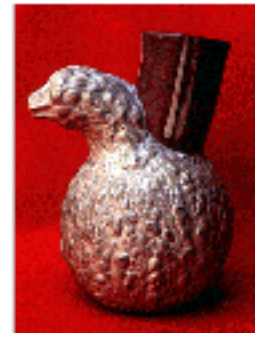




Ethnobotanical Leaflets



Hevea brasiliensis: The Rubber Tree

By Laura Law

During the Age of Exploration many people were sent out to seek unknown plant species that might serve as raw material, remedy, or ornament. Of all the great feats of that era of botanical discovery, none was more imposing than that of the domestication of rubber. New World inhabitants had shown rubber, which they obtained from several tropical plant species, to early explorers, including Columbus. Since it was an unstable product, it remained for more than three centuries a mere curiosity. Then, in 1839, it was found that through treatment with sulfur and heat (vulcanization), rubber's elastic properties could be made more permanent. (1)

Hevea brasiliensis is the source of virtually all the world's rubber production. Cutting the bark of this tree releases the latex which is then collected, preserved, and stabilized. The latex is located in the inner bark of the tree and flows in the vessels of the tree. Latex is thought to be a defense against insect predators for the tree. (1)

Hevea brasiliensis was first found in the Amazon basin. The rubber trade became a mainstay of the Brazilian economy, providing at its height almost 40 % of its export revenues. It was not long before the idea was conceived of domesticating rubber. However, Brazil was not the site of the successful commercialization of rubber. Rubber cultivation was, instead, transferred to Southeast Asia. Soon abundant and cheap, rubber was put to thousands of uses. Its reduced cost was an important factor in the emergence of a mass market of automobiles; from two-thirds to three-quarters of the demand for rubber soon came from the makers of tires and tubes for motor vehicles. (1) After tires, latex products, footwear, belts and hoses, and wire cables are the most important uses for rubber. (3) Rubber is harvested in Africa, Central and South America, and in Asia, the latter accounting for greater than 90% of production.

There are 11 species of *Hevea*. *Hevea brasiliensis* is a member of the Euphorbiaceae family (spurge family). Although not limited to the Euphorbiaceae, latex production is one of its distinguishing characteristics. (7)

The plants of the Euphorbiaceae family are mostly monoecious herbs, shrubs, and trees, sometimes succulent and cactus-like, and comprise one of the largest families of plants with about 300 genera and 7,500 species that are further characterized by the frequent occurrence of milky sap. (6)

The flowering and pollination of the *Hevea brasiliensis* tree are also distinguishing characteristics of this plant. *Hevea* may undergo two flowerings. In Malaysia for example, flowering occurs in February to April and (a lesser flowering) in September and October with winterings in January and February, and August and September. The inflorescence is a panicle of separate staminate and pistillate flowers borne in the axils of basal leaves of new shoots that grow out after wintering. Pistillate flowers are terminal to the central stem and other major branches of the inflorescence. Smaller and more numerous staminate flowers make up the rest. Both flowers are shortly stalked and scented. Neither flower has petals but rather five triangular lobes. Staminate flowers have two rings of five stamens each borne on a stalk. Pistillate flowers have a compound ovary with three locules topped by three sticky, sessile stigmas. Within an inflorescence, a few staminate flowers open first and fall off after one day. Pistillate flowers then open for a period of three to five days after which the rest of the staminate flowers open. This mechanism ensures a high degree of cross-pollination. (7)

Pollination is primarily through insects, specifically midges and thrips. Wind appears to play no role. Fertilization occurs within 24 hours after pollination. Unfertilized pistillate flowers quickly wither and die. There appears to be no evidence of self-incompatibility although cross-pollination usually results in better fruit set. Hand-pollination for breeding purposes is customary. Stamens are removed from the seed parent to prevent selfing. A staminate flower from the pollen parent is then applied to the pistillate flower of the seed parent and secured with cotton. (7)

Some economically important relatives of *Hevea brasiliensis* are *Ricinus communis* (castor bean), *Manihot esculenta* (tapioca, manioc), and *Euphorbia pulcherima* (poinsettia). (6)

There are many common names associated with this plant. Some of the names are: rubber tree, jebe, Para rubber, seringueira-branca, siringa, etc. It seems that each set of explorations to the New World from differing European countries yielded a new name for this tree. (8)

The species is native to South America. It occurs in Bolivia - Beni [north]; Brazil - Amapa, Amazonas, Mato Grosso, Para; Columbia - Amazonas; Peru - Huanuco, Loreto, Madre de Dios, Pasco, San Martin. However, plants of this species were also cultivated and domesticated elsewhere. (8)

Although the production of natural rubber began in the Americas, the introduction of *Hevea brasiliensis* seedlings by the British into other countries has led to predominance of the industry in Southeast Asia. Production of rubber from plantations expanded during World War II, and plantation rubber is still produced in Latin America, but the production is overshadowed by that from Southeast Asia. (4)

The plantations developed, of course, around certain plants - annuals, shrubs, or trees - whose produce was either completely or comparatively unknown in Europe. (2)

The rubber tree had not even been domesticated by the time the colonists arrived, although the natives may have been harvesting it wild in the jungle and forests for centuries. In this case, the planter had to start by domesticating the plant before he could decide how and where to grow it and what use to make of its produce. In these activities, he got most help from the botanists who, as plant hunters, plant breeders, practical gardeners and analytical chemists, were the indispensable all-purpose scientists of the eighteenth and nineteenth centuries. The botanists, more than anyone else, helped to break the Chinese quasi-monopoly of tea and the Brazilian monopoly of rubber. (1)

Hevea is one of our youngest domesticated crops. (7) Rubber was first discovered on a French expedition to the New World. The French expeditions to the New World made notable contributions to botanical knowledge. A Frenchman named La Condamine who was not a botanist, gave Europe its first notice of the *Hevea* tree from which comes South American rubber. (5)

The world rubber industry began to develop in the 1800's. The impetus came from technological innovations: the invention of the masticator, which enabled solid natural rubber (NR) to be softened, mixed, and shaped, and of the vulcanization process, which drastically improved the physical properties of natural rubber. Throughout the 1800's and most of the first half of the 1900's, important changes took place within the world rubber economy. Wild rubber from Brazil and Africa gave way to plantation rubber from East Asia. These changes in the mode and geographical location of natural rubber production led to vast improvements in productivity.(3)

The production of natural rubber is now concentrated in only a few countries. Three major Asian producers - Malaysia, Indonesia, and Thailand - account for 80 percent of

the world total. Two other Asian producers - Sri Lanka and India - and two African producers - Liberia and Nigeria - account together for another 12 percent of the world total. (3)

Hevea is prone to many diseases. One reason the cultivation of *hevea* took place in Southeast Asia as oppose to South America was that the strand domesticated in South America was susceptible to South American Leaf Blight caused by *Michocyclus ulei*. This disease is native to the Amazon and continues to limit the growth of the rubber industry in Brazil. The seedlings that were taken to Southeast Asia were free of this disease and have so far remained untouched by it. (7)

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