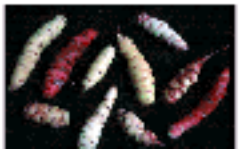
Ethnobotanical Leaflets



The Rubber Tree (*Hevea brasiliensis*)

By Keith E. Morgan

Rubber is a valuable commodity in today's economy. A vast number of products are made from it, including washers, gloves, gaskets, tubing, waterproof clothing, toys, erasers, belts, elastics, bottle stoppers, and insulation for electrical wiring. The largest single use of rubber is in the manufacture of pneumatic tires which consumes 60% to 70% of the total world production each year. Demand for rubber has grown remarkably since the beginning of the industrial revolution.

It is one species, *Hevea brasiliensis*, which makes up 99% of the world's natural rubber production. In 1989 that production was worth an estimated 4 billion dollars.

Hevea brasiliensis (the para rubber tree) is a South American native that can grow to a height of 150 feet. The trees have a smooth bark and palmately compound leaves. They are monoecious and have small inconspicuous flowers. The seeds are akin to castor beans. On ripening, the fruit capsule explodes and propels the seeds away from the tree.

Hevea brasiliensis is a member of the family Euphorbiaceae (the spurge family). Euphorbiaceae is a diverse family with approximately 290 genera and 7,500 species. Within the family, there are herbs, shrubs, trees, and fleshy cactus-like species. Some plants from this family are used for their medicinal properties and edible parts. Others are used simply as ornamentals.

While there are many useful plants in the family Euphorbiaceae, the sweet and bitter cassava plants (*Manihot dulcis* and *Manihot esculenta*), as well as the castor oil plant (*Ricinus communis*), are of greatest economic importance.

Latex bearing plants are found in some 20 botanical families. The most prominent families include Sapotaceae, Moraceae, Compositae, Apocynaceae, Asclepiadaceae, and Euphorbiaceae. In total there are about 18,000 species of latex-producing plants. Yet, only a few species are currently exploited.

Commercially useful rubber-producing species include *Hevea benthamiana* (Para rubber), *Hevea*

guianensus (Para rubber), *Manihot glaziovii* (Ceara rubber), *Manihot dichotoma* (Jeque rubber), *Castilla elastica* (Panama rubber), *Ficus elastica* (India rubber), *Funtimia elastica* (Lagos rubber), *Landolphia kirkii* (Landolphia rubber), *Landolphia gentilli* (Landolphia or Madagascar rubber), *Landolphia heudelotii* (Landolphia or Madagascar rubber), *Landolphia owariensis* (Landolphia or Madagascar rubber), *Crytostegia grandiflora* (Madagascar rubber), *Crytostegia madagascariansis* (Madagascar rubber), *Parthenium argentatum* (Guayule), *Taraxacum kok-saghyz* (Russian dandelion), *Taraxacum megalorhizon* (Russian dandelion), *Palaquim gutta* (Gutta percha), *Manilkara bidentata* (Balata), and *Manilkara zapata* (Chicle).

Depending on the species of plant, the latex may be found in a number of locations. It may be within the cells or intercellular spaces of the roots, stems, or leaves of the plant.

In *Hevea brasiliensis* latex is conducted in vessels within the inner bark. Modern tapping methods take advantage of this. Latex is drained from the tree by cutting a shallow groove in the bark that stops short of injuring the cambium. This technique causes no permanent damage to the tree and allows for a productive life span of up to 15 years.

The Aztec Indians of Central America and the Inca Indians of South America were the first to use rubber on a relatively large scale. Rubber was in use in the New World for perhaps a thousand years before Europeans arrived. Yet, the precise time and circumstance of its discovery are unknown. The Indians used rubber to make a variety of goods, including footwear, bottles, torches, and balls.

There were two problems that kept rubber from becoming a widely utilized commodity by Europeans. First, rubber articles had to be fashioned within hours of obtaining the latex from the tree as, once the rubber congealed, there was no known means to return it to its liquid state. Second, and perhaps more acute, was rubber's temperature sensitivity. Rubber articles became sticky when hot and brittle when cold. This last problem severely limited rubber's usefulness.

From its "discovery" in the late 1500's until the 1900's, rubber remained largely a curiosity in Europe. Elastics were produced for use in clothing; and, attempts were made to create tubing for medical uses. By 1770, rubber cubes were being used in England as erasers, which is where the name "rubber" originated. In the 1820's methods of re-liquefying rubber were developed and used to produce water-proof two-ply clothing.

By the 1840's, the method of vulcanization (combining sulfur with rubber at elevated temperature) was employed to make rubber stable in hot and cold temperatures. With vulcanization, rubber became a useful commodity.

With the mastery of rubber processing came invention and exploitation. The more mundane uses of rubber (for stoppers, etc.) were perfected almost over-night. But, it was the development of the pneumatic tire, first for the bicycle and later for the automobile, that produced the world's great demand for raw rubber.

Prior to 1900, natural rubber was obtained solely from wild plants. *Hevea brasiliensis*, *Ficus elastica*, and *Castilla elastica* were the most extensively utilized. Both of the later species had to be killed in order to extract the latex. This factor, among others, made *Hevea brasiliensis* the best candidate for domestication.

Several attempts were made by the British to introduce *Hevea* plants into their colonies in the Far East. In the late 1870's a large number of viable *Hevea* seeds (70,000) were successfully transported from Brazil to Kew Gardens. Only a fraction of the seeds survived to germinate. After a few months in England the seedlings were carefully shipped to Java, Singapore, and Ceylon (now Sri Lanka). Some ten percent of the seedlings died; but, there were enough survivors to establish *Hevea* plants in the Far East.

As cultivation techniques were developed, tapping procedures were improved and methods of vegetative propagation were devised. It took several years, however, to persuade people to plant rubber instead of more familiar crops. So, while the seeds and techniques for plantation style rubber cultivation were available in the Far East as early as 1880, it took almost 20 years before the first plantations were established.

In the 1940's, the first process for making synthetic rubber, made from petroleum, was developed. By the late 1950's the production of synthetic rubber surpassed that of natural rubber. Currently, the world production of synthetic rubber is twice that of natural rubber. But, as the demand for rubber has steadily grown since World War II, natural rubber production has also increased. So, while natural rubber's share of total production has declined, the total output of natural rubber has quadrupled.

Today, 85% of the world's natural rubber comes from the Far East (Malaysia, Indonesia, Thailand, Sri Lanka, and India). Small quantities of rubber are also produced in South America and Africa (along the Ivory Coast).

In South America, plantation agriculture has failed because of "South American Leaf Blight" (*Dothidella ulei*), which is chronic among wild trees that are widely spaced but becomes epidemic in closely grown plantation clones.

The rubber industry has become a vast extension of our technological society. Much of our modern lifestyle is possible because of rubber. The history of rubber, from curious good to essential commodity, is a story we should keep in mind when we look at the curiosities of today. Some of them may become the essential commodities of tomorrow.

References

Allen, Peter W., 1972. Natural Rubber and the Synthetics. John Wiley & Sons, New York, NY.

Bloch, Nina, 1990. Crops and Robbers. Earthwatch 10:2 14-21.

Coates, Austin, 1987. The Commerce in Rubber: The First 250 Years. Oxford University Press, Singapore.

Coon, Nelson, 1974. The Dictionary of Useful Plants. Rodale Press, Emmaus, PA.

Firestone, Harvey S., Jr., 1932. The Romance and Drama of the Rubber Industry. The Firestone Rubber Co., U.S.A.

Grilli, Enzo R., Barbara Bennett Agostini, and Mania J.'t Hooft-Welvaars, 1980. The World Rubber Economy. Johns Hopkins University Press, Baltimore, MD.

Heywood, Vernon H., ed., 1982. Popular Encyclopidia of Plants. Cambridge University Press, Cambridge.

Hyams, Edward, 1971. Plants in the Service of Man. J.B. Lippincott Co., Philidelphia, PA.

Long, Harry, ed., 1985. Basic Compounding and Processing of Rubber. Lancaster Press, Lancaster, PA.

Schery, Robert W., 1972. Plants for Man 2nd ed, Prentice-Hall Inc., Englewood Cliffs, NJ.

Wilson, Charles M., 1943. Trees and Test Tubes. Henry Holt and Co., New York, NY.

EBL HOME PAGE
