Bactris gasipaes

Kunth

Arecaceae

pupunha, pejibaye, palmito, palm heart, coeur de palmier

LOCAL NAMES
English (peach palm,pewa nut); French (palmier pêche,parepon); Spanish (cachipay,chonta,chontaduro,gachipaes,macana,palma de castilla,pijiguoao,pupunha,tembe,pejibaye,periguao,pijuayo,piba); Trade name (palmito,palm heart,pejibaye,coeur de palmier,pupunha)

BOTANIC DESCRIPTION
Bactris gasipaes is a multi-stemmed or single-stemmed palm, 6-24 m tall, 12-30 cm in diameter; 1-13 stems, straight, cylindrical, unbranched; nodes 2-9 cm long; internodes 7-27 cm long at breast height, reduce in number with age. After 5 years, may have spines on the internodes; 1-97 spines, usually dark in colour with variable consistency, most are 3-4 cm long; adventitious roots produce a thick, partially superficial mat that may extend 4-5 m around plant, mostly occupying the upper 20 cm of the soil horizon; some primary roots extend to a depth of 2 m or more, depending on soil and genotype.

Leaves, pinnate, 10-30, spineless or have short spines along the sheath, petiole and midrib, with leaflets inserted at different angles; spines may occur on the abaxial and adaxial midribs and veins, and along margins of leaflets; petiole sheath 49-179 cm long; rachis 179-396 cm long; 180-386 leaflets, 58-115 x 3-6 cm, often fused basally and apically; juvenile leaves have pubescent leaflets that are fused along a reduced rachis.

Multibranched inflorescence develops in leaf axils; initially covered by 2 bracts, it may contain 25-1200 pistillate and 10 000-30 000 staminate flowers; exterior bract (prophyle) is hard, triangular, about 13 cm wide and weighs 50-875 g; internal bract (penduncular) may be spineless or have spines covering its entire surface or only the tip; fully developed but still closed spathe is 51-126 x 6-18 cm, 2-15 mm thick and weighs 1-6 kg; its internal surface is cream or light yellow; peduncle 10-17 cm long, rarely has spines; rachis 31-75 cm long, has 0-16 aborted and 25-145 fertile rachillae 16-47 cm long, straight or curved; both covered with trichomes. Bracteoles vary in length, diameter and shape. Tree is monoecious, with unisexual male and female flowers developing on the rachillae. Female flowers irregularly arranged among male ones; male flowers cream, light yellow, 2-6 x 2-6 mm, with 6 stamens arranged in pairs on the sides of the corolla; female flowers usually yellow, or rarely green, 3-13 x 4-12 mm. Gynoecium is syncarpous, triocular; functional hermaphroditic flowers are present, especially in young plants; poorly differentiated flowers may also be observed.

Fruit shiny orange, red or yellow drupe, 2-7 x 2-8 cm, weighs 4-250 g; mesocarp is creamy white to orange and may have superficial striations. Tip may be mammiform, rounded, angular or truncated. Number of mature fruits and inflorescences varies from 0 to 764, with total fruit weight of up to 20 kg; pathenocarpic fruits common; about 21 raceme, and generally slightly smaller than the fertile fruit. Endocarp dark, ovoid, elliptic, round, oblong or cuneiform, 1-4 x 1-2 cm, weighs 1-9 g. Seed located centrally in the fruit but may occur at the distal end; generally flattened fibres on its surface that may adhere to the mesocarp.

BIOLOGY
B. gasipaes begins flowering after 3-5 years and may produce annual fruit crops for 50-75 years. The flowering phase is extended and indeterminate (pleonanthic). Insects are the main pollen vectors, but pollen dispersal also occurs via wind and gravity. The pollination cycle lasts 3 days, and unfertilized flowers remain receptive for over 24 hours. Male flowers release their pollen in 15-30 minutes and then abscise.

The curculionid beetle, Adranthobius palmarum, is the main pollinator in Central America, and several species of the genus Phyllotrox are the main pollinators in the Amazon Basin. Other insect vectors are also recognized, including Epurea (Nitidulidae) in Peru and Cyclocephala (Scarabaeidae) in Costa Rica. The tree is predominantly allogamous, having separate pistillate and staminate flowers and protogynous development. Self-

B. gasipaes, with mature and immature fruit. (David Boshier)

B. gasipaes in Yurimaguas street (Hannah Jaenicke)

B. gasipaes in Yurimaguas street (Hannah Jaenicke)

fertilization may occur, however, allowing isolated plants in the wild to reproduce. Selfing is regulated by a genetic incompatibility mechanism. Subpopulations may arise because the trees are normally scattered, and seed dispersal is limited.

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ECOLOGY

B. gasipaes is found in tropical regions with heavy rainfall and poor soils. It is well adapted to a variety of climatic and soil conditions but does not tolerate waterlogging. It can withstand relatively hot dry seasons (3-4 months). Seedlings develop very slowly under forest shade conditions, and mature plants require full sunlight for optimal production of flowers, fruits and offshoots. B. gasipaes occurs in disturbed natural ecosystems, principally along riverbeds and primary forest gaps. The individuals are scattered and relatively isolated or occur at low densities in small patches.

BIOPHYSICAL LIMITS

Altitude: 0-1500 m, Mean annual temperature: 18-24 deg. C, Mean annual rainfall: 2000-4000 mm

Soil type: Most productive on relatively deep, fertile, well-drained soils, clay soils, and highly eroded laterites with 50% aluminium-saturated, acid soils.

DOCUMENTED SPECIES DISTRIBUTION

Native: Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Nicaragua, Panama, Peru

Exotic: Honduras, Indonesia, Malaysia, Philippines

The map above shows countries where the species has been planted. It does neither suggest that the species can be planted in every ecological zone within that country, nor that the species can not be planted in other countries than those depicted. Since some tree species are invasive, you need to follow biosafety procedures that apply to your planting site.

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PRODUCTS

Food: Fruit flavour of B. gasipaes is variable, ranging from bland to strong. The fruit is always cooked, because of the presence of an alkaloid, pupunhadine, and is eaten directly or dried and ground for flour. The whole fruit is separated from the bunch and boiled in salted water for 30-60 min to eliminate the irritating oxalate crystals and trypsin inhibitor. The flour is fermented to make 'chicha', a beer gruel with good flavour and nutritional qualities, or is used in making breads, cakes and other pastries and as a potato substitute in meat or fish stews. Seeds may be consumed as nuts. The fruit palm is an energy-rich source of carbohydrates and oil; the pulp contains all the essential amino acids and is an excellent source of quality protein; the mesocarp is rich in beta-carotene.

Palmito is a food delicacy. In Peru it is used as a fresh salad. Amerindians consume the palmito from the main stem, the offshoots and the stem sap. Fresh, dried and canned palmito is being marketed for use in salads, soups and fillings and as roasted chips. The mesocarp oil has a relatively high proportion of unsaturated fatty acids, notably oleic acid, and contains no cholesterol. It is used for cooking. Cooked male flowers serve as a condiment.

Fodder: High starch levels along with protein oil and carotene are bases for using B. gasipaes as an animal ration; the ration can be enriched with soya beans or fishmeal to augment protein levels as required. B. gasipaes flour can partially or completely substitute for maize, sorghum or wheat as the base that is generally used in animal rations. It can serve as the principal energy source in primary rations, but it should be used less intensively in starter rations. Heat treatment is essential, especially for starter rations, to deactivate the trypsin inhibitor. Silaging the fruits is said to be an excellent means of storing them for pigs. This feed may also be acceptable to cattle.

Apiculture: The inflorescence is a suitable source of pollen for bee keeping.

Fibre: B. gasipaes, including leaf and stem parts, produces a valuable fibre for manufacturing paper. Cellulose may be produced for cellophane paper and rayon.

Timber: The stem is a durable material for bows, arrows, fishing poles, harpoons and carvings; the Amerindians use the wood for flooring and panelling their houses and also fashion long spines into needles. In rural Amazonia, the stem is valued for parquet, furniture, carvings and home construction.

Tannin or dyestuff: The leaves provide a green dye for colouring fabrics.

Lipids: B. gasipaes may turn out to be a better economic option than most other American oil palms. Oil levels of up to 62% of the dry weight have been reported, and there are reports that a large pot of boiling fruit can produce 2-3 kg of oil. The oil separates easily when the fruits are cooked. As with other palms, it is a potential source lauric oils. The seed is rich in saturated fatty acids, and could be used to manufacture cosmetics and soap.

Alcohol: The soft part of the stem may be used to make liquor.

Poison: Roots provide a vermicide.

Other products: Palmito, or heart-of-palm, is a current product in agribusiness; more than 2000 ha of B. gasipaes had been planted in Costa Rica by 1990. The fruits are marketed in jars and cans and can also be sold dehydrated. The leaves yield thatch for houses and basket materials.

SERVICES

Ornamental: As with other members of the Arecaceae family, B. gasipaes is planted for aesthetic purposes.

Soil improver: In B. gasipaes plantations, unused leaf and stem parts are used as organic fertilizer.

TREE MANAGEMENT
Weeding and herbicides are required to minimize competition, especially from grasses. Plantations of B. gasipaes are managed for the product palmito (heart-of-palm). Cutting the main stem and offshoots for palmito does not kill the plant but allows preformed buds to develop into new offshoots. Proper fertilization with adequate phosphorus is critical for seedling growth and resistance to anthracnose. For fruit production, trees are planted at a spacing of 5 x 5 m, or are spaced at 4 x 4 m with an 8-m strip between double rows. The latter is more conducive for interplanting with other crops. The stocking rate for both spacings is 400 plants/ha. Plants are pruned to leave 2-3 stems, which makes fruit harvesting easier. Fertilizer containing 180 kg nitrogen, 25 kg phosphorus, 50 kg potassium and 100 kg magnesium sulphate per hectare per year is applied during the 1st 4 years for young fruit plantations and heart-of-palm plantations, depending on the nutrient levels of the soil. For palmito production, tree stocking rate is 4000-20 000 plants/ha; 21 t/ha per year of dry biomass is harvested but only about 2% of this is removed from the plantation; the rest is used as mulch.

GERMPLASM MANAGEMENT
Seeds are recalcitrant. They rapidly lose viability when dried and should not be exposed to direct sunlight during germination. Fresh seed has 45-50% mc, and if this falls below 38-40%, germination is reduced. Excessive seed moisture encourages fungal attack.

PESTS AND DISEASES
Seeds can be treated with fungicide before sowing to protect them from rats and mice. Parrots consume immature fruits. Insect pests of the tree include Calyptocephala marginipennis, Demotispa pallida, the small black curculionid beetle, Leptoglossus lonchoides, Metamasius hemipterus, Parisoschoenus spp., Rhadinaphelenchus cocophilus, Rhynchophorus palmarum and Strategeus aloeus. The foliage mite Retracus johnstoni is an important pest of B. gasipaes but has not yet become a pest in palmito plantations.

Fungal growth is often a problem, especially for seedlings grown in plastic bags. Trees are attacked by anthracnose. Fungal organisms that attack plants include Ceratocystis spp., Chalaropsis spp., Monillia spp., Phytophthora palmivora, Thielaviopsis paradoxa (fruits); Botrydiplodia theobromae, Chalaropsis, Fusarium spp., Schyzophyllum commune, Thielapiopsis paradoxa, Penicillium spp., Xylaria spp. (seeds); Colletotrichum spp., Deschlera incurvata, Fusarium moniliformae, Mycosphaerella spp., Pestaliopsis spp. (leaves), Erwinia chrysantemi and Phyphthora palmivora (stems).

FURTHER READNG

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