



Ethnobotanical Leaflets



Cotton: The Fabric of Our Lives

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Oils, balls, swabs, bandages, tissue, paper, napkins, diapers, socks, underwear, shirts, shorts, sweaters, pants, coats, towels, linen, cushions, drapery, upholstery, rugs, carpet, comforters, mattresses, insulation, filtration, and many other things that are used daily by everyone are composed of, or inspired by cotton. Cotton is a soft, fluffy, naturally occurring fiber plant that can be processed into an array of materials and goods.

Many, many things that we wear, sleep on, sleep under, walk on, or utilize in wound-care, etc., contain some percentage of cotton. It is a fiber that is used everyday, by everyone, in one way or another. It has qualities that have made it a choice crop for centuries around the world. Today though, cotton is being largely displaced by synthetic fibers that have qualities that exceed the natural crop plant. These fibers can also be mass-produced and sold at relatively lower costs.

Still, cotton stands alone as the most utilized fiber crop plant used around the world. Also known as "King Cotton," in the United States, it was the major force behind the institution of the American age of slavery, and cotton prevailed as the economic source for the southern states of the United States and its antebellum prosperity before the civil war. It holds an important place in America's past, present, and future. Cotton is truly the "Fabric of Our Lives".

Characteristics

Cotton is an annual, biennial or perennial plant, but in cultivation it is generally treated as an annual; herbaceous to short shrub or small tree - two to six feet tall. It consist of a primary axis, erect and branched with a vegetative lower zone having monopodial branches, and a fruiting upper zone with sympodial branches. The leaves of the cotton plant alternate, cordate petiolate, three to nine lobed and palmately veined, with varying size, texture, shape and hairiness. The large, showy, cream yellow, red or purple flowers are extra axillary, terminal, solitary, and borne on sympodial branches. The calyx (= collectively the sepals) consists of a very short cup-shaped structure at the base of the corolla. The five petals of the corolla are either free or slightly united at the base of the convoluted bud (Sundararaj,

1974).

Cotton belongs to *Gossypium*, a genus named by Linnaeus in the middle of the 18th century. The genus has been classified in both the Malvaceae or mallow family and the Bombacaceae families and in both the Hibisceae and Gossypieae tribes. Today, the genus seems firmly placed in the Malvales order, the Malvaceae family, and tribe Gossypieae, because of the uniqueness of the lysigenous glands found throughout species within the genus. These glands contain a number of sesquiterpenes, collectively called gossypol. Only those species of *Gossypium* producing seed hairs can accurately be called cotton (Smith, 1995).

The seed hairs are unicellular outgrowths of the epidermis of the seed, or seed coat, and consist of a thin primary wall and a secondary cellulose wall, which develops after primary growth of the plant has ceased. In commercial cotton, the hairs are of two types, lint and fuzz. Lint hairs are the cotton of commerce or the seed hairs suitable for spinning, and develop in a different way than cotton fuzz (Munro, 1987). Lint hairs are distinguishable by being convoluted or twisted. The deposit of cellulose in the cuticle is much less. When the capsule opens and the lint hairs dry, they collapse around their central hollow axis. The cellulose thickening is deposited in spirally arranged fibrillae. The spirals reverse directions at intervals so that they are present in the same hair in both clockwise and counter-clockwise directions (Prentice, 1972). This causes the ribbon to twist, and these irregularly twisted ribbons cling together when spun into thread. This cling allows a strong thread to be produced from cotton, although the individual fibers are much shorter than those of wool or flax (Munro, 1987).

The fuzz hairs or linters are generally shorter, have a larger diameter, a smaller lumen and a much thicker cellulose deposit in the secondary wall which prevent the formation of twists when the cell dries out at maturity. This makes the fuzz unspinnable, but it is marketable for items such as upholstery stuffing and for the production of cellulose (Prentice, 1972).

History

The origin, evolution, and domestication of cotton remain somewhat of a mystery even to this day. The time when cotton fiber was first used by humans is not known. It is known, though, that civilizations on both sides of the world possessed cotton. The oldest archaeological record of cotton textiles, which dates back to about 3000 B.C., was found in excavations at Mohenjo-daro in the valley of the Indus River in West Pakistan. Peruvian archaeological excavations found cotton specimens that had been fabricated into textiles as far back as 2500 B.C. There are even reports of cotton fabrics found in prehistoric pueblo ruins in Arizona - in the New World, and in the Upper Nile, what is now Sudan country of Africa - in the Old World (Brown, 1958).

There are 43 species of cotton. These consist of both diploid ($2n = 2x = 26$ chromosomes) and tetraploid ($2n = 4x = 52$ chromosomes) types. The New World tetraploid species are allo-tetraploids, which means that their chromosomal makeup combines the genomes of two distinct diploid species (Munro, 1987). The two genomes were so sufficiently different that their chromosomes would not pair during

meiosis, consequently, the initial hybrid was sterile. Therefore, natural doubling of each set of chromosomes had to occur for the natural hybrid to be fertile and produce offspring, this is an extremely rare event in nature.

Thirty-seven of the 43 species of *Gossypium*, are diploid and distributed predominately across the Old World: Africa, Asia Minor, Mexico, and Australia. The remaining six species of cotton are tetraploid and their origins are believed to be in the New World, specific countries being Mexico, Peru, Brazil, Hawaii, and the Galapagos Islands (Smith, 1995). There are many varieties of cotton grown in different countries. These differ in the attributes of their fiber, yield, ginning percentage, disease resistance and vegetative characters (Munro, 1987).

Cotton is unique among cultivated crops in that four distinct species were domesticated by humans, and in that, two evolved in the Old World and two evolved in the New World:

- * *Gossypium herbaceum* var. *herbaceum* race *acerifolium*, this race is considered the most primitive cultivated form of the Old World cotton.

- * *Gossypium arboreum*, is probably a mutation selected by humans. This second Old World species is found today only under production, or as escapes from production.

- * *Gossypium hirsutum*, a New World species which is believed to have evolved in Mexico. The oldest archaeological specimens of this species were found in Tehuacan, and are tentatively dated at 3400 to 2300 B.C.

- * *Gossypium barbadense*, is the second species of New World cotton. This cotton, it is noted, was considered to have been the cotton of choice because of the quality of its fibers, compared to the *Gossypium hirsutum* by the Mayans (250 to 900 A.D.). This variety generally has almost no fuzz on its seed.

It is unknown exactly how cotton from the Old World traveled to the New World, but one theory suggests that from the origins in Africa and Asia Minor ancient trade routes existed along the east coast of Africa, to the western coast of India. Through ocean trade routes, even as escaped cargo, the fiber plant, it is reported, found its way to the New World (Smith, 1995).

Although the cotton industry is very successful today, and cotton is the most common textile fiber now in use, it was the last natural fiber to attain commercial importance. In the 5th century B.C., the Greek historian Herodotus reported that among the valuable products in India was the "wild plant that bears fleece as its fruit." In the following century, cotton was introduced from India into Greece by Alexander the Great. Although the early Greeks and Romans used cotton for "awnings and sails," as well as for clothing, it was not adopted for widespread use in Europe until centuries later ("Cotton", Microsoft Encyclopedia).

In the New World the Mexicans used cotton for weaving in the pre-Columbian period, as stated earlier. It is known that the natives upon Columbus' arrival cultivated two types of cotton. Cotton could have been used as wadding, packing, or for dressing wounds. Smith states, "The use of cotton as a spinnable fiber probably occurred in societies that already spun flax or animal hair (Smith, 1995).

Cotton has been produced in the present-day continental United States each year since 1621. Because it was a very labor-intensive crop to harvest and prepare for spinning before Eli Whitney's cotton gin, the United States cotton production was very low, but since the introduction of the cotton gin the yield has increased greatly. Cotton is produced in 17 states across the southern United States with over a million bales produced in each of the "Cotton Boll" states. Texas is the leading producer of upland cotton, while Kansas produces the least (Smith, 1995). Today, cotton ranks just behind corn, soybeans, wheat, and hay among the leading cash crops of the United States agriculture and is among the nation's principal agricultural exports. The leading cotton producing states, also known as the Cotton-Belt, are Texas, California, Mississippi, Louisiana, Arkansas, and Arizona. World production of cotton in the early 1990s stood at 18.9 million metric tons annually. In the 1930s, the United States produced more than half the world's cotton; by the early 1990s it was turning out about a sixth. The other leading producers included China, India, Pakistan, Brazil and Turkey ("Cotton", Microsoft Encarta 96 Encyclopedia).

Cotton is the principal raw material for the world's textile industry, but its dominant position is being systematically displaced by synthetic fibers. This, however, does not change the fact that cotton still has natural qualities that people prefer, such as comfort, softness, durability, and versatility that has maintained its position as the fabric of our lives.

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Last updated: 12-Feb-2000 / du