Camellia sinensis

Camellia sinensis is a species of evergreen shrub or small tree in the flowering plant family Theaceae. Its leaves, leaf buds, and stems are used to produce tea. Common names include **tea plant**, **tea shrub**, and **tea tree** (unrelated to *Melaleuca alternifolia*, the source of tea tree oil, or the genus *Leptospermum* commonly called tea tree).

White tea, yellow tea, green tea, oolong, dark tea (which includes pu-erh tea) and black tea are all made from two of the five varieties which form the main crops now grown, *C. sinensis* var. *sinensis* and *C. s.* var. *assamica*, but are processed differently to attain varying levels of oxidation with black tea being the most oxidized and white being the least.[3] Kukicha (twig tea) is also made from *C. sinensis*, but uses twigs and stems rather than leaves.

Description

Camellia sinensis is native to East Asia, the Indian Subcontinent, and Southeast Asia, but it is today cultivated all around the world in tropical and subtropical regions. It is an evergreen shrub or small tree that is usually trimmed to below 2 m (6.6 ft) when cultivated for its leaves. It has a strong taproot. The flowers are yellow-white, 2.5–4 cm (0.98–1.57 in) in diameter, with seven or eight petals.

The seeds of *C. sinensis* and *C. oleifera* can be pressed to yield tea oil, a sweetish seasoning and cooking oil that should not be confused with tea tree oil, an essential oil that is used for medical and cosmetic purposes, and originates from the leaves of a different plant.

The leaves are 4–15 cm (1.6–5.9 in) long and 2–5 cm (0.79–1.97 in) broad. Fresh leaves contain about 4% caffeine, as well as related compounds including theobromine.[4] The young, light-green leaves are preferably harvested for tea production when they have short, white hairs on the underside. Older leaves are deeper green. Different leaf ages produce differing tea qualities, since their chemical

Camellia sinensis

Camellia sinensis foliage

Conservation status

Data Deficient (IUCN 3.1)[1]

Scientific classification

Kingdom:	Plantae
Clade:	Tracheophytes
Clade:	Angiosperms
Clade:	Eudicots
Clade:	Asterids
Order:	Ericales

compositions are different. Usually, the tip (bud) and the first two to three leaves are harvested for processing. This hand picking is repeated every one to two weeks.

In 2017, Chinese scientists sequenced the genome of *C. s.* var. *assamica*.[5] It contains about three billion base pairs, which was larger than most plants previously sequenced.[6]

Taxonomy

Linnaeus did not consider this plant a *Camellia* but placed it in a separate genus *Thea*.[7] Then in 1818, Robert Sweet merged the two genera, selecting *Camellia* for the merged genus, and shifted all the former *Thea* species to that genus.[8] The name *sinensis* means "from China" in Latin.

The generic name *Camellia* is taken from the Latinized name of Rev. Georg Kamel,[9] SJ (1661–1706), a Moravian-born Jesuit lay brother, pharmacist, and missionary to the Philippines.

Five varieties of *Camellia sinensis* are accepted:[10][2]

Family:	Theaceae
Genus:	*Camellia*
Species:	***C. sinensis***

Binomial name

Camellia sinensis

(L.) Kuntze

Native range of *Camellia sinensis*

Synonyms[2]

Camellia sinensis

- *Camellia angustifolia* Hung T.Chang
- *Camellia arborescens* Hung T.Chang & F.L.Yu
- *Camellia assamica* (J.W.Masters) Hung T.Chang
- *Camellia dehungensis* Hung T.Chang & B.H.Chen
- *Camellia dishiensis* F.C.Zhang et al.
- *Camellia longlingensis* F.C.Zhang et al.
- *Camellia multisepala* Hung T.Chang & Y.J.Tang
- *Camellia oleosa* (Loureiro) Rehder
- *Camellia parvisepala* Hung T.Chang

- *Camellia parvisepaloides* Hung T.Chang & H.S.Wang
- *Camellia polyneura* Hung T.Chang, Y.J.Tan & P.S.Wang
- *Camellia thea* Link
- *Camellia theifera* Griffith
- *Camellia waldeniae* S.Y.Hu
- *Thea assamica* J.W.Masters
- *Thea bohea* L.
- *Thea cantonensis* Loureiro
- *Thea chinensis* Sims
- *Thea cochinchinensis* Loureiro
- *Thea grandifolia* Salisbury
- *Thea olearia* Loureiro ex Gomes
- *Thea oleosa* Loureiro
- *Thea parvifolia* Salisb.
- *Thea sinensis* L.
- *Thea viridis* L.
- *Theaphylla cantonensis* (Loureiro) Rafinesque

Flower of tea plant

Pollen grains of *C. sinensis*

C. sinensis plant, with cross-section of the flower (lower left) and seeds (lower right)

C. sinensis fruit and seeds

Image	Name	Description	Distribution
	*C. sinensis* var. *sinensis*	Style fused apically 3-lobed. Widely grown for tea.	China (Anhui, Fujian, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, S Shaanxi, Sichuan, Xizang, Yunnan, Zhejiang), India, Japan, Korea, Taiwan
	*C. sinensis* var. *assamica* (J.W.Masters) Kitamura	Lower surface of leaves are villous along midvein. Widely grown for tea.	Laos, Myanmar, Thailand, Vietnam, India (Assam), China (Guangdong, Guangxi, Hainan, Yunnan)
	C. sinensis var. *pubilimba* Hung T. Chang	Sepals are white and pubescent.	China (SE. Yunnan, Guangxi, W. Guangdong, Hainan)
	C. sinensis var. *dehungensis* (Hung T. Chang & B.H.Chen) T.L.Ming	Lower surface of leaf is appressed pubescent.	China (S. Yunnan)
	C. sinensis var. *madoensis* T. V. Nguyen, V. D. Luong & N. T. Le	Style is free half to the base.	Vietnam (Phu Yen)[11]

The Cambodia type tea ("*C. assamica* subsp. *lasiocalyx*") was originally considered a type of Assam tea. However, later genetic work showed that it is a hybrid between Chinese small leaf tea and Assam tea.[12]

Tea plants are native to East Asia, and probably originated in the borderlands of north Burma and southwestern China.[13]

- Chinese (small leaf) tea [*C. sinensis* var. *sinensis*]
- Chinese Western Yunnan Assam (large leaf) tea [*C. sinensis* var. *assamica*]
- Indian Assam (large leaf) tea [*C. sinensis* var. *assamica*]
- Chinese Southern Yunnan Assam (large leaf) tea [*C. sinensis* var. *assamica*]

Chinese (small leaf) tea may have originated in southern China possibly with hybridization of unknown wild tea relatives. However, since no wild populations of this tea are known, the precise location of its origin is speculative.[14][15]

Given their genetic differences forming distinct clades, Chinese Assam type tea (*C. s.* var. *assamica*) may have two different parentages – one being found in southern Yunnan (Xishuangbanna, Pu'er City) and the other in western Yunnan (Lincang, Baoshan). Many types of Southern Yunnan Assam tea have been hybridized with the closely related species *Camellia taliensis*. Unlike Southern Yunnan Assam tea, Western Yunnan Assam tea shares many genetic similarities with Indian Assam type tea (also *C. s.* var. *assamica*). Thus, Western Yunnan Assam tea and Indian Assam tea both may have originated from the same parent plant in the area where southwestern China, Indo-Burma, and Tibet meet. However, as the Indian Assam tea shares no haplotypes with Western Yunnan Assam tea, Indian Assam tea is likely to have originated from an independent domestication. Some Indian Assam tea appears to have hybridized with the species *Camellia pubicosta*.[14][15]

Assuming a generation of 12 years, Chinese small leaf tea is estimated to have diverged from Assam tea around 22,000 years ago; this divergence would correspond to the last glacial maximum,[14][15] while Chinese Assam tea and Indian Assam tea diverged 2,800 years ago.

Chinese small leaf type tea was introduced into India in 1836 by the British and some Indian Assam type tea (e.g. Darjeeling tea) appear to be genetic hybrids of Chinese small leaf type tea, native Indian Assam, and possibly also closely related wild tea species.[16]

Cultivars

Hundreds,[17] if not thousands of cultivars of *C. sinensis* are known. Some Japanese cultivars include:

- Benifuuki[18]
- Fushun[19]
- Kanayamidori[18]
- Meiryoku[19]
- Saemidori[19]
- Okumidori[19]
- Yabukita[19]

Cultivation

Camellia sinensis is mainly cultivated in tropical and subtropical climates, in areas with at least 127 cm (50 in) of rainfall a year. Tea plants prefer a rich and moist growing location in full to part sun, and can be grown in hardiness zones 7–9. However, species is commercially cultivated from the equator to as far north as Scotland,[20] with the northernmost tea plantation at 59°N latitude on Shapinsay in the Orkney Islands.[21] Many high quality teas are grown at high elevations, up to 2,200 m (7,200 ft), as the plants grow more slowly and acquire more flavour.

Tea plants will grow into a tree if left undisturbed, but cultivated plants are pruned to waist height for ease of plucking. Two principal varieties are used, the small-leaved Chinese variety plant (*C. s.* var. *sinensis*) and the large-leaved Assamese plant (*C. s.* var. *assamica*), used mainly for black tea. Tea trees can remain productive for many years.

Chinese teas

The Chinese plant is a small-leafed bush with multiple stems that reaches a height of some 3 m (9.8 ft). It is native to southeast China. The first tea plant variety to be discovered, recorded, and used to produce tea dates back 3,000 years ago; it yields some of the most popular teas.

C. s. var. *waldenae* was considered a different species, *C. waldenae* by SY Hu,[22] but it was later identified as a variety of *C. sinensis*.[23] This variety is commonly called Waldenae Camellia; it is grown on Sunset Peak and Tai Mo Shan in Hong Kong, and also occurs in Guangxi province.[22]

Indian teas

Three main kinds of tea are produced in India:

- Assam, from *C. s.* var. *assamica*, comes from the near sea-level heavily forested northeastern section of India, the state of Assam. Tea from here is rich and full-bodied. The first tea estate in India was established in Assam in 1837. Teas are manufactured in either the *orthodox* process or the "crush, tear, curl" (CTC) process.
- Darjeeling, from *C. s.* var. *sinensis*, is from the cool and wet Darjeeling highland region, tucked in the foothills of the Himalayas. Tea plantations could be at altitudes as high as 2,200 m (7,200 ft). The tea is delicately flavoured, and considered to be one of the finest teas in the world. The Darjeeling plantations have three distinct harvests, termed 'flushes', and the tea produced from each flush has a unique flavour. First (spring) flush teas are light and aromatic, while the second (summer) flush produces tea with a bit more bite. The third, or autumn flush gives a tea that is lesser in quality.
- Nilgiri is from a southern region of India almost as high as Darjeeling. Grown at elevations between 1,000 and 2,500 m (3,300 and 8,200 ft), Nilgiri teas are subtle and rather gentle, and are frequently blended with other, more robust teas.

Pests and diseases

Tea leaves are eaten by some herbivores, such as the caterpillars of the willow beauty (*Peribatodes rhomboidaria*), a geometer moth.

Seed-bearing fruit of *C. sinensis*

Health effects

Green tea has been consumed for health purposes for thousands of years and is currently promoted for various health benefits though scientific studies show mixed results, with some evidence suggesting modest effects in certain populations; the United States Food and Drug Administration has approved a specific green tea extract ointment for treating genital warts.[24] Black tea is rated by the Natural Medicines Comprehensive Database of Natural Standard as likely effective for improving mental alertness, possibly effective for conditions like low blood pressure, heart attack risk, osteoporosis, ovarian cancer, and Parkinson's disease, possibly ineffective for various cancers and diabetes, and lacks sufficient evidence for other uses.[25]

Biosynthesis of caffeine

Caffeine, a molecule produced in *C. sinensis*, functions as a secondary metabolite and acts as a natural pesticide: it can paralyze and kill herbivorous insects feeding on the plant.[26] Caffeine is a purine alkaloid and its biosynthesis occurs in young tea leaves and is regulated by several enzymes. [27][28] The biosynthetic pathway in *C. sinensis* is similar to other caffeine-producing plants such as coffee or guayusa.[29] Analysis of the pathway was carried out by harvesting young leaves and using reverse transcription PCR to analyze the genes encoding the major enzymes involved in synthesizing caffeine. The gene *TCS1* encodes caffeine synthase. Younger leaves feature high concentrations of TCS1 transcripts, allowing more caffeine to be synthesized during this time. Dephosphorylation of xanthosine-5'-monophosphate into xanthosine is the committed step for the xanthosines entering the beginning of the most common pathway. A sequence of reactions turns xanthosine (9β-ribofuranosylxanthine) into 7-methylxanthosine, then 7-methylxanthine, then theobromine (3,7-dimethylxanthine), and finally into caffeine (1,3,7-trimethylxanthine).

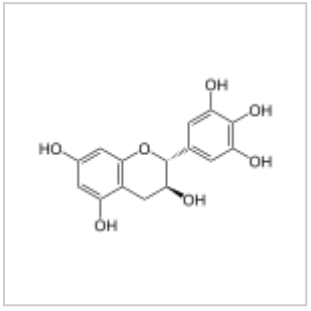
See also

Biochemical pathway detailing caffeine synthesis in *C. sinensis*

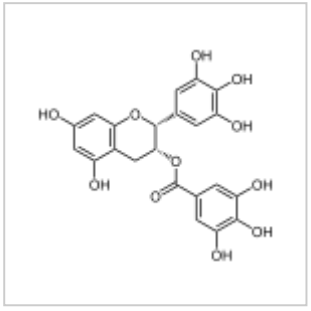
Plants portal

- Chinese herbology
- Green tea extract
- International Code of Nomenclature for Cultivated Plants
- ISO 3103, a method of brewing tea according to the ISO
- Kaempferol, a flavanoid found in tea and associated with reduced risk of heart disease
- List of tea companies
- Tasseography, a method of divination by reading tea leaves.
- Tea classics
- Tea production in Sri Lanka
- Turkish tea
- Tea production in Kenya
- Tea leaf grading
- *Camellia taliensis*

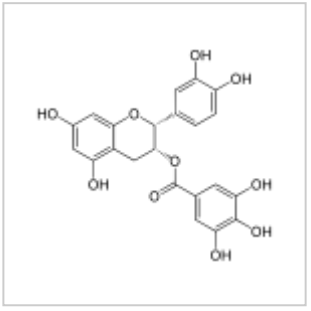
Primary green tea catechins



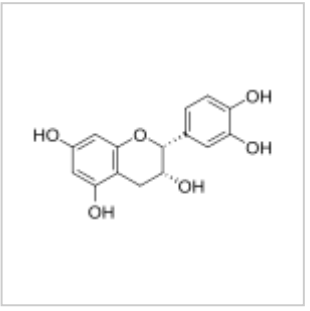
(–)-Epigallocatechin



(–)-Epigallocatechin gallate



(–)-Epicatechin gallate



(–)-Epicatechin[30]

References

1. Rivers, M.C.; Wheeler, L. (2018). "*Camellia sinensis*" (https://www.iucnredlist.org/species/62037625/62037628). *IUCN Red List of Threatened Species*. **2018**: e.T62037625A62037628. doi:10.2305/IUCN.UK.2018-1.RLTS.T62037625A62037628.en (https://doi.org/10.2305%2FIUCN.UK.2018-1.RLTS.T62037625A62037628.en). Retrieved 19 November 2021.
2. Min T, Bartholomew B. "18. Theaceae" (http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200014043). *Flora of China*. Vol. 12. Archived (https://web.archive.org/web/20221229180605/http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200014043) from the original on 29 December 2022. Retrieved 16 October 2011.