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BEVERAGES: TEA

Beverages are **liquid food** or **drinks** other than water. Their primary function is to **quench thirst**, but these have **refreshing and stimulating**, as well as **nutritive**, **therapeutic** and **intoxicating** properties as well. In general, **beverages** as well as **fumitories**[1] **and masticatories**[2] have **narcotic properties** producing **hypnosis**, **sedation** and **hallucination**. Most beverages—**alcoholic** or **non-alcoholic**—are derived from plants, except **dairy products**. **Alcoholic beverages** are **depressants**, produced by the **fermentation** and **distillation** of **sugars** and **starches** in plant products such as the **stem sap** (*e.g.* rum from sugarcane, and the indigenous toddy from toddy palm), **cereals** (*e.g.* beer, gin and whiskey from malt), **tubers** (*e.g.* vodka from potato), **fruits** (*e.g.* wine and brandy from grapes, cider from apple, the indigenous fenny from cashew nut and *mahua* from *Madhuca longifolia* of Sapotaceae). **Non-alcoholic beverages** from plants include **fruit juices** as well as **mildly-stimulating caffeinaceous drinks** such as **tea** (leaf, *Camellia sinensis* of Theaceae, native to China), **coffee** (seeds, *Coffea arabica* of Rubiaceae, native to Ethiopia and Arabia) and **cocoa** (seeds, *Theobroma cacao* of Sterculiaceae, native to Mexico)—all **tropical crops**. **Caffeine**, a xanthine **alkaloid** with **refreshing** and **stimulating** actions, can increase mental activity, reduce fatigue, and increase flow of digestive juices (**stomachic**) and urine (**diuretic**). **Coffee** is more **stimulating** for the **brain**, **cocoa** for the **kidney**, but **tea** can stimulate most of the **body organs**. While **tea** and **coffee** have little **nutritive value**, **cocoa** (used both as food and drink) and **alcoholic beverages** are considered as **energy sources**.

Tea (*Cha* B.)

Camellia sinensis (L.) Kuntze (Originally *Thea sinensis* and then *C. thea*)
Theaceae (formerly Ternstroemiaceae)
Leaves (leaf buds and tender leaves)

Tea had probably originated in the **Yunnan Province** of **southeast China** (**primary centre of origin**) in the form of tall plants with soft, small leaves representing *C. sinensis* var. *sinensis* (the **Chinese variety**). In the adjoining **Assam Province** of **northeast India** (**secondary centre of origin**), the dwarf plants with leathery, large leaves representing *C. sinensis* var. *assamica* (the **Assam variety**), probably originated from the older Chinese variety. Tea is cultivated as a shrub (**tea bush**), but it still found in the wild as a **tree** in Southeast China, Northeast India and Northern Myanmar. While **China** is still the **largest tea producer** in the world, **India** and **Sri Lanka** have emerged as its largest exporters during the last two centuries. In India, about half of the tea is produced in **Upper Assam**, followed by the **Darjeeling Hills** and the **Terai-Dooars** belt of **North Bengal**. Assam tea is famous for its **colour**, while Darjeeling for its **aroma**, and these commercially **blended** together. Other important tea producing areas are in the Southern Western Ghats: Kerala (**Munnar**), Karnataka (**Coorg**) and Tamil Nadu (**the Nilgiris**). This beverage is also produced in Himalchal Pradesh (**Kangra**), Uttarakhand (**Kausani**) and Sikkim (**Temi**).

[1] Those substances which are used for smoking, e.g. tobacco, etc.
[2] Those substances which are used for chewing, e.g. betel, tobacco, etc.

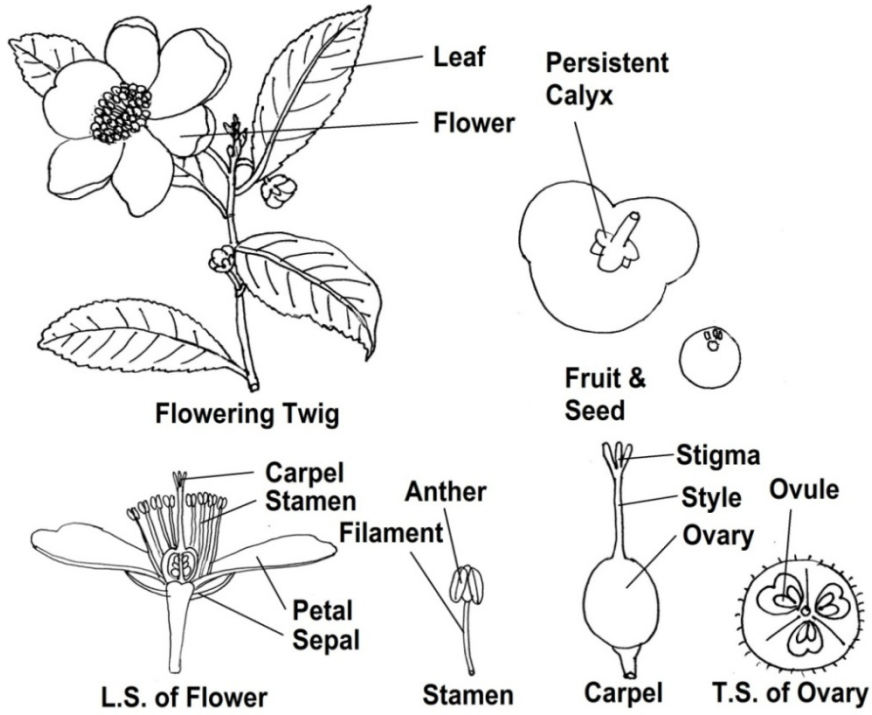
Ecology

Habit
Evergreen shrubs or small trees, up to 15-20 m (height).
Habitat
Terrestrial, lower montane, evergreen, broad-leaf forests, in thickets (100-2,200 m).
NB: Cultivated as in plantations (anthropogenic) as bushes of 0.5-1.5 m (height).

Morphology

Leaf
Simple, alternate, exstipulate, petiolate, dark green, leathery, adaxially glabrous and abaxially pubescent, elliptic to lanceolate, unicostate-reticulate, apex acute, base cuneate, margin serrated, dotted with glands, size 5-15 cm (length) x 2-5 cm (width).
Flower
Axillary, solitary to 3 clustered, pinkish, yellow or white, actinomorphic (regular), complete, bisexual, hypogynous, pedicel 5-10 mm (length), size 2.5-3.5 cm (diameter).
Calyx: Sepals 5-7, polysepalous, persistent, imbricate, green.
Corolla: Petals 5-7, polypetalous, deciduous, imbricate, white.
Androecium: Stamens numerous, united at the base; anthers basifixed.
Gynoecium: Carpels 3 (syncarpous); ovary superior, placentation axile, 3-celled with 2 ovules in each chamber (in T.S.); style terminal; stigma 3-lobed.
Fruit
Capsule, 3-lobed, woody, smooth, green, 3-6 seeded, size 2.5 cm (diameter).
Seed
Small, round, brown, size 1.25 cm (diameter)

Diagram: Morphology of *Camellia sinensis* (Theaceae)



Cultivation

Tea is a **tropical cash crop**. It is commercially cultivated as **bushes** growing in **plantations** located in warm and moist hilly regions such as the **sub-tropical** and **warm temperate mountains** as well as in the **tropical floodplains** near the foothills, often in areas reclaimed after deforestation. Tea cultivation requires a minimum **rainfall of 150 cm per annum** and **temperature** from **20** to **32°C**. The **soil** must be **well-drained** (as **terraced slopes** with **drainage canals**, which also prevents soil erosion), **acidic** (pH from 4 to 6), **loamy** and rich in **organic matter**. The young plants are protected from strong sunlight by **shade trees** *e.g. Dalbergia assamica* (Fabaceae), *Albizia procera* (Fabaceae), *Derris robusta* (Fabaceae), *Leucaena leucocephala* (Fabaceae), *Erythrina indica* (Fabaceae), *Gliricidia sepium* (Fabaceae), Melia *azedarach* (Meliaceae), *Grevillea robusta* (Proteaceae), etc. Dominantly from Fabaceae, these prevent **soil erosion**, **ventilate** the soil for root growth, replenish **soil nitrogen** and help in **biological control** of **insect pests**.

Propagation

Tea bushes are propagated either **sexual** by **seeds** (having lower yield of 350 kg per acre) or **asexual** by **cuttings** and **budding** (with higher yield of 1,000 kg per acre). After flowering from July-October, **seeds** are **collected** from **full-size trees**. After **ripening** (in about a year), seeds are **sown** in **seed beds** for **germination** (in about a month), and the **young seedlings** are **transferred** to either **basket** or **jungle nurseries**.

Planting

There are **two methods—square** or **rectangle system**. From April to October, about 6-18 month old **basket seedlings** or 1-2 year old **jungle seedlings** are planted in 30-45 cm (deep) x 23 cm (diameter) pits, along with the **saplings** of **shade trees** planted at 12-15 m apart.

Drainage

The network of **drainage canals** along the **slopes** of the tea plantations are well-maintained and these are **cleared** and **repaired** before the rainy seasons.

Manuring

This is usually done after each pruning, with the **nitrogenous** ones for better leaf growth, by manually applying **manure**, **compost**, **green manure** (**organic**), and even **fertilizers** (**inorganic**) to the soil.

Weeding

This is done at regular intervals usually during the **rainy seasons** by manually **hoeing** the soil and removing weeds to **ventilate** the soil for better root growth and **control of weeds**.

Pruning

Tea bushes are manually **maintained** by the **pruning method** to keep the **plucking height** and accelerate **leaf emergence**. Initial **decentring** (at the main axis 20 cm above ground to allow the growth of lateral branches) is done in the **first year of planting**. This is followed by **regular pruning** (45-50 cm above ground) from the **third year of planting**, usually during November, leaving 1.2 cm of new wood at the branch tips. **Fresh leaves** appear after pruning during the early rains (the **first flush** followed by **additional flushes**, see below).

Plucking

Tea leaf is manually **harvested** by the **plucking method**, starting from the fifth year of planting after establishing a **plucking level** or **table** at 0.5-1.5 m (height). Plucking is restricted to the terminal, unopened **leaf buds** and expanded, **tender leaves**—usually two (**fine plucking**), sometimes three (**medium plucking**). This is done from March to December in the **sub-tropics**. In **North India** there are **four flushes**: (1) **first flush** (March), (2) **second flush** (April-May), (3) **third** (**monsoon**) **flush** (June-July) and (4) **fourth** (**autumn**) **flush** (October). Plucking is done throughout the year in the **tropics**. In **South India**, with two monsoons, there are **two flushes**: April to May (25%) and September to December (40%).

Processing

From plucked leaves **four major types of commercial tea** are manufactured: (1) **black tea** (**fermented** type from **China, India** and **Sri Lanka**) is fully-fermented to develop **distinct dark colour**, (2) **green tea** (**unfermented** type from **China** and **Japan**) retains the original **greenness**, (3) **brick tea** (**fermented** type from **Tibet**) is **moulded into bricks** for easy transportation, and (4) **oolong tea** (**semi-fermented** type from **Taiwan**) is **intermediate** between **black tea** and **green tea**—partly-fermented to mildly develop the **colour of black tea** but retaining the **flavour of green tea**. There is two more **minor types** of commercial tea: **yellow tea**[3] and **white tea**.[4] Large-scale commercial processing of **black tea** in India is reduced to three steps: (1) ***C*rushing**, (2) ***T*earing** and (3) ***C*urling**, or the **CTC method**, and 70% of the tea manufactured in India is **CTC tea** (and the traditionally processed is **orthodox tea**). The factory processing of plucked leaves to produce commercial tea common involves steps such as **withering, shaping, bruising, oxidation, fixation, drying** and **compression**.

Withering

This is the process of **natural** or **artificial water loss** from the leaves (**wilting**) to make them **soft**, **flaccid** and **pliable** so that they **do not break** during the subsequent **mechanical processing**. **Plucked leaves** have a **high** moisture content (80-90%). This is **reduced** during this process to a **moderate** level (50-60%) in the wilted leaves. This step is done either by **artificial wilting** or **withering** on open-air **withering racks** (with plucked leaves, arranged in thin layers and left for 18-24 hr at 30°C) for **black tea** and **oolong tea**, or by **natural wilting** and **panning** (by **heating** plucked leaves in **cast iron pans** for 10 min at 71-94°C) for **green tea** (with no fermentation) and **brick tea** (containing coarse leaves and hard twigs).

Shaping

This is the process of **mechanically curling** the leaves to help them develop their **characteristic shapes** and release **essential oils** in order to enhance the **specific aroma**. This step is performed with either manually or mechanically-operated **rolling machines** (**thrice** for 30 min each at 24-26°C by **curling** the wilted leaves **directly** for **black tea**, **brick tea** and **oolong tea**, but **only once** for 30-45 min at 34-36°C by **curling** the wilted leaves **only after steaming** in case of **green tea**).

[3] A delicate tea with additional processing in the form of yellowing (slightly-fermented type, from Fujian, China).

[4] Another delicate tea with minimal processing (slightly-fermented type from Anhui, Sichuan, Zhejiang and Hunan China).

Bruising

This is the process of mechanical disruption of the leaves to help them release **sap** from their cells that contain **enzymes** and **substrates.** This step operates **simultaneously** with the **shaping** (curling) of the wilted leaves by the **rollin**g process as described above, **except** for the unfermented **green tea**.

Oxidation

This is the process of natural **enzymatic oxidation**, the most important phenomenon that is erroneously called '**fermentation**,' in the leaves due to the mixing of the **enzymes** (such as **polyphenol oxidase** from the **plastids**) and the **substrates** (such as **tannins** from the **vacuole**) to give rise to characteristic products such as the **theaflavins** (**stimulant**) and **thearubigins** (**colorant**), turning the leaves **red-brown**. This process is already initiated along with the **simultaneous shaping** (curling) and **bruising** (disruption) of the wilted leaves by the **rolling** process as described above for all except the unfermented **green tea** which undergo **fixation** (steaming) before **rolling**. For the semi-fermented **oolong tea**, only **partial oxidation** (5-40%) is done which is limited to the **rolling** process (followed by **immediate fixation**). For the fermented **black tea** and **brick tea**, the rolled leaves undergo **prolonged fermentation** (oxidation) by keeping them on **fermentation beds** (in thick layers of 1.2-2.5 cm for **black tea** and up to 15 cm for **brick tea**) and **covered** under **controlled conditions** (2-5 hr at 24-26°C, min. and 90% humidity for **black tea**, but **5 days** for **brick tea**). Therefore, this allows the **complete oxidation** (40-80%) after the **rolling** process (with **delayed fixation**). Furthermore, for **brick tea**, a **black mould** developed on the leaves also **releases enzymes** for **oxidation**.

Fixation

This is the process of **thermal disruption** for **denaturizing enzymes** to **arrest oxidation**. This is a **key control point** during processing for **developing characteristic flavours**. This step is done by applying **heat** to the leaves at different points of processing depending on the tea type. For unfermented **green tea**, this is done by **steaming** (in another **cast iron vessel** for 10 min at 120°C) the wilted leaves before rolling. For fully-fermented **black tea** and **brick tea**, the rolled and fermented (oxidized) leaves are **fired** (in a stream of hot air from a furnace at 90-100°C, for 20-25 min) or **sun dried** (respectively) for fixation. For partially-fermented **oolong tea**, rolled leaves are directly **fired**, as described above.

Drying

This is the process of final **water loss** from the leaves (**desiccation**) to make them **hard** and **durable** for subsequent **storage** and **transportation**. The final product has a **low** moisture content (5%). Generally, as the last step in processing, this also **controls** the development of the **characteristic flavour** of a tea type. For **green tea**, where **fixation** (**steaming**) is done early (between **wilting** and **rolling**), **only drying** occurs during **firing**. For the other types, **drying** and **fixation** occurs **simultaneously** by **firing** or **sun drying** as described above.

Compression

This is the **additional process** of **packing** the leaves of **brick tea** to facilitate their **transportation** across difficult **mountainous terrains**. This is done by **moulding**, *i.e.* **ramming** the dried tea leaves into **cast iron moulds** (1.2 m length x 23 x 11 cm cross section) to produce sets of 4 **tea bricks** (of 1.8 kg each).

Table: Processing of Tea

Tea Types	Steps of Tea Processing					
	Withering	**Fixation**	**Shaping** **Bruising** **Oxidation**	**Oxidation**	**Fixation** **Drying**	**Compression**
Black Tea	Wilting	X	Rolling	Fermentation	Firing	X
Green Tea	Panning	Steaming	Rolling (only shaping)	X	Firing	X
Brick Tea	Panning	X	Rolling	Fermentation	Sun drying	Moulding
Oolong Tea	Wilting	X	Rolling	X	Firing	X
Function	Reduces moisture content to prevent breaking during rolling	Inactivates enzymes and prevents oxidation	Curls the leaves to release volatiles Disrupts the leaf cells to releases sap Starts enzymatic oxidation	Completes enzymatic oxidation to yield dark coloured products	Inactivates enzymes and arrests oxidation Removes moisture for long-term storage	Allows compact packing for transportation across hilly terrains

Table: Grades of Tea

1	**Whole leaf**	Intact or almost intact leaves, best quality grades, *viz.* Finest Tippy Golden Flowery Orange Pekoe (the highest quality grade). NB: pekoe = unopened bud
2	**Broken leaf**	Larger leaf pieces, higher intermediate quality grades.
3	**Fanning**	Smaller leaf pieces, lower intermediate quality grades.
4	**Dust**	Leaf powder, lowest quality grades.

Chemistry

Tea contains **polyphenols** as well as **alkaloids** and **essential oils**. The **polyphenols** include **tannins** (**astringents**) in all teas, related **theaflavins** (**antioxidants and stimulants**) and **thearubigins** (**colorants**) in black tea, and **flavonoids** such as **catechins** (**antioxidants and stimulants**) in **green tea**. The **alkaloids** (**stimulants**) include **caffeine** (major) as well as the related **theobromine** and **theophylline** (minors). There are also numerous **essential oils** such as **theol** (**aroma**). Tea also contains small amounts of **vitamins**, **minerals**, **amino acids**, **sugars**, **lipids,** etc.

Table: Major Constituents of Tea

Chemical Class	Constituent	Function
Polyphenols	Tannins	Astringency (all teas)
	Theaflavins	Stimulation (black tea)
	Thearubigins	Colour (black tea)
	Flavonoids	Stimulation (green tea)
Alkaloids	Caffeine	Stimulation (all teas)
Essential Oils	Theol	Aroma (all teas)

Uses

The history of the **traditional use** of tea in **China** is more than 2,000 years old (Mandarin '*cha*', Fujian '*te*'). Tea was introduced in **Japan** more than 1,000 years ago, but to the rest of the world not more than 500 years ago, initially along the **Silk Route** and later along colonial sea trade routes. However, the **indigenous use** of tea is also known from **Upper Assam** (India) and **Upper Myanmar**. Tea is used as: (1) **beverage**, (2) **medicine**, (3) **vegetable**, (4) **flavouring agent**, (5) **dye**, (6) **cosmetic** & **fragrance**, etc.

Beverage

Tea is the **world's most popular beverage**. **Tea leaves** added to **boiling water** yields the beverage as a **liquor** with **astringency**, **aroma**, and **stimulating and refreshing** properties. **Tea liquor** is often enriched with **dairy products** (*e.g.* milk, butter, cream, etc.), sweetened with **sugar,** and even **honey**, or additionally flavoured with **spices** (*e.g.* cardamom, cinnamon, black pepper, clove, ginger, saffron, etc.), **fruit juices** (*e.g.* lemon juice, etc.), even **salt**, for consumption as hot beverage (**hot tea**), or even chilled as cold beverage (**ice tea**). In China and Japan, **green tea** is more popular. Fragrant (dried) flowers of **jasmine** (*Jasminum officinale* of Oleaceae) are frequently added. In Tibet (and Central Asia) **brick tea**, in Taiwan as **oolong tea**, and in the rest of the world **black tea**, often as **CTC tea**, are more popular. Tibetan **butter tea** contains **yak butter** and **salt**. Indian **masala** (**spice**) **tea** contains pulverized **spices** (*e.g.* green cardamom, cinnamon, black pepper, cloves and ginger). In India, the Kashmiri **saffron tea** additionally contains **saffron**. Turkish **lemon tea** contains **lemon juice** sweetened with **honey**. In addition to the hot tea, **ice tea** served chill contains **fruit juices** (*e.g.* lemon, peach, etc.).

Medicine

In **China**, tea was originally consumed as a **herbal drink** with **healing properties**. This is still in vogue in **Traditional Chinese Medicine** (TCM) where **green tea** is as popular as ginger and onion for herbal remedies. Tea refreshes the mind, enhances alertness, boosts concentration, and promotes digestion and urination. It is consumed to relieve conditions such as **headache**, **dizziness**, **sleepiness**, **indigestion** and **irregular bowel movement**. **Green tea** with little or no processing (oxidation) is used as a herbal tonic during **hot and humid** summers due to its **cooling properties**. As a rich source of **polyphenols**, it also has strong **antioxidant action** by **scavenging free radicals** and **chelating metals** to reduce **oxidative stress** and prevent **cancer**. It also boosts **immunity**, reduces **obesity**, has **anti-inflammatory**, **anti-diabetic**, **antibacterial** and **antiviral** effects and prevents ailments of the **heart**, **lungs**, **liver**, **kidney** and **skin**. The **antioxidant** action of **green tea** is lost during the additional processing (oxidation) for the other teas. This processing (oxidation) makes the tea darker with greater **toxin draining action** and **metabolism boosting effect**, and are used as **herbal tonics** during **cold and dry** winters. ***Pu-erh cha*** (a **fermented type** tea from **Yunnan, China**) and **green tea** lower blood **cholesterol** (**hypocholesterolemic** effect). **Oolong tea** and **white tea** lower **blood pressure** (**hypotensive** effect). In **China**, tea is used as home remedy for skin problems such as **burns**, **wounds** and **swelling**s. A **poultice**[5] of **green tea** eases **itching**, stops **bleeding** relieves pain from **insect bites. Green tea** and **black tea** are also a rich sources of **fluoride** and it binds enamel particles together to prevent **dental decay**.

[5] Soft, moist mass of material placed with a cloth on the body to relieve inflammation.

Vegetable

In addition to the **cosmopolitan** consumption of tea as a liquid food or **beverage**, the edible **leaves** and **flowers** of this plant are used by **indigenous communities** as **minor vegetables** collected from the wild. **Myanmar** is one of the few countries where tea is eaten as well as drunk. ***Lahpet*** or **Burmese tea leaf salad**, a national delicacy, is unique to this region and prepared from fermented or pickled tea leaves dressed with sesame oil or groundnut oil. This minor food originated as a **masticatory** among the indigenous people of Upper Myanmar. ***Miang*** is a similar **tea leaf salad** prevalent among the indigenous people of adjoining **Thailand**. In **northeast India**, indigenous people are known to cook tea **leaves** as a **vegetable** along with garlic and oil and **tea leaves** are mixed as a **herbage** with cooked rice, soaked overnight for mild fermentation. In **Kutch**, **Gujarat**, the local tribes use the strained residual **tea leaves** after boiling with milk and sugar as **snacks**. In **Assam** and **North Bengal**, the tribal tea workers from Nepal (Madhesias) eat the **flowers** prepared as **fritters**.

Flavouring agent

This is also used as a **flavouring agent**. Tea is extensively used for **smoking** food in **East Asian cooking**. This gives a light smoky flavour without obscuring the natural taste of the food. In **Chinese cuisine**, tea-smoked dishes represent the traditional culinary technique of flavouring food by smoking with **black tea leaves**.

Dye

This is also used as a **dye**. Tea is extensively used as a **natural edible dye** for **darkening** food in South Asian cooking. This renders a deep brown colour to the otherwise light coloured food. In **Indian cuisine**, infusing with **black tea leaf** is an innovative culinary technique for **darkening** the gravy of curries. **Aqueous extracts** of **black tea leaves** are rich in **tannins** and are also widely used as a **natural dye** as part of the innovative technique of dyeing **natural fibres** such textiles made of **silk**, **wool**, **cotton** and **jute**.

Cosmetic & Fragrance

Tea consumption is not only good for the body from the inside, but when applied from the outside it can be useful for topical treatment of **hair** and **skin**. Tea-based formulations are used for topical hair care products such as **hair conditioner**. These formulations are also used in a broad range of skin care products including **serum**, **skin lotion**, **face cream**, **eye balm**, **exfoliating scrub** and **face mask**. Tea is also an ingredient of **anti-acne** and **anti-age** creams. Furthermore, the usefulness of tea is as much about the mouth and skin as the nose in the form of tea-infused **perfumes** and **candles**.

Further Reading:

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