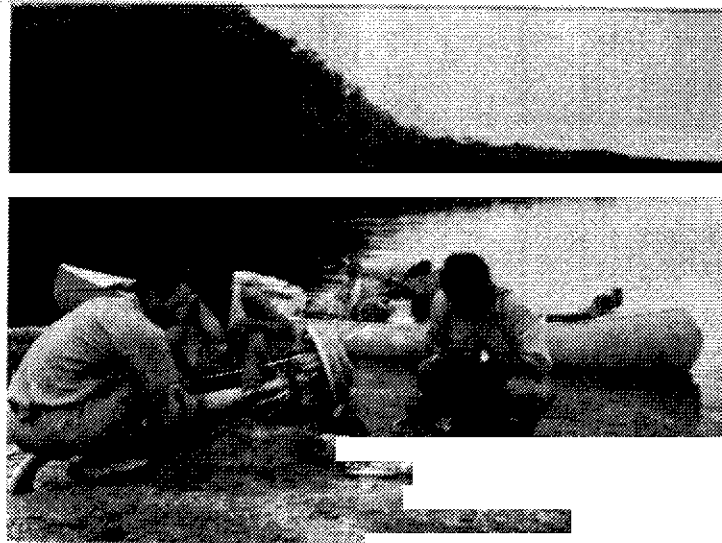
**RICHARD E. SCHULTES\***

\*Dr. Schultes, at present Curator of the Ames Herbarium at the Botanical Museum of Harvard University, was one of a number of scientists and technicians employed by the government and private companies to improve and expand rubber growing in the New World. Working as Botanist in the Rubber Plant Investigations Division of the Bureau of Plant Industry, U. S. Department of Agriculture, Schultes has recently returned from extended explorations in the Amazon Valley aimed towards a search for rubber trees of higher yield and disease resistance.

*All photographs by Richard E. Schultes, USDA, unless otherwise indicated*



▲ **LIVING QUARTERS** in the Colombian Amazon were necessarily primitive. Dr. Schultes (standing) examines a collection of plants made near the Falls of Jirijirimo on the Apáporis River.



▲ **TRAVEL** was by waterway. Most of the expeditions were made in an 18-foot aluminum canoe equipped with an outboard motor.

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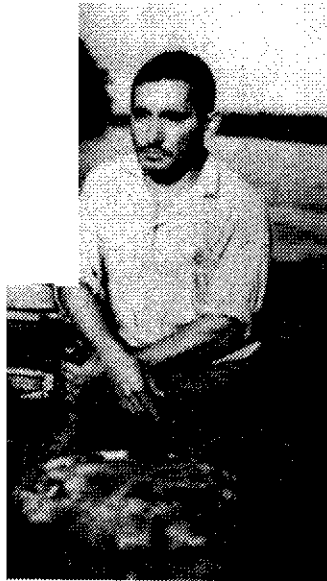


◀ **THE SCOPE** and demands of his studies took the botanist up countless remote jungle waterways of the Colombian Amazon. Some of his more rewarding experiences occurred in the Leticia area, and along the banks of the Putumayo, Apáporis, Miriti Paraná, and Vaupés Rivers.

▲ **RECREATION** for Dr. Schultes sometimes had a surprising twist. In this picture (he's the tall one), he was preparing to join the Yukuna Indians in their 48-hour Kai-ya-ree dance.

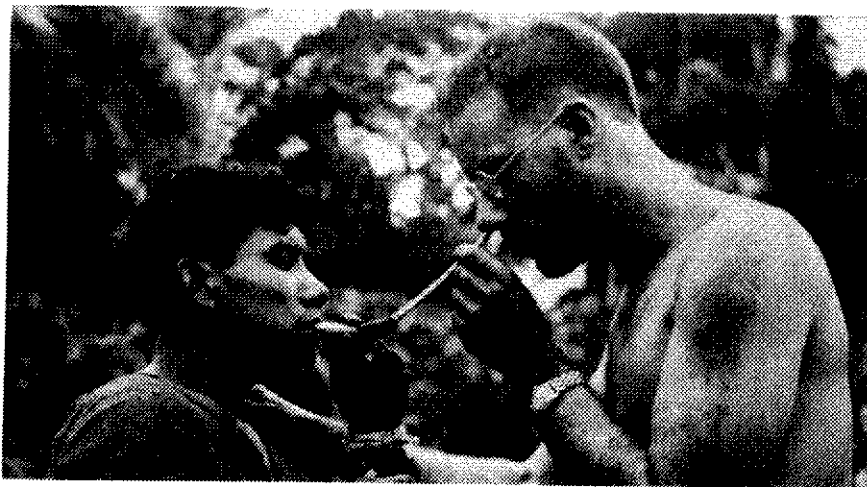


▲ PEDRO, Dr. Schultes' Indian assistant, was the son of a witch doctor and well-versed in jungle narcotics. Here, he is preparing *paricá* snuff, a powerful drug used by primitive mystics.



▲ ISIDORO CABRERA, a white-Indian *mestizo*, was another faithful assistant for the venturesome botanist. Though Isidoro grew up on a cattle farm in eastern Colombia, he took quickly to navigation on Amazonian waterways.

▼ A YUKUNA INDIAN offers snuff to Dr. Schultes through a composite bone and wood tube. The scientist's arms had been painted in preparation for a tribal dance in which he participated.



▼ DR. SCHULTES examines a tree of *Hevea brasiliensis*, some of which show promise of excellent rubber and possible resistance to leaf blight. Bud wood material of this tree was shipped back to plantations for testing.

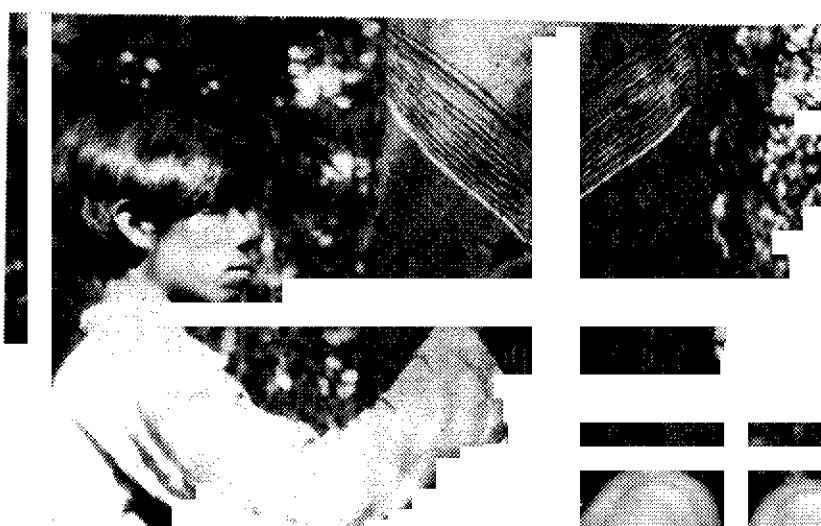
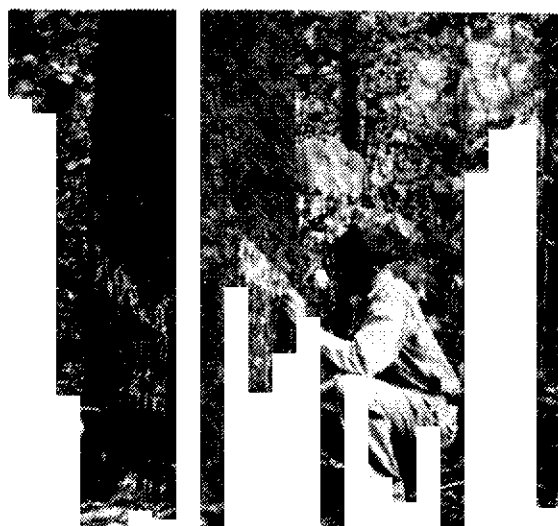
▼ THE INDIAN of the northwest Amazon is an excellent rubber gatherer. Each day, he trots through the forest on almost invisible trails, cutting the bark of up to 150 trees, inserting a little cup under each cut, and returning before sunset to gather the "white blood" the trees have yielded.

zilian jungles for the occasional tree of promise, and to get living samples of superior types into nurseries for testing. To me, this represented the opportunity of a lifetime. Besides the chance to explore the secrets of the rubber tree, it would permit the study of hundreds of rare, unusual plants, some of which had never been known to science.

My one-year stay in the jungle was destined to stretch to twelve. In the years that followed, my fellow scientists and I collected hundreds of elite individual rubber trees, or *clones*, and tons of rubber tree seeds—all of which were flown to various nurseries for study.

Capsule results of this concentrated group effort are difficult to present, but suffice to say that production of rubber from wild trees in the Amazon rose by thousands of tons during the war, and that the painstaking scientific studies provided vital background for present and future rubber plantations.

The area in which we worked, the Amazon jungle, is vast almost beyond comprehension—two million square miles, the largest forested region on earth—interrupted only by rivers feeding into the world's greatest waterway. Actually, there are many kinds of forests in the Amazon Valley, and the rubber trees we sought were found in several of them. To get what we wanted it was necessary to travel widely and to live in primitive regions for



months, since a botanist literally must live with plants to be successful in his efforts. He must study them throughout the year to obtain both flowers and fruit, watch changes in the leaves, and evaluate the effects of high and low water. Only through long and intimate association with a particular plant can he come really to understand it.

For example, I spent three years studying one species of rubber: *Hevea brasiliensis*. This, the most important species of commercial rubber tree, is common in Peru and Brazil south of the Amazon, but occurs north of it in Colombia only in one small patch—a small colony of about 150,000 trees in the Leticia area, along 80 miles or so of the Amazon River. I worked this small area over very carefully because these trees seemed to possess a natural resistance to the leaf blight, a characteristic we were seeking. We sent out several hundred selected clones and about 1,440,000 seeds—seven tons of them. These seeds, shown by experiment to be more resistant than usual, were used for root-stock in several of the budding nurseries in tropical South America.

### Helping hands

Scientists at work in an area like the Amazon Valley cannot possibly succeed without help from all kinds of people. I received invaluable assistance from Colombian government and army officials, Colombian scientists, missionaries, businessmen, farmers, workers, and last, but certainly not least, the Indians. I might not have even survived, much less accomplished any botanical work, without help from loyal, hard-working Indians who knew every bend in the rivers and every hill in the forests.

One lesson I learned early is that much of the paraphernalia usually lugged along on jungle expeditions is quite unnecessary, especially much of that highly prized in military circles. High boots, jungle hammocks, complicated tents and the like never weighed down my canoe. The lighter an explorer travels in the Amazon the better. This



★ AN INCA INDIAN of the Putumayo region aims his 8-foot blow gun at a monkey. A strong puff will direct a poison curate dart to a small target in the upper branches of a 100-foot tree.

applies to food, too. Contrary to current belief, the natives of the Colombian Amazon are well fed, and there is no reason to shun their diet. I have never seen an Indian with beri-beri, but I have seen many white men with it and have had it myself. At the start of each trip, I stepped into my canoe carrying only my medicine kits and a few tins of emergency rations. For the rest, I depended on the Indians.

Through the years, I had a number of outstanding natives with me. During the last three, for example, my crew consisted of Isidoro Cabrera, a 30-year-old white-Indian *mestizo*, and Pedro, an Indian of the Puinave tribe. From time to time, I would pick up an extra boy or two as interpreter, local guide or tree climber, or for help in getting around rapids. These lads were usually 12 to 15 years old—always exceedingly vigorous and alert.

Isidoro, though not an Amazoni-

an by birth, had worked with other botanists before me. He had been thoroughly converted to working with plants and animals as a life's calling, and gladly came along with me into lands he had never seen. He soon learned to run the outboard motor on my 53-pound aluminum canoe and quickly took to the waters of the great rivers.

The other boy, Pedro, was unbelievably skilled in navigating through rough water. He would stand up in the prow of the canoe while Isidoro and I piloted it with paddles or used the motor at very slow speed to get through the strong rapids. A slight miscalculation on his part could easily have dashed us all to death against the rocks, but Pedro had the knack of telling instantly which way was best. Often it was the *only* way to go. Like all Indian boys, he was a great tree climber. While Isidoro or I would use climbing irons, he would put a

loop of bark between his feet for good grip and, by a series of short jumps, go up much faster than we.

Pedro was contemplative to the point of impressing most whites as moody, probably due to the influence of his father, who had been a witch-doctor. He remembered much plant lore from his father's teachings, and it was he who helped clear up a mystery of long standing to me: the identity of the plant used by these natives to make their powerfully narcotic *paricá*-snuff. It is used by witch-doctors to throw themselves into a delirious stupor, during which they divine and prophesy. Pedro made some for me from the bark-resin of a tree belonging to the nutmeg family. It is such a strong narcotic that a small dose of it made me sick for two days.

#### Lost Worlds

One of the most fascinating areas I visited on my trips was the Apáporis River in Colombia, which requires a poet's pen to do justice to its vast solitudes. Botanically, I consider it one of the most absorbing regions on earth.

Practically no Indians inhabit the main river, which is hedged in by an immense forest still to be studied

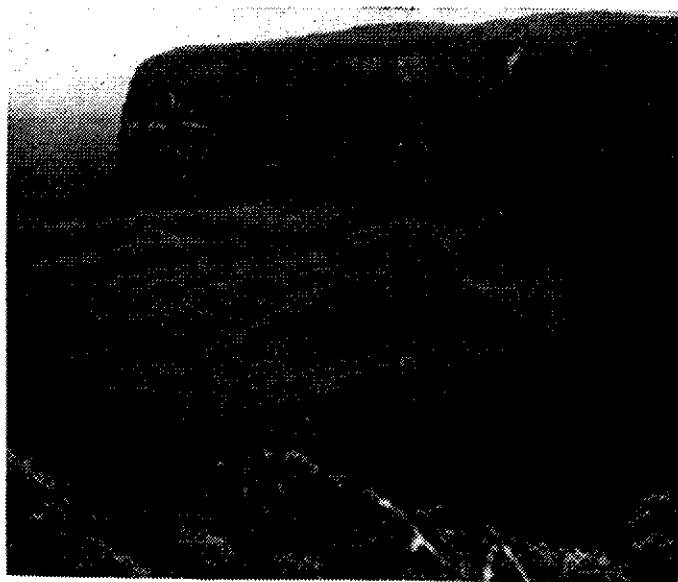
in all its phases. I first went there in 1943, because a few white people had brought back glowing tales of its wealth of wild rubber trees. It is much more accessible now, since a Colombian airline provides transportation to the area and a group of Colombians are pushing a colonization scheme based in part on production of wild rubber.

But then it was different. It was while exploring in the headwaters of the Apáporis in 1943 that we came upon some curious sandstone mountains—a discovery that was to mark the beginning of a ten-year exploration of many of these unknown land-masses. Most of the Amazon Valley is flat; but these mountains, grotesquely eroded, rear up like ancient castles and cathedrals. I know now that they are remnants of a once more or less continuous mountain-mass that extended in an arc from eastern Colombia across southern Venezuela to British and Dutch Guiana. The isolated mountains of today represent hard cores that have resisted erosion through the ages. The plants surviving on their tops are anachronisms and show many unusual adaptations. For this reason, the mountains are often called the "Lost Worlds." Many of the plants

from their domes are not related any way to plants in the surrounding Amazon forest. Among them one finds many that are either new to science or have their closest relatives far away in the mountains of Venezuela and the Guianas.

If I had been adhering to a routine study of rubber alone, I would never have made a discovery that has since proved to be significant in a broader understanding of the rubber plant. One day, tired and tedious portaging, my boys and I decided to scale one of those intriguing sandstone domes. We could hardly wait to see the dwarf vegetation on the top, a blurred preview of which my glasses had given us.

When we arrived at the crest of the sun-baked ridge, we discovered the summit was covered with dwarf rubber trees! Instead of towering 100 or 150 feet, they were only 6 to 8 feet tall! There were hundreds of them. Some were so small as to be lying almost flat. We chopped up one tree and started it on a long odyssey by Indian-back and canoe that took it eventually to Washington, D. C., for analysis by the Bureau of Standards. The dwarf tree was found to contain rubber of good quality; but the trunk, of course



▲ SANDSTONE MOUNTAINS, rearing up like ancient fortresses above the green plain, were treasure troves of rare and unusual plants.

▼ A DWARF RUBBER TREE was Dr. Schultes' most exciting discovery on the sandstone mountains. He called it *toxicodendroides*, because the leaves reminded him of poison ivy.



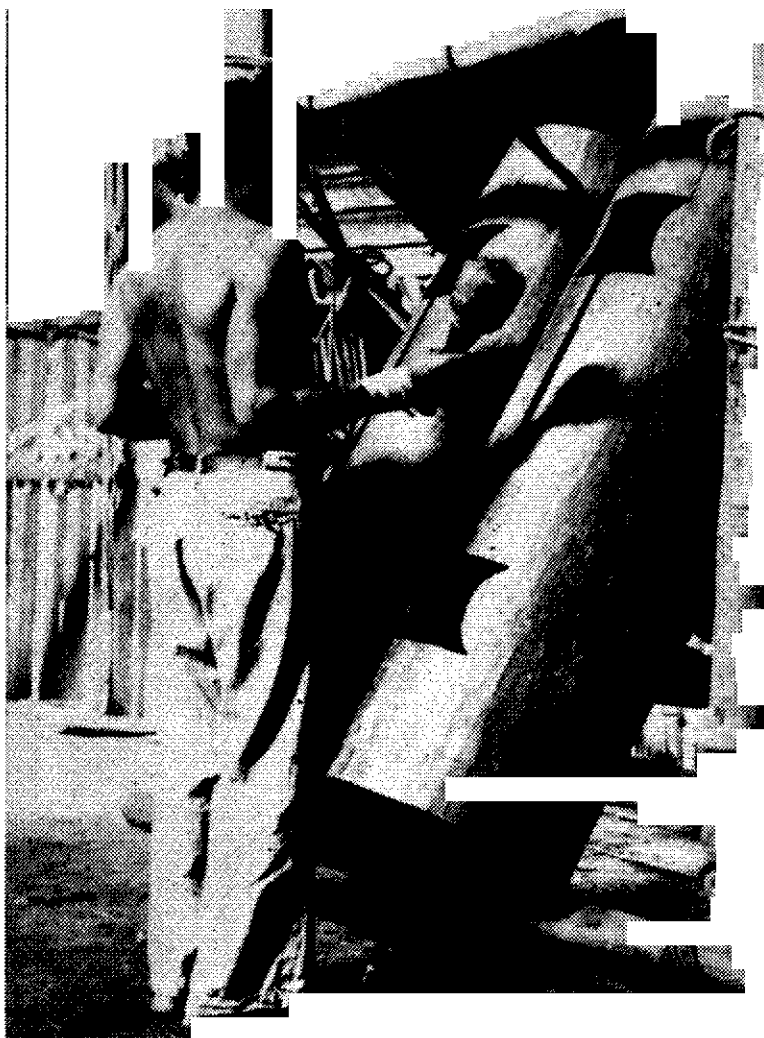
was too small for tapping. We called it *toxicodendroides*, a word meaning "resembling poison ivy," for, with its three, typical, glossy, dark green leaflets, the similarity is indeed striking.

Despite the economic limitations, I found the little tree intriguing academically. I wondered if I had stumbled onto a primitive kind of rubber tree. I could not be sure, however, because the extreme scarcity of soil on the mountaintop might have accounted for the stunted growth. Furthermore, the mountaintops were actually deserts; there was nothing on them to keep the heavy rains from running off quickly. So, on a second trip, I secured a living specimen and had it planted in the fertile soil of a rubber nursery where the yearly rainfall sometimes reaches six yards! Would the treelet grow larger under these conditions, proving it only an ecotype (a variant produced by environmental conditions)? Or was it a real, stable variety?

After many months of growth

the little tree was somewhat more luxuriant, but still bushy and small. Thus we had something of considerable interest to geneticists working for a deeper understanding of the rubber tree.

There is more, much more, to be investigated in these forests. There is the curious liana *yoco*, which the Indians of the Putumayo area of Colombia use as we do coffee, and the bark of which actually contains caffeine. There is the violent narcotic tree with hanging, white flowers ten inches long—a genus and species totally unknown to botanical science and as yet not described—used by the witch-doctors of certain tribes to bring on a very dangerous intoxication. There is the discovery of a six-foot member of the pipewort family and several new species of trees related to *Hevea*-rubber, the re-discovery of scores of plants that have not been seen by botanical explorers since the first collection a hundred or more years ago, the encountering of beautiful new species of orchids, and the identification of



▲ JUNGLE COMMUNICATION is facilitated by the *manguare*, w. Indians of the upper Amazon thump out messages to tribes many day's travel distant. The hollowed-out logs are of unequal size and out slightly different tones when struck with rubber-tipped d

some of the food-plants that the Indians have cultivated or used in the wild for years, but which had not been known to us with certainty.

#### *Jungle friends*

An absorbing corollary to my botanical work was an attempt to learn some of the ways and customs of the Indians. There are said to be some 60 different Indian languages in Amazonian Colombia. Most of these are dialects spoken by only a few people, but there are at least four spoken by a great many: Witoto, Tikuna, Cubeo, and Tukano. Each of these four represents a tribe of from 2,000 to 4,000 people.

All of these Indians are peace-loving. Most tribes are submissive, but a few, like the completely untouched tribes dwelling along the Piraparaná River have, in recent

years, killed a number of famous rubber men who tried to force them to work in forests far from their homes.

We were constantly fighting against going up certain mountains. I found the natives to be very helpful. I think that perhaps a linguist can get along especially well with them because he shares their common interest. They, too, are interested in plants, and are naturally curious about anyone whose entire life is directed toward their culture and study.

"What is this plant in your country?" they would ask repeatedly. "Why do you want it?"

It is often hard to explain things, especially with language difficulties, but usually it is easiest to show. It is a good remedy for some ailments. Often, a lively discussion



▲ TINY INDIAN BABIES are bathed regularly in rivers that flow by their homes. The waters apparently are so pure that there is no danger of infection.



LITTLE KAPI was the son of Taiwano chieftain, and worked for Dr. Schultes as guide and tree-climber. When he accompanied the botanist to the tiny Colombian town of Mitú, he requested payment in clothing. The transformation is seen at right.



low, leading to interesting information.

Practically all of the inhabitants of this huge region in Colombia live on fish, game, and farina. The last-named is a dry, pulverized product of the poison yuca or tapioca plant (*Manihot esculenta*) and is their main source of carbohydrate. The dry meal is unpalatable to civilized whites, but the natives always carry a basketful of it when traveling. The poison is leached out by two or three washings. Even the violently poisonous water is put to use; the natives boil it down, until it becomes as thick and brown as molasses and until all of the poisons are broken down by heat. The result is a thick syrup called *tucupí*, a delicious condiment when spread on meats. Tucupí has a taste difficult to describe; the natives add chili peppers to it for extra flavor. It may be a good source of vitamins.

Just as essential as food to these Indians is their coca. The coca plant (*Erythroxylon coca*), from which cocaine can be extracted, is cultivated on a vast scale all over Colombia's Amazon. The Indians prepare it differently from the people in the Andean highlands. The Amazon natives toast and pulverize the coca leaves. The resulting powder is mixed with ashes of the leaves of the *yarumo* tree (*Cecropia*) to produce a gray-green mixture. In some tribes, coca is chewed almost continuously throughout the day.

Campaigns against coca are being waged by some local governments and by certain international groups. Colombian missionaries and government officers sometimes attempt, in the fastnesses of the Amazon jungles, to deprive the Indian of his coca. But their efforts are futile. As used in the Amazon, it does not seem to be a physiologically habit-forming drug or appreciably harmful. The Indian will never go on long canoe trips or hunting expeditions without his chew of coca, and one of the great preparations for dances, in which the whole tribe takes part, is the making of huge quantities of coca for the guests. Coca, incidentally, can be of incal-

enlabeled help to the plant-explorer who wants to go through the day without eating at noon, for one of its useful properties is a deadening of hunger pangs.

### *A great tribute*

One of the friendliest gestures an Indian can show a white man is the preparation of a tribal dance in his honor. All the native dances are fascinating, of course, but there was one that held my interest especially and in which I took part.

It was among the Taiwano Indians on the Kananari River. Refreshments for the dance were *chicha* and *yajé* (also known as *caapi*). *Chicha* is a slightly fermented drink which may be made from whatever fruit happens to be in season—pineapples, peach-palm, or other—and is prepared in a dugout canoe. At this dance, the Taiwanos were drinking pineapple *chicha*, and we danced and drank until the canoe was empty. Intermittently, some of the participants were also drinking *yajé*, a narcotic derived from a jungle vine (*Banisteriopsis Caapi*). *Yajé*

induces colorful visual hallucinations. When under its influence, the Indians often stop dancing, sit back, and lapse into a pleasant laziness.

I drank some of this drug. The experience could be described by no other word than "pleasant." First there came a sensation of ease and well being, after the heat of the dance. Then the visual effects began. I found myself gradually becoming aware of the largeness of the round Indian house in which we were sitting and of the extreme brightness of the fires. The flames, to my astonishment, gradually turned a hazy blue! I did not experience the extreme visual hallucinations that the natives assert *yajé* induces. There can be no question that they see jaguars and other animals, but the hallucinations come in a semi-dream state and usually are not frightening to them.

Some tribes use an overdose of this drug to bring on an artificial bravery. It is used, for example, in the fast-disappearing Yuruparí dance, in which boys to be initiated into manhood must stand up under

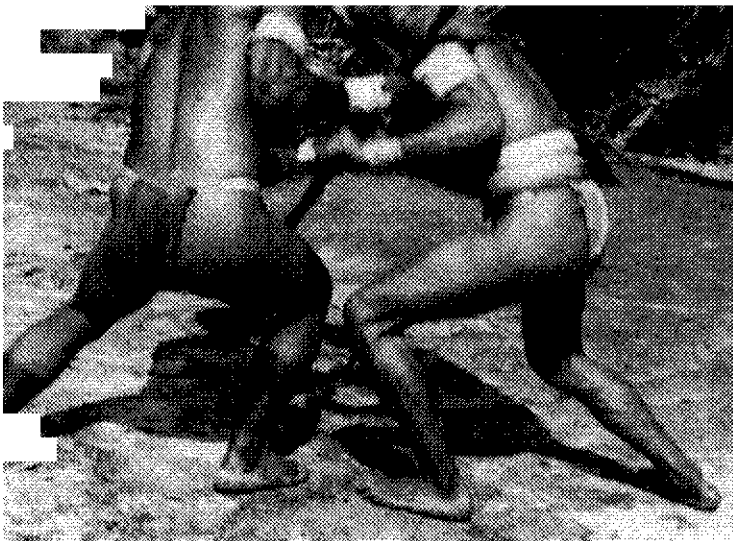
unmerciful lashings. Older men do the lashing, and it is severe enough to raise welts! Sometimes the beatings result in death. Should a boy flinch during the ceremony, his coming-into-manhood is put off another year, and with that goes his right to take a bride. Many are those who pass this crucial test thanks to the narcotic *yajé*.

Some of the happiest moments of my rubber-hunting days were spent with Indian tribes in their spacious, rain-proof, palm-thatched houses, observing their ceremonies and gathering information. Mingling with the natives helped break down their suspiciousness and made it easier to delve into their botanical lore.

The tribes that impressed me as having the most beautiful and weirdest of all Indian dances in Colombia, perhaps in all of South America, are the Yukunas and the Tanimukas. They inhabit the headwaters of the Mirití Paraná River and, while important tribes, are not even mentioned in our anthropological handbooks. They celebrate the

*continued on page 165*

with a stout, gnarled stick, seeking an opportunity to  
Great strength and agility are required, and winners are feted royally.



★ THE CUBEO INDIANS of the Vaupés River are a happy people who love rhythmic dancing. The thumping stick (trunk of a young balsa tree hollowed out by fire) is used for marking time.

greatest of all of their annual rites with the Kai-ya-ree dance.

The Kai-ya-ree is undertaken only when the peach-palm fruit (*Guiljelma speciosa*) is ripe. This fruit makes a delicious and nutritious yellow-orange, slightly fermented beverage. The dance is one that continues without interruption for a day and a night. Only the men dance. While one man will not dance all that time, the ceremony is continuous and is actually a collection of 80 different dances in one—apparently representing the entire mythological history of the tribe, commencing with its beginnings, when the gods changed a tiny fish, which they call *o-mee-na*, into the first Yukuna men. The dancers wear shirts and skirts made from the pounded bark of *Olmedia* trees. They also wear masks, representing animals and men, made of the pitch from the rare and beautiful pink-flowered *Symphonia* tree. All of the songs and masks, according to Indian belief, were revealed to chiefs by the gods in yajé dreams. At the end of the dance, in the early morning hours, the mysterious balsawood mask, known as the *muloero*, is worn. It symbolizes a kind of semi-god of the ancient Yukunas and is the center of one of the most pleasingly graceful dances imaginable.

Like primitive peoples all over the world, the Indians have superstitions which arouse genuine fear. On one of my collecting trips, I had to pass through the awesome Jirijirimo rapids on the Apáporis River—a natural wonderland. Here, miles from the nearest Indian hut, in the midst of an immense jungle, the river suddenly narrows from about a mile's width down to 60 or 100 feet. It then rushes headlong over a waterfall and cascades down nearly a hundred feet, thereafter to flow through a canyon for some ten miles. In some places it narrows to a mere 20 feet, and at one place in the canyon the water disappears entirely as it runs through a natural tunnel.

At the falls, many enormous boulders are strewn helter skelter, and a giant face has been carved by nature on one of the cliffs. As we drew near this area, my young Indian guide, Kapi, grew visibly nervous. When I urged him to paddle on, he shook his head and indicated that he wanted to go ashore. My civilized helper and I paddled on through the tunnel ourselves, and Kapi met us farther downstream—after a 15-mile walk! His explanation was that, according to tribal lore, the boulders were actually the souls of dead Indian leaders and that the giant face belonged to a huge stone god who guarded their spirits. It was taboo for any Indian to look upon that face. This belief was so compelling among the Tairuanos that they had worn trails through the forests over which they dragged their canoes for 15 miles rather than pass the great stone face by the river.

#### "Green Hell" doesn't exist

Though wilderness areas are always fascinating, it is unfortunate that an aura of awe has grown up around the tropical jungle and an almost laughable aura of heroism around those who "brave the green Hell." Life there is certainly much freer from physical danger than on our modern highways. Many of the misconceptions are created by writers of books of "exploration." The young scientist should know that far too many of these are written solely to sell. The man who, after a few short weeks in the jungle, produces a thriller in which death is avoided almost daily, natives are treacherous, man-eating animals lurk in every bush, and supplies are always lost at the critical moment, is either exaggerating greatly or else unfit to be loose outside a large city.

I shall never forget the remark of a friend of mine, a botanist and explorer, who said: "If an expedition is always meeting unusual obstacles or hair-raising adventures, it is a sure sign that it was poorly organized and carried out." Although

I cannot pose as an advisor, I cannot refrain from saying to anyone starting a career as a plant-scientist: Do not be over-awed by the unknown. Go into your new territory as though you were about to go into the Maine woods on a two-week deer-hunting trip.

Does plant exploration in the jungle over a long period make a man dissatisfied with civilization? My answer is that a botanist would be remiss in his professional obligations if he let such a thing happen. New knowledge cannot be made available unless it is worked up for publication in our botanical institutions and libraries. Field work is but a preliminary part.

Nevertheless, I do miss the Amazon. I know that there are untold botanical discoveries yet to be made there, even in that little piece of the Amazon Valley that lies within Colombia's borders, and, some day, I hope to paddle down the rivers and tread the jungle trails again.

My sentiments are like those expressed by Charles Waterton, that great British traveler of a century and a half ago, speaking of Guiana:

"Gentle reader, after staying a few weeks in England, I strayed across the Alps and the Apennines and returned home but could not tarry. Guiana still whispered in my ear and seemed to invite me once more to wander through her distant forests."

The Colombian Amazon frequently whispers to me.

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In response to a request from the editors of NATURAL HISTORY, Dr. Schultes prepared a list of useful books for persons who wish a more extensive introduction to Amazonian exploration and tropical botany. Following are selections from that list.

Spruce, R. (edited by A. R. Wallace): *Notes of A Botanist on the Amazon and Andes* (1908) 2 vol.

Herndon, W. L.: *Exploration of the Valley of the Amazon* (1854), recently re-issued.

Bates, H. W.: *The Naturalist on the River Amazon* (1864).

Schomburgk, R. (translated by W. E. Roth): *Travels in British Guiana* (1923).

Goodspeed, T. H.: *Plant Hunters in the Andes* (1941).

vonHagen, V. W.: *South America Called Them* (1948).

Richards, P. W.: *The Tropical Rain Forest* (1952).

Verdoon, F. (editor): *Plants and Plant Science in Latin America* (1945).

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