



Prota 16: Fibres/Plantes à fibres

Record display

***Piliostigma thonningii* (Schumach.) Milne-Redh.**

Protologue

Hooker's Icon. Pl. 35: 2, t. 3460 (1947).

Family

Caesalpiniaceae (Leguminosae - Caesalpinioideae)

Chromosome number

$2n = 24, 26$

Synonyms

Bauhinia thonningii Schumach. & Thonn. (1827).

Vernacular names

Camel's foot, camel's foot tree, monkey bread, wild bauhinia, picture-frame tree (En). Pied de boeuf (Fr). Mchikichi, mchekeche, msegesse, mkoma, msabuni (Sw).

Origin and geographic distribution

Piliostigma thonningii is native to tropical Africa. It is widespread in the Sudano-Guinean region from Senegal eastward to Eritrea and occurs southward to Namibia, Botswana, Mozambique and South Africa. It also occurs in Yemen.

Uses

The bark is commonly used for tying, for instance in hut, fence and bridge building. In Sudan and Mozambique the inner bark is used for binding an arrowhead to its shaft. The bark was formerly made into barkcloth. Fibres extracted from the bark are widely used for making string, rope and cloth. Root fibres are made into rope as well. The leaves are used for wrapping food, and twigs and roots serve as toothbrushes. The dried fruit is used to smooth pottery, and the roots are used for giving a glaze to gourds.

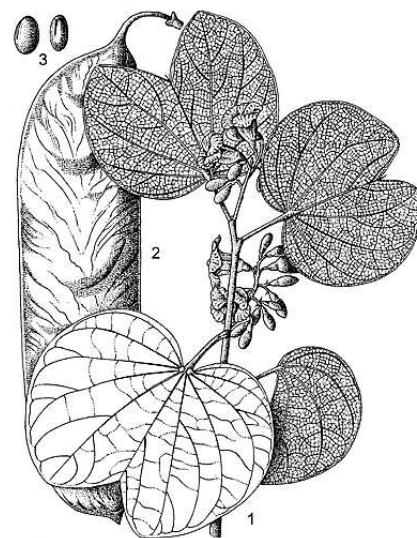
The bark provides tanning material and yields a red-brown dye used for cloth and wooden tools. The root yields a red-brown or black dye, and the fruit and seeds a black or blue one. In Ghana, Nigeria and DR Congo women chew the root-bark to redden their lips; the bark is also rubbed on the lips to colour these red. Hausa in Nigeria stain their teeth red by chewing the bark.

The fruit is eaten as a snack or as an emergency food, especially by children and herdsman. In times of scarcity the fruits are ground and boiled into porridge or made into drinks. In Sudan the roasted seeds are eaten. In Kenya the bark is eaten in times of severe food shortages. Maasai people in East Africa chew the leaves as thirst-quencher. The foliage and fruits are browsed by cattle and other livestock. The flowers are a substitute for tobacco, and the roots are used to increase the strength of tobacco. Mature fruits are burnt to obtain a salt.

The tree provides poles and timber for local house construction. The wood is also used for kitchen utensils, tool handles, furniture, bedposts, wheel-work and carpentry. The Maasai make bows from the wood. The wood is used as firewood and for



wild



1, branch with female flowers;
2, fruit; 3, seeds.

Redrawn and adapted by
Achmad Satiri Nurhaman

making charcoal.

The unripe fruits are used as a soap substitute, and the ash of ripe fruits is also used in soap making. In Côte d'Ivoire dried leaves are used together with those of *Parinaria curatellifolia* Planch. for making gunpowder. Infusions of the bark, leaf or pod are used to coagulate *Funtumia* latex in making rubber. The bark yields a gum that swells and softens in water and is used for caulking. A resin obtained from the unripe fruit is used as glue for fastening the iron parts of tools and spears to the handles.

Piliostigma thonningii is an agroforestry tree, suitable for intercropping with crops. It provides good shade and serves as shelterbelt in homesteads when in full foliage. It is used in live fences around fields and as a live support for vines of weaker plants. Honeybees forage for abundant pollen and nectar in dry land areas and the tree is recommended for planting to increase honey production.

Piliostigma thonningii is widely used in African traditional medicine. Root preparations are applied on wounds and ulcers as a haemostatic and to promote healing. They are also used as a diuretic and for the treatment of diarrhoea, dysentery, worms and other intestinal problems. Cough remedies are prepared from the root as well. Various root preparations are taken or applied in case of snake bites, and in DR Congo roots serve as antidote to poisonous plants. In DR Congo and Malawi the roots are used to treat rheumatism. The root heated in fat is used as a poultice in case of a painful spleen. Root decoctions are drunk to prevent miscarriage. Root decoctions or infusions are taken in case of heavy menstruation and a painful uterus, and given to a mother that has given birth. Root infusions are taken to promote conception and against venereal diseases. They are used in baths against vertigo. In Uganda the root is smoked against insanity, and in Zimbabwe the powdered root is eaten against convulsions. Bark preparations are remedies against cough, colds, chest pain, pneumonia, diarrhoea, dysentery, worms and other intestinal problems, and snakebite. They are also applied on wounds, ulcers and skin infections. The bark is credited with pain-relieving activity, and is used for the treatment of sore throat, toothache, gum problems, earache, stomach-ache and general body pain. Bark decoctions are rubbed in or used as a vapour bath for the treatment of rheumatism, muscular pain and bone inflammation. They are also taken as an antiemetic. Infusions of the bark are taken for the treatment of internal abscesses and haematuria, and infusions of the bark and leaf are used against malaria. In East Africa bark sap, or the bark boiled in milk or in soup, is drunk for the treatment of gonorrhoea. In Gambia sap from the bark is used to induce dizziness in dancers. The ash of young wood is rubbed in with oil against chest complaints. Leaf preparations are used for the treatment of diarrhoea, dysentery, worms and other intestinal problems. They are also used against cough and other respiratory problems throughout tropical Africa. In Zambia, for instance, the leaves are boiled in water and the steam is inhaled. Various leaf preparations are used as antiseptic and cicatrisant to promote wound healing, and against skin diseases, itching and snake bites. Pounded leaves are



Photo: Biosystematics Group, Wageningen UR

Piliostigma thonningii



Photo: Biosystematics Group, Wageningen UR

Piliostigma thonningii



Photo: P. Ekpe / NSBP
obtained from [The Virtual Field Herbarium](http://www.thevirtualfieldherbarium.org/)

rubbed on the head in case of headache, whereas leaves boiled in water are rubbed on the back against lumbago. A leaf decoction is added to bath water against stiffness. In case of toothache, a leaf infusion or decoction is drunk or the boiled leaves are chewed. In Zimbabwe the leaves are boiled and the strained liquid is rubbed into incisions for the treatment of painful legs. Leaf decoctions are drunk or used in baths or vapour baths against fever. A decoction of the leaves is used as a vaginal wash and enema to a mother giving birth. In case of epilepsy and possession leaf decoctions are drunk or used for bathing. Leaf decoctions are used as a wash on fractures and the residue is massaged on the part affected. In case of bone inflammation a steam bath of the leaves boiled in water is taken. In southern Africa leaf decoctions or infusions are taken in case of heavy menstruation. Leaf infusions are used as anti-emetics. Leaf sap or infusions are applied for the treatment of eye problems. In Côte d'Ivoire a paste made from ground young leaves and flower buds is diluted with water and drunk against palpitations. In Senegal the leaves are used in the treatment of dementia. Powdered dried flowers are eaten in food, drunk in water or smoked like tobacco against cough. The fruit is an ingredient of preparations used for the treatment of cough, bronchitis and headache. Scrapings of the fruit are applied as a dressing on wounds.

Production and international trade

Piliostigma thonningii yields a wide range of useful products, but no statistics are available on their production and trade.

Properties

The bast fibre of *Piliostigma thonningii* is recorded to be long and strong.

The heartwood is pinkish to dark brown, the sapwood pale brown. The wood has an air-dry density of about 750 kg/m³. It is easy to work, but liable to attack by termites and borers. The usually small size limits its usefulness. It is good fuelwood, burning long, providing a hot flame and giving little smoke. The fruit contains per 100 g edible portion: water 5.0–9.8 g, energy 1089–1185 kJ (260–283 kcal), protein 6.3–6.9 g, fat 1.8–3.2 g, carbohydrate 54.6–58.9 g, Ca 360 mg, Fe 40 mg (Irvine, 1961). Pod meal is said to be pleasantly scented. Fruit meal from Zimbabwe contained per 100 g dry matter: crude protein 7.8 g, neutral detergent fibre 44.6 g, ether extract 3.2 g and crude ash 4.8 g. The in-vivo degradability of dry matter and crude protein in Holstein-Friesian steers was 33.4% and 29.8%, respectively, and it was concluded that the meal could be a useful feed supplement to cattle grazing poor quality forage during the dry season. Per 100 g seeds from Nigeria contained: moisture 6.7 g, crude protein 30.3 g, crude fat 1.4 g, carbohydrate 23 g, crude fibre 35.0 g. Dried leaves contain per 100 g: water 9.3 g, protein 9.6 g. Epicatechin and inositol derivatives were isolated from the fruits. Screening of the seeds revealed the presence of saponins, flavonoids, phenolics, anthraquinones and glycosides.

The tannin content of the bark of smaller twigs is about 20%. In the bark of the roots and larger branches the tannin content is lower, about 18%.



Piliostigma thonningii



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Root, bark and leaf extracts showed antiviral activity against Herpes simplex virus type 1 and 2 (HSV-1, HSV-2), HIV and different strains of influenza and syncytial viruses. The roots, leaves and stems showed in-vitro activity against the tapeworm *Hymenolepis diminuta* ('rat tapeworm').

The polyphenol fraction of the root bark has shown in-vivo antitussive and bronchodilator activity in guinea pigs, whereas in mice it showed anti-inflammatory and analgesic activity against phenylquinone-induced writhing.

Stem bark extracts exhibited antibacterial activity against *Bacillus subtilis*, *Corynebacterium pyogenes*, *Escherichia coli*, *Proteus vulgaris*, *Shigella dysenteriae* and *Staphylococcus aureus*. An ethanolic extract of the stem bark induced persistent contractions of the isolated guinea pig ileum. Bark extracts have shown in-vitro larvicidal activity against intestinal parasites of cattle. An ethanolic extract of the bark showed anthelmintic activity, and D-3-O-methylchiroinositol isolated from the stem bark showed anthelmintic activity against *Haemonchus contortus* larvae from faecal samples of infected lambs. The presence of alkaloids is reported for the bark.

Leaf extracts showed anti-inflammatory and antimicrobial activity. An aqueous leaf extract caused constriction of blood vessels in isolated rat aortic rings and reduced bleeding times in rats, which confirms the traditional medical application of the leaves in arresting bleeding. Butanol and ethyl acetate fractions of the leaf extract exhibited strong antioxidant activity.

Piliostigmin (a new 2-phenoxychromone) and three C-methylflavonols (6, 8-di-C-methylquercetin 3-methyl ether, 6-C-methylquercetin 3,7-dimethyl ether and 6,8-di-C-methylquercetin 3,7-dimethyl ether) were isolated from the leaves. Some of these C-methylflavonols have shown anti-inflammatory and antibacterial activity. Quercetin and quercitrin are present in the leaf. The leaves and the fruits contain l-tartaric acid.

Adulterations and substitutes

Piliostigma thonningii is frequently confused with *Piliostigma reticulatum* (DC.) Hochst. Traditionally, people often use both species in the same way.

Description

Deciduous, dioecious tree up to 10(–40) m tall, sometimes shrubby; bole branchless for 2–3 m, twisted, up to 30(–35) cm in diameter; outer bark rough, longitudinally fissured, dark brown to grey or black, inner bark fibrous, pink to dark red-brown when cut; crown spreading; branches with rusty-brown tomentum, somewhat glabrescent later. Leaves alternate, conspicuously bilobed for one eighth to one third of the length; stipules 3–6 mm long, deciduous; petiole 2–5(–7) cm long, pubescent; blade up to 17 cm × 21 cm, base usually strongly cordate, apex of lobes rounded to acute, leathery, upper surface glabrous, lower surface with rusty-brown crisped hairs and conspicuous reticulate venation, palmately veined with 11–15 basal veins. Inflorescence a panicle, usually alternately leaf-opposed and axillary along branches, male inflorescence very narrowly pyramidal, up to 25 cm × 5.5 cm; female inflorescence up to 7 cm long, few-



Photo: B. Wursten
obtained from [Zimbabweflora](http://www.zimbabweflora.org)



Photo: P. Latham
Piliostigma thonningii

flowered; axes brown-tomentellous. Flowers unisexual, fragrant; calyx cupular, 1–2.5 cm long, 5-lobed, brown-tomentellous; petals 5, obovate, 1–2.5 cm long, wrinkled, margin strongly undulate, white to lilac or pink; stamens 10(–11), scarcely reaching the throat of the flower, reduced to staminodes in female flowers; ovary brown-tomentose, rudimentary in male flowers; style very short or absent; stigma capitate. Fruit an oblong to linear-oblong pod 12–30(–37) cm × 3–7 cm, woody, brown-pubescent when young but later glabrescent, persisting on the tree but finally decaying on the ground, many-seeded. Seeds obovoid to ellipsoid, 4–9 mm × 2–7 mm × 3–4 mm, dark brown to blackish, compressed. Seedling with epigeal germination.

Other botanical information

Piliostigma comprises 3 species in tropical Africa, Asia and Australia. *Piliostigma thonningii* is frequently confused with *Piliostigma reticulatum* due to similarity in appearance, but the former has larger leaves with hairs on the lower surface, and usually occurs in less dry areas.

Growth and development

Growth rates up to 60 cm per year have been recorded, but in an annually burnt zone in Côte d'Ivoire an average annual growth of only 4.5 cm was recorded over a period of 20 years for trees larger than 2 m at the start of this period. The tree becomes nearly leafless in the dry season. Flowering occurs in the dry season or after the first rains, shortly after the leaves have emerged. In the Sahel *Piliostigma thonningii* flowers in December–June. In Ethiopia flowering happens from November to March and fruiting from May to September, while in southern Africa the flowering time is from November to June and fruiting from March to October. Root suckers develop from exposed roots. Juvenile individuals are susceptible to fire damage, but *Piliostigma thonningii* survives fire through quick resprouting of aboveground structures.

Ecology

Piliostigma thonningii occurs from sea level up to 2200 m altitude in areas with an average annual temperature of 20–21°C, an average annual rainfall of (400–)600–1200(–1500) mm, and a dry season of 6–8(–11) months. It is sensitive to frost. It grows on any soil type, but heavy clayey soils or medium loamy soils are preferred. *Piliostigma thonningii* is common in secondary and gallery forest, woodland, wooded grassland and bushland, often in river valleys, and in disturbed locations. It is often left in cultivated fields and it rapidly colonises abandoned areas.

Propagation and planting

Natural regeneration, direct sowing, and planting out of seedlings or root suckers can be used for propagation. The number of seeds per kilogram is 7300–8500. Seed collection should be done soon after the fruits turn brown, to prevent insect attack. Appropriate seed drying is also important, in order to prevent seed decay. The seeds are difficult to extract. This is done by drying the fruits in the sun, cutting them into pieces and separating the seed from the pulp. Seeds can be stored for several years in cool, dry, insect-free conditions. Seeds usually germinate 5–10 days after sowing. Seed pre-treatments such as



Photo: L.Y.T. Westra, InsideWood
wood in transverse section

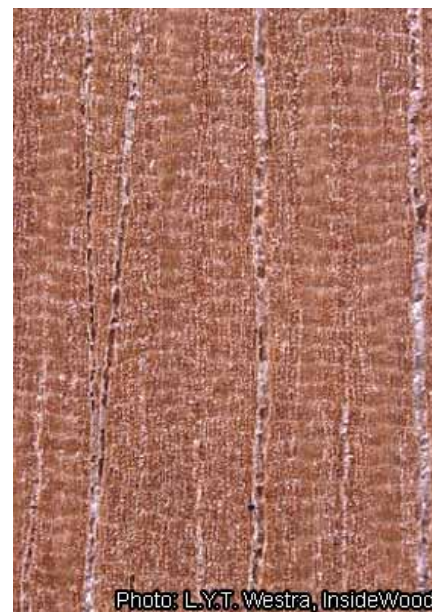


Photo: L.Y.T. Westra, InsideWood
wood in tangential section

washing, soaking in water for up to 24 hours, hot water treatment and scarification usually improve germination.

Successful in-vitro plant regeneration has been achieved with hypocotyl explants cultured in auxin-supplemented Murashige and Skoog (MS) medium.

Management

Piliostigma thonningii is usually collected from the wild and not planted or protected. Lopping, pollarding, trimming and coppicing are possible. In Tanzania fruits are collected in the dry season, and they can be stored for about 4 months.

Diseases and pests

The seeds of *Piliostigma thonningii* are damaged by the bruchid *Caryedon serratus*, a major pest of stored groundnuts. Eggs are laid on the surface of ripe *Piliostigma thonningii* fruits, after which larvae bore through the husk and into the seed, where larval development takes place, resulting in damaged seeds.

Handling after harvest

The bark is stripped off the tree for immediate use or the bark is peeled off and the fibre is separated from the outer bark for making ropes. For this, the fibre should first be sun or air dried. After drying, the fibre will be immersed in water to make it easily flexible prior to utilization. Twine is made by dampening coarse fibres and rolling two strands between palm and thigh. Rope is made by twisting thicker strands. Dry, coarse fibre can be kept for some time without deteriorating, and will regain resilience when dampened.

To prepare drinks, the fruits are pounded and the powder is soaked in water, after which the liquid is stirred. To obtain dye in Burkina Faso, the bark is pounded, boiled and macerated.

Genetic resources

Piliostigma thonningii is widespread in tropical Africa and not threatened by genetic erosion. However, collection and conservation of genetic resources from various regions are recommended to investigate genetic and phytochemical variations in populations.

Prospects

Piliostigma thonningii is widely used as a fibre plant and for a range of other purposes, making it an important multi-purpose tree in semi-arid and subhumid regions. Unfortunately, very little information is available on the fibre properties. However, because of the extensive utilisation of the tree and the isolation of many pharmacologically active compounds, investigations on domestication and cultivation practices is certainly worthwhile.

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