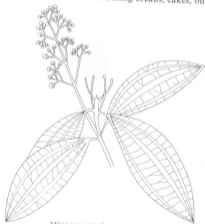


seeds. Cardamom is also cultivated in America, mainly in Guatemala, but it has never become popular among the white American people.

Cardamom was already known by Europeans in early historical times; it was an article of trade in Greece in the fourth century B.C., and in ancient Rome it was the most popular oriental spice, recommended by Apicius (a Roman epicure of the first century A.D.) to help digestion.

236. Cassia Bud

Cassia buds are unripe drupes of *Cinnamomum cassia* (Lauraceae). The unripe fruit is completely covered by the calyx and is harvested together with the pedicel. The entire structure is 6–14 mm long. It is sold as a spice and has an aroma very similar to that of the bark of true cinnamon (*C. zeylanicum*). *C. cassia* is also known as CHINESE CINNAMON; it is native to South Vietnam and today is cultivated only in south-western China. Like other species of *Cinnamomum*, Chinese cinnamon also yields an aromatic bark, but it is the only species to yield buds that are used as a spice. Cassia buds are used like cinnamon bark for flavouring breads, cakes, buns, etc.



236. CASSIA BUD (*Cinnamomum cassia*)



236b. Single Cassia bud (x0.5)



236c. Cassia bud, L. S. (x6)

- A. Epicarp
- B. Mesocarp
- C. Endocarp
- D. Testa
- E. Developing seed
- F. Calyx lobe
- G. Calyx tube

[72.] Celery

Apium graveolens var. *dulce* (Umbelliferae), a native of temperate regions of Eurasia, has already been described as a vegetable, but it also yields fruits that are consumed as a spice. The fruit is schizocarpic and splits into two mericarps which are up to 1.6 mm long with 5 light-coloured ribs. The dry, ripe mericarps contain 2–3% volatile oil which is extracted and used for culinary purposes, particularly in the form of salt flavoured with it; the seed is also used entire. Celery was formerly grown also for its leaf blades which were eaten as a flavouring or as a garnish.



a. Vegetative part



b. Reproductive part

[72.] CELERY (*Apium graveolens* var. *dulce*) (x0.5)

237. Chervil

Chervil, *Anthriscus cerefolium* (family Umbelliferae), is a plant similar to parsley (95) and popular in Europe but little known in North America. It produces leaves that are ready for consumption in 6–8 months from sowing. Like parsley, chervil is used for garnishing and flavouring.

The turnip-rooted chervil is a different plant, producing a root that is consumed as a vegetable (see 75).

237. CHERVIL (*Anthriscus cerefolium*) (x0.5)

238a. Chives growing in a flower pot. The cut-stem leaves are used as shown above (238a.)



238b. Leaves cut into small pieces for use in cooking

238. CHIVES (*Allium schoenoprasum*) (x0.5)

238. Chive

Chive, *Allium schoenoprasum*, is a perennial herb (family Liliaceae, Monocotyledoneae) and native to the temperate zones of Eurasia. Its narrow, hollow, cylindrical leaves are chopped into tiny pieces and used as a condiment for flavouring soups, boiled potatoes, cheese, etc. The leaves have a strong onion-like odour and flavour, and because of their fresh green colour they are also used as a decorative garnish for many dishes. Chive is very popular in continental Europe but although it is grown on a domestic scale in Britain it is rarely marketed.

239. Cinnamon

The spice from cinnamon bark is derived from several species of *Cinnamomum*, evergreen trees maintained under cultivation in the form of small bushes, whereas wild cinnamon trees are 7.5-15 m tall. The genus belongs to the family Lauraceae.

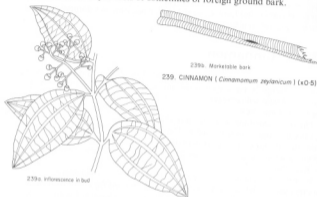
The spice cinnamon was known in the Mediterranean region by the fifth century B.C. and was mentioned by Herodotus. However, in China, derived from the species *C. cassia*, cinnamon was already used in 2500 B.C.; this species also yields cassia buds (see 236), the export of which is monopolized by Red China.

In Britain the name CASSIA is given to the bark of *Cinnamomum cassia* and of other species, while the name cinnamon is reserved for *C. zeylanicum*, the species indigenous to Ceylon. In recent times *C. zeylanicum* has superseded cassia cinnamons derived from *C. cassia*, *C. loureirii* (native to Vietnam and sold under the name SAIGON CINNAMON or cassia) and *C. burmanni* (of Indonesian origin and grown chiefly in Sumatra). Cinnamon leaves obtained from Indian cassia (*Cinnamomum tamala*) and known as FOLIA MALABATHRI are used in India as a spice, mainly in the preparation of curries. Cassia cinnamon differs from the true cinnamon bark in being thicker and coarser, and having a reddish colour when it is ground into powder.

Cassia and cinnamon are grown in fundamentally the same way and the bark is removed from trees that are kept under cultivation in the form of coppiced bushes about 2-3 m in height. Only young shoots 2 or 3 years old are used for this purpose. The bark is stripped off in two longitudinal halves and then all the cork is removed from the outside so that only the inner bark, consisting of the pericycle and phloem, remains. The inner portion is then left to dry, and as it does so it curls inwards, forming the so-called quills. During drying, the smaller quills are inserted within the larger ones, and in this way the bundles for export are formed. The cinnamon quills are normally ground into a fine powder before use as a spice for flavouring cakes,

buns, etc. Stick cinnamon is used entire as an important ingredient in pickles, stewed fruit and in the preparation of beverages. In Mexico cinnamon is used especially for the brewing of chocolate. The volatile oil is extracted from the bark and sold as a flavouring or for other purposes (it is called cinnamon bark oil), while cinnamon leaf oil is extracted from the leaves. Both cinnamon oils are used mainly for flavouring confectionery and liqueurs.

Cinnamon or cassia spice may be adulterated in the ground form by the addition of waste products or sometimes of foreign ground bark.



239b. Marketable bark

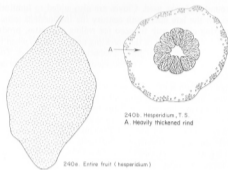
239. CINNAMON (*Cinnamomum zeylanicum*) (x0.5)

239a. Inflorescence in bud

240. Citron

Citrons are the fruits of *Citrus medica* var. *bajoura* (Rutaceae), a small tree native to south-west Asia or India. They were the first citrus fruits to be introduced into Europe and were used by the ancient Romans as a flavouring. Citrons reached Europe in about 300 B.C. and they were mentioned by Theophrastus who called them PERSIAN or MEDIAN APPLES. It was Pliny who gave them the name citron, which Linnaeus adopted and used for the whole genus. The fruit is a hesperidium with an enormously thickened rind. Citrons are cultivated on a commercial scale only in Italy, Greece and Corsica and are of little economic importance. The juice is used as a flavouring, mainly in the preparation of drinks, while the thick rind may be candied. The candied rind is used as a condiment in cooking and is known in Germany as ZITRONAT.

Citrons have been replaced in recent times by lemons which have a much thinner rind. They also belong to the species *Citrus medica* but to the variety *limonum*.

240b. Hesperidium, T.S.
A. Heavily thickened rind

240a. Entire fruit (hesperidium)

240. CITRON (*Citrus medica* var. *bajoura*) (x0.5)

241. Clove

Cloves, perhaps the best known of the spices, are the dried floral buds of *Syzygium aromaticum* (formerly *Eugenia caryophyllata* or *E. caryophyllus*), a member of the family Myrtaceae. The plant is a tropical evergreen tree native to the Moluccas. The Chinese were familiar with the clove by 300 B.C. and it was brought to Egypt in A.D. 176, but it was two centuries before the use of the clove was established throughout the Mediterranean region, and it became known in other parts of Europe in about the eighth century A.D. Like cinnamon, clove was at first entirely in the hands of the Portuguese who discovered the Moluccas, otherwise known as the Spice Islands. These islands were controlled by Portugal for almost the whole of the fourteenth century, until they were expelled by the Dutch in 1605. The Dutch monopoly was broken when, in 1770, the French governor of Mauritius (at this time known as Ile de France) succeeded in smuggling out from the Moluccas some seedlings of the clove tree.

The tree is 9–12 m tall and bears its flowers in terminal cymes. The floral buds, from which the spice is derived, are about 1.5 cm long and their bulk is formed by the fleshy calyx tube which terminates in four triangular lobes. The calyx tube is termed a hypanthium and encloses the inferior ovary. The whole bud resembles a nail and this likeness is reflected in its common names in many European languages. English is no exception: the name clove originates from the French word *clou*, in turn derived from the Latin *clavus*, both of which mean nail. The fruit that develops from the flower is a drupe.

Cloves are used for flavouring sweet as well as savoury dishes, and either

whole or ground buds are used. Cloves are also added to fumitories and masticatories. In the late nineteenth century the Indonesians initiated the process of mixing cloves with tobacco for rolling cigarettes, producing a mixture called *kretek* because of the crackling noise it makes when burned; the mixture is in the ratio of two parts of tobacco to one of cloves. Today the demand for *kretek* is so great that in Indonesia 70,000 workers are occupied in its production.

The volatile clove oil is extracted not only from the flower buds but also from the stems, the pedicels and peduncles and from the leaves. Clove oil is not used for flavouring, but only for industrial purposes: for manufacturing perfumes, bath salts, etc. and also in microscopy as a clearing agent. The largest producer and exporter today is Tanzania (the islands Zanzibar and Pemba), while the largest importer is Indonesia, owing to the practice of *kretek* smoking which is responsible for converting half of the world production of cloves into ashes.



241a. Twig with leaves and inflorescence (x 0.25)

241b. Inflorescence (x 0.5)

241. CLOVE (*Syzygium aromaticum* or *Eugenia caryophyllata*)



241c. Floral bud, stem (x1.5)



241d. Floral bud, L. S. (x1.5)

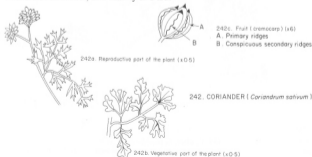
242. Coriander

Coriander, *Coriandrum sativum* (family Umbelliferae), is an annual herb native to the Mediterranean region, and it still occurs wild in Egypt and the Sudan. Coriander is mentioned in the ancient records of the Indians, Egyptians, Greeks (Hippocrates) and Romans (Cato, in the third century B.C., recommended it as a food seasoning). Later, in the Middle Ages, coriander was again mentioned by Charlemagne, who in A.D. 812 ordered that coriander should be grown on the Imperial farms.

The fruit, which forms the spice, is a cremocarp and the fruits develop from flowers arranged in compound umbels. However, the cremocarps do not readily split into two mericarps and the fruit may therefore be classified as a two-seeded capsule. Because the fruit does not split, it has a spherical, globular shape. Its surface is marked by an alternation of 10 straight and 10 wavy longitudinal ribs called costae. The varieties of coriander are distinguished by the size of the fruits: *C. s. var. vulgare* has relatively large cremocarps measuring 3.5–5.0 mm in diameter, and *C. s. var. microcarpum* yields cremocarps only 1.5–3.0 mm in diameter.

Coriander is used either entire or ground in pickles, curries, pilaus, confectionery and also as a flavouring in beverages. In Paris in the early seventeenth century a liqueur called Eau de Carnes was produced from coriander. This liqueur had a double function: it was used as a beverage but it could also be used externally like eau de Cologne. The fruits of coriander must be dried before use because when fresh they have an unpleasant odour reminiscent of bed bugs.

Today coriander is cultivated mainly in the U.S.S.R., India, Morocco, Poland, Romania, Yugoslavia, Argentina and the U.S.A. Known in Spanish as *culantro* or *cilantro*, it has become a favourite spice in many South American countries, and mainly in Peru.



242c. Fruit (cremocarp) (x4)
A. Primary ridges
B. Conspicuous secondary ridges

242a. Reproductive part of the plant (x0.5)

242. CORIANDER (*Coriandrum sativum*)

242b. Vegetative part of the plant (x0.5)

243. Cumin

Cumin, *Cuminum cyminum*, is another member of the family Umbelliferae which yields cremocarpic fruits that are used as a spice. Cumin is an annual herb native to the Levant, the eastern part of the Mediterranean region. The fruit develops in compound umbels and readily splits into two mericarps 3.0-6.5 mm in length. The mericarps have five conspicuous primary ribs and four secondary ribs. The mericarps of cremocarps are used in much the same way as caraway "seeds" for flavouring soups, sauces, pickles, bread, cheeses and also beverages.

Cumin is grown in Iran, India, Morocco, China, Russia, Indonesia, Japan and Turkey, Iran being the largest producer and exporter. In Europe cumin is used mainly for flavouring bread and cakes (especially in Germany), as an additive in cheese (in the Netherlands), for the production of cordials, etc.; while in other countries it is chiefly used as an ingredient of curry powder and chilli powder. In recent times caraway "seeds" have almost completely supplanted the use of cumin in Europe, but the name persists, and in many European languages has been extended to mean caraway seed.



243. CUMIN (*Cuminum cyminum*) (x0.5)
Showing stems, leaves and inflorescence

244. Dill

Dill, *Anethum graveolens* (Umbelliferae), an annual indigenous to Europe (the Mediterranean region) and Asia (Caspian Sea), is a flavouring plant which was already used in ancient times by the Greeks and Romans. The etymology of its common name is doubtful but some authors are convinced that it is derived from the Old Norse *dilla* which means to lull, according to the superstition that it has a soothing effect on crying children.

Two separate parts of the dill plant are commonly used as flavourings—either the leaves or the fruits. The fruit is a cremocarp 3-5 mm long and 2.0-2.5 mm wide, splitting into two mericarps which have three prominent ribs and two wing-like lateral ribs. The much divided leaves, chopped into small pieces, are used either fresh or dried for sauces, while the section of the stem with the fruiting tops is used for pickles, e.g. for pickling cucumbers and gherkins. The mericarps alone are used for flavouring soups, sauces and for other culinary purposes.

Dill is cultivated in India as well as in many temperate parts of Europe, including even Scandinavia. It is not very popular in Britain or the U.S.A. but demand for it has increased in recent years.

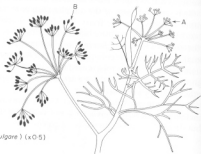


244. DILL (*Anethum graveolens*) (x0.5)

[84.] Fennel

Fennel, *Foeniculum vulgare* (Umbelliferae), produces cremocarps that split into mericarps and which are used as a spice. Fennel is a perennial herb native to the Mediterranean region and was already cultivated by the ancient

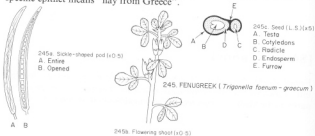
Egyptians. Its name is directly derived from the Latin *foeniculum*, meaning a type of fragrant hay. The mericarps, normally up to 8 mm long and 3–4 mm wide, are used to flavour soups, sauces, bread, sweets and liqueurs. Fennel occurs in a number of varieties, but the "wild" fennel which is commonly encountered seems in fact to be an escape from cultivation. Fennel from which the blanched leaf stalks are eaten as a vegetable, popular mainly in France, is the variety *F. vulgare* var. *dulce* which also yields fruits used as spice.



[84] FENNEL (*Foeniculum vulgare*) (x0.5)
A. Inflorescence
B. Infructescence

245. Fenugreek

Fenugreek, *Trigonella foenum-graecum* (family Leguminosae) is an annual herb native to southern Europe and Asia. Its fruit is a sickle-shaped, beaked legume, containing 10–20 hard seeds 4–6 mm long and 2–3 mm wide. They are yellowish-brown and a deep furrow divides them into two parts, the larger occupied by the cotyledons and the smaller by the radicle. Fenugreek seeds are used as a spice but they also have a nutritive function as they are rich in protein. The principal exporting countries are India, Egypt, Lebanon, Argentina and even France, but in recent years it has declined in Europe. The specific epithet means "hay from Greece".



245a. Sickle-shaped pod (x0.5)

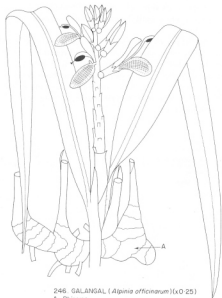
A. Entire
B. Opened

245. FENUGREEK (*Trigonella foenum-graecum*)

245b. Flowering shoot (x0.5)

246. Galangal

Galangal, *Alpinia officinarum*, is a member of the monocotyledonous family Zingiberaceae. This is actually the lesser galangal, native to southern China, while the greater galangal, *Alpinia galanga*, is a larger plant of Java and Malaya sometimes also used for flavouring. *Alpinia officinarum* has a reddish-brown rhizome with a spicy aroma and a pungent taste somewhere between pepper and ginger. The rhizomes are 5–6 cm long and 1–2 cm thick. The Chinese name for the plant is *kao-lian-kian*, which was corrupted in Persian and Arabic into *khuland-jan* and further by Europeans into *galangal*. Nowadays galangal is very seldom used in Europe and then only as a substitute for the more precious spices.



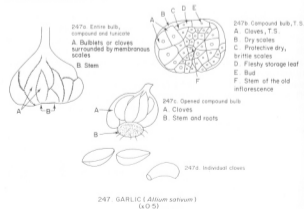
246. GALANGAL (*Alpinia officinarum*) (x0.25)
A. Rhizome

247. Garlic

The bulb of garlic, *Allium sativum*, a herbaceous biennial belonging to the monocotyledonous family Liliaceae, is a well known condiment. The bulb is a compound one and consists of small bulbs or bulbils termed "cloves". Each clove is formed from two leaves. The outer, cylindrical leaf has a protective function while the inner one surrounding the bud is a storage leaf.

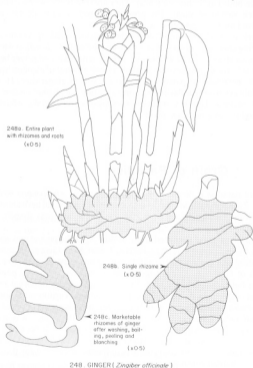
Garlic was already used by the ancient Egyptians and, according to the records, formed part of the diet of the workers who constructed the pyramids of the Pharaohs. The extremely pungent odour and taste of garlic is very disagreeable to some European nations who avoid the use of it in cooking. For example, it does not have wide popularity in Britain, but it is very popular in France, especially in Provence, where almost every dish is flavoured with garlic. The characteristic smell is due to the liberation of an enzyme, allinase, which starts to work on its substrate, allinine, breaking it down into allacin, the active compound. Thus, until the garlic is cut or crushed it does not give off the pungent odour.

As a condiment, the peeled "cloves" are used either entire or crushed into a pulp, usually added to meat, sauces, dressings and vegetables; or the cut edge of a clove may be rubbed around a salad bowl before use. It is also used to flavour garlic toast or bread. The raw compound bulb consists of 61.3% water, 6.2% proteins, 0.2% fats, 30.8% carbohydrates, and in every 100 g it contains 0.25 mg thiamine, 0.08 mg riboflavin, 0.5 mg niacin and 15 mg ascorbic acid (vitamin C).



248. Ginger

Ginger, *Zingiber officinale*, a monocotyledonous perennial herb of the family Zingiberaceae, is a native of southern Asia but is now cultivated in many other tropical regions, mainly in the West Indies and Sierra Leone. However, China and India are still the largest producers and exporters. The name ginger is derived from the Latin *zingiber*, which in Greek was modified to *ziggiberis* while its original form in Sanscrit is *crngavera*, meaning horn-like body. The first records come from China where it was mentioned by Confucius (551-479 B.C.). Ginger, in Chinese called CHIANG, was exported at an



early date into the Mediterranean area by Arab traders and in the first century A.D. it was listed in "De Materia Medica" by Dioscorides. In the early sixteenth century it was taken to the West Indies by the Spaniard Francisco de Mendoza and cultivated there.

The aerial shoots of ginger arise from a fleshy rhizome which is the useful part yielding a condiment. It is sold as white or black ginger, the two forms resulting from different methods of processing. White ginger is obtained by washing, boiling, peeling and blanching, while black ginger is merely washed and boiled before drying. Preserved ginger, produced mainly in China, results from another method of preparation: the young rhizomes are washed and then boiled until they are tender. They are then boiled several times with half their weight of sugar. The preserved ginger is normally exported in porcelain jars. Candied ginger is also produced.

Ginger is used in Britain and other English-speaking countries for flavouring cakes and drinks, and it may be used to flavour melon when it is eaten as an appetizer. The well known drinks, ginger ale and ginger beer, are usually soft drinks but they may contain a small amount of alcohol. Stronger alcoholic beverages prepared with ginger are sold as ginger wine. However, ginger always is only a flavouring additive while the alcohol content is derived from sugar. Thus in every case ginger must be considered as a flavouring plant and not as a beverage plant.

249. Grain of Paradise

Grain of paradise is the name given to the seeds of *Aframomum melegueta* (family Zingiberaceae, Monocotyledoneae). It is a perennial herb about 2.5 m tall with fragrant leaves and aromatic seeds borne in a pear-shaped orange capsule. The plant is native to West Africa.

Grains of paradise were used in the Middle Ages like pepper and were also known by the name MELEGUETA PEPPER. Under King George III a law was introduced that prohibited the addition of grains of paradise to beer, under penalty of £200 fine. At one time grains of paradise were very popular in Europe but today they are virtually unknown and are imported only for purposes other than flavouring, e.g. for perfumery. Various other species of *Aframomum*, *Amomum* and *Alpinia* were also used as grains of paradise and sometimes also *Elettaria cardamomum*, itself a valuable spice, was used as a substitute. Grains of paradise were exported to Europe from a part of the West African coast once called the Grain Coast, and today Ghana and Nigeria remain the only countries where there is a demand for them as an article for human consumption.



249. GRAIN OF PARADISE (*Aframomum melegueta* or *Aframomum grain paradisi*) (C.O.S.)

250. Hop

Hop, *Humulus lupulus*, is a climbing plant with perennial roots and is a member of the family Moraceae. It is a native of Europe but grows in the temperate zones of both hemispheres. Its fruit is a strobilus, a dry multiple fruit formed from a female inflorescence bearing achenes each of which is enclosed in a bract. The strobilus has the appearance of a cone about 3 cm long. Hop is cultivated in fields with poles and wires to support the climbing stems. It was introduced to Britain from the Netherlands, probably together with the name "beer": beer was originally brewed in Britain without hops and was called "ale". Until the Second World War, hops produced in Czechoslovakia in the region of Žatec (Saatz) were considered to be the best, and these were used for the well known Pilsner lager brewed in nearby Plzeň (Pilsen). Hops give to beer the special bitter taste imparted by an aromatic bitter substance, lupulin. The ancient Romans seem to have been the first European people to become acquainted with hops.

The genus *Humulus* contains only two species, but the other species, *H. japonicus*, is useless for brewing beer.

Hop is also used commercially as a vegetable in France and Belgium. For this purpose the panicles of the male inflorescence are broken off and are consumed like asparagus (42).



250a. Leaf



250b. Strobili

250. HOP (*Humulus lupulus*) (x0.5)

251. Horseradish

The botanical name of horseradish is *Armoracia rusticana*. It is a member of the family Cruciferae and is cultivated for its long, fleshy roots which are used as a condiment. It is a native of south-east Europe, but today it is grown



251a. Root (x0.3)

251. HORSERADISH (*Armoracia rusticana*)

251b. Root in marketable form (x0.5)



251c. Leaf (x0.5)

all over the world, even in the tropics where it is limited to higher altitudes. It is propagated by means of cuttings and its adventitious roots are harvested. The corky covering of the root is peeled off and the root is then grated, to be used either raw (e.g. with frankfurters, ham or smoked pork) or boiled and made into various sauces (e.g. with roast beef). Its extremely pungent, "hot" taste is caused by mustard oil which is hydrolysed into the glucoside sinigrin by the action of the enzyme myrosinase. The name horseradish means a strongly pungent root (*radix*).

In India the roots of the horseradish tree, *Moringa oleifera* (Moringaceae), are used as a substitute for horseradish.

252. Lemon

The lemon tree is considered either as the species *Citrus limon* or as a variety of *Citrus medica*, *C. m. var. limonum*. It belongs to the family Rutaceae. Its origin was in south-east Asia and it was brought to Europe during the Middle Ages (in the twelfth or thirteenth century); it was known by the Arabs in the tenth century A.D. It was introduced into America by Columbus himself, who took it to Haiti on his second voyage of discovery (in 1493).



252a. Entire hesperidium

252. LEMON (*Citrus medica* var. *limonum*)

252b. T.S. Hesperidium

Lemon, like citron, is not usually eaten fresh but is used as a flavouring. Its juice is used for the preparation of lemonade or added to tea (Russian tea), salads, sauces, alcoholic drinks etc.; it is sliced and used as a flavouring or as a garnish for fish and meat dishes and for drinks; and its rind is used grated, thinly peeled or candied for flavouring cakes and beverages.

Like all other citrus fruits, lemon is a hesperidium and it has a thin rind in comparison with citron. This is certainly why lemon has ousted citron from the market. However, in some languages the name citron has been adopted to mean lemon (e.g. French CITRON and German ZITRONE). In Europe, lemons are cultivated in Italy, Spain and Cyprus.

Lemons may be considered commercially as fruits in that marmalade is made from the whole fruit, as it is from oranges, but lemon marmalade has not achieved the same degree of popularity.

Lemons contain a large amount of vitamin C. The peel has the highest content—129 mg vitamin C per 100 g—while the peeled fruit contains 53 mg per 100 g, and the expressed juice 46 mg per 100 g.

253. Lime

Lime, *Citrus aurantifolia* (Rutaceae), is probably indigenous in the East Indian archipelago. It bears hesperidia similar to lemons but yellow-green in colour; like citrons and lemons they are not eaten fresh as a fruit, but marmalade is prepared from the whole fruit. The juice is used for flavouring soft and alcoholic drinks.

Lime trees grow only in the tropics and the fruits are not often imported into Europe and other temperate regions because they do not stand up well to transportation.

The fruit is poorer in vitamin C than lemons; it contains only 37 mg per 100 g fresh weight.

254. Liquorice

The underground parts of liquorice, *Glycyrrhiza glabra* (Leguminosae), are used as a flavouring agent in confectionery and in the tobacco industry for improving the taste of tobacco. The plant is native to southern Europe and western and central Asia. Its cultivation began in Britain in the sixteenth century but the majority was always imported, mainly from Spain.

In Spain, liquorice is propagated by means of cuttings and the stolons that develop are harvested together with the roots, and it is mainly stolons that are exported. The peeled, decorticated stolons or roots are cut into sticks, about 20 cm long and 1–2 cm thick, which are yellowish in colour but when they are processed by grinding and boiling they yield a liquid which solidifies into a black material. The change of colour is caused by the boiling which hydrolyses the main constituent of liquorice, the glucoside glycyrrhizin, into glycyrrhetic acid and two molecules of glucuronic acid. Glycyrrhizin is responsible for the enormous sweetness of liquorice which is equivalent to 50 times the sweetening power of sucrose. For this reason, liquorice was sold as pieces of raw stolon as a natural sweetmeat for chewing. This sort of liquorice was very popular in Europe until the beginning of the twentieth century but it is now very hard to obtain.

The name liquorice is a corruption of *glycyrrhiza*, meaning sweet root, and in German it is called *Suessholz* (sweet wood).

Another large exporter of liquorice is Russia where it grows wild, mainly along the river Volga. However, this is a special variety, *Glycyrrhiza glabra*

var. *glandulifera*, which produces a rhizome from which develop enormous adventitious roots. These may be up to 10 cm thick at the proximal end. Thus, Russian liquorice is mainly composed of roots. The variety *G. glabra* var. *riolacea* is exported from Iran and is known as Persian liquorice, while further suppliers are Turkey and Syria. The Turkish, so-called Anatolian liquorice is sold in very thick sticks, 5–8 cm in diameter. Both Anatolian and Syrian liquorice seem to be derived from the European *G. glabra* which is cultivated in Sicily as well as in Spain.



254. LIQUORICE (*Glycyrrhiza glabra*) (xO.5)

255. Lovage

Lovage is a corruption of the Latin *Levisticum*, the generic name of the species *L. officinale* to which the herb belongs. It is a member of the family Umbelliferae and is a native of mountainous southern Europe. It was mentioned by Pliny and other early authors. In the eighth century it was brought across the Alps from Italy, according to a record in Charlemagne's "Capitulare de Villis" (A.D. 794).

Lovage is a perennial herb 1–2 m tall and the leaves are used as a culinary herb or spice. The rhizome is also used as a spice, being dug up when the plant is 2–3 years old and pulverized. In soups, it imparts the flavour of a mixture of spices and for this reason it is given the name in Germany of *MAGGIWURZEL*.

Lovage is also grown in North America, where it was introduced from Europe. It is used there for flavouring purposes, mainly in confectionery. It

should also be mentioned that in former times the leaf stalks of lovage were blanched and eaten like celery.

From an early date various medicinal properties were attributed to lovage and it was also believed that it had a magical influence on love affairs. (This is a possible alternative derivation for the name.) The German common name *LIEBSTÖCKEL* acquired the root *lieb*, meaning love, by a corruption of the Greek *libystikos* which means Ligurian and gave rise to the scientific name *Levisticum*.



255. LOVAGE (*Levisticum officinale*) (x0.5)
Showing inflorescence

256. Mace

Mace is the aril of the seed of *Myristica fragrans*, a member of the family Myristicaceae native to the Moluccas. Under cultivation the evergreen tree reaches 12–18 m. Mace was introduced into Europe as a spice in the twelfth century by Arab traders, and when the Portuguese discovered the Spice Islands in 1512 the trade in mace, as well as in nutmeg (the seeds of the same plant), became their monopoly. The aril, i.e. the mace, surrounds the single seed which is 2–3 cm long within a berry 6–9 cm long; the aril develops from the funicle and micropyle. It is a branching, bright red, net-like structure adhering closely to the testa of the seed. The testa is dark brown and shiny, adding to the brilliance of the scarlet mace, while the pericarp that encloses the seed with its aril is succulent and yellowish in colour. It opens by means of two valves to release the single seed together with the aril. The fruit is collected at the time it starts to split and the mace is normally separated by hand from the seed (the nutmeg). The mace and the nutmegs are then dried separately, either indoors or outdoors. During its drying and simultaneous curing mace acquires its pungent aroma. It is used as a spice in cakes, sauces (e.g. ketchup), pickles and pastries.

The Portuguese retained their monopoly on the world supply of mace and nutmeg for about 100 years. Then they were expelled from the Spice Islands by the Dutch who took over the trade monopoly until the Moluccas were occupied by the British for a short period (1796–1802). This short period was, however, long enough to destroy the monopoly for ever. The British introduced mace and nutmeg to other countries; first to Penang, later to Singapore and finally in 1802 to the New World tropics—to St. Vincent in the West Indies.



256a. Mace in situ over the surface of the nutmeg



256b. Separated mace

256. MACE (*Myristica fragrans*) (x1)

257. Marjoram

Marjoram, or SWEET MARJORAM, is the species *Majorana hortensis*, a perennial herbaceous plant of the family Labiatae, native to the Mediterranean region and western Asia. Fresh marjoram is used as a seasoning for salads and its dried leaves and flowering tops are used entire or ground as a spice for flavouring sauces, meats and vegetables.



257a. Flowering top



257. MARJORAM (x0.5)

257b. Foliage

Marjoram was well known in the Graeco-Roman era, as was WILD MARJORAM which is a different plant, *Origanum vulgare*, also native to the Mediterranean region. *M. hortensis* is produced mainly in France, Italy, Rumania, Lebanon, Mexico and Chile. Under cultivation it reaches about 30 cm in height and is treated as an annual.

Marjoram is often adulterated with other dried leaves, particularly those of *Cistus* spp. (*C. albidus* or *C. salvifolius*) which are shrubs typical of the Mediterranean maquis belonging to the family Cistaceae. Other adulterants include *Tilia argentea*, a species of lime, and a member of the family Malvaceae, *Althaea officinalis*.

POT MARJORAM, a hardy perennial, is another species of *Majorama*. *M. onites*. It is not used a great deal as a flavouring because its leaves are too mild.

258. Mugwort

Mugwort, *Artemisia vulgaris*, is a perennial plant of the family Compositae and arises from a woody rhizome. The plant is aromatic and reaches 60–120

cm in height. Its leaves are deeply divided into sharp-pointed segments and hairs on the abaxial surface forms a silky down. The flowers are tiny, reddish-yellow structures arranged in many short spikes. The leaves and flowering tops are used as a spice, but the plant must be gathered when the flowers are still immature because any later it becomes too bitter to use. Mugwort is used chiefly to flavour roast geese, duck, pork, etc.

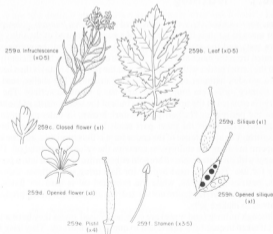


258. MUGWORT (*Artemisia vulgaris*) (x0.5)

259. Mustard

Mustard, from which the paste used as a condiment is derived, is an annual plant of the genus *Brassica* (family Cruciferae). There are two species cultivated for the production of mustard, *B. nigra* and *B. alba* (black and white mustard respectively), the latter also being known by the names *Sinapis alba* and *Brassica hirta*. The useful parts of the plants are the exalbuminous seeds which develop in a silique. The seeds of black mustard contain the glucoside sinigrin, which hydrolyses to produce mustard oil, responsible for the "hot" taste of mustard. Hydrolysis of sinigrin is brought about by the enzyme myrosinase which is liberated by grinding the mustard seeds and is activated by addition of vinegar to the powder. White mustard has, in place of sinigrin, a very similar glucoside called sinalbin which also yields a mustard oil. A paste is thus produced to which salt and aromatic substances are subsequently added. Mustard is prepared from the seeds of both black and white mustard. In continental, and mainly in central Europe, the white, milder flavoured seeds are preferred, while in Britain it is mainly the seeds of the hotter species *Brassica nigra* that are processed.

Black mustard is native to Eurasia while white mustard (*B. alba*) is native to the Mediterranean region. It was known at an early date as a medicine as



259. MUSTARD, WHITE (*Brassica alba*)

well as a condiment. The name is derived from the word *must*, meaning juice of the grape; mustard was originally called *MUSTUM ARDENS* (hot must) because the ancient Romans used must to prepare a paste from mustard seed. Its use was mentioned by Pythagoras (ca. 530 B.C.), by Hippocrates (ca. 400 B.C.) and by the Roman emperor Diocletian when in A.D. 301 he fixed the price of mustard by one of his edicts. In the Middle Ages its cultivation was introduced into Spain by the Arabs and from there it spread throughout Europe.

The most common use of mustard is in the form of a paste, but it is also used as a powder known as mustard flour, or the whole seeds are used in pickles, e.g. in sauerkraut and in pickled gherkins.

The seeds of *B. alba* are about 2 mm in diameter and yellow in colour. The plant is an annual about 30 cm tall, while *B. nigra* is a larger plant reaching 1 m in height. Mustard is cultivated in England, the Netherlands, Denmark, Poland, France, Italy, India, China, Ethiopia, Canada, the U.S.A., Argentina and other countries.

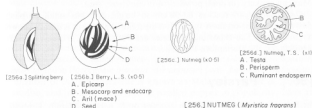
Besides their use as condiments, both types of mustard are cultivated as food plants: their seedlings are used as a salad vegetable (see 77 and 118).

[256.] Nutmeg

Nutmeg or *NUS MUSCATA* is the shelled seed of *Myristica fragrans* as described under mace (q.v.). It is the single seed of a berry, deprived of the shiny dark brown testa and the scarlet aril (the mace). After harvest the nutmegs are separated from the mace and dried. They are considered to be sufficiently dry when the kernel rattles within the shell, and the shell (the testa) is then broken with a wooden hammer or with a cracking machine. The shelled seed, the true nutmeg, is 2–3 cm long, ovoid, and has a wrinkled surface. The tiny embryo is situated at the tip, so that the bulk of the seed consists of the endosperm and perisperm. The perisperm is dark brown, its outer part in nature facing the testa, while the inner part sends branches into the pale brown endosperm. The appearance of the endosperm is thus ruminant, and the inner perisperm invading the endosperm contains the valuable essential oil. Dried nutmegs with the testa removed are sold either entire or ground into a powder ready for use. They are used mainly for flavouring sweet dishes, custards, cakes, pastries and drinks, while the extracted oil is used for flavouring tobacco. The ripe pericarps are not wasted, but are used in nutmeg-producing countries to make a jelly.

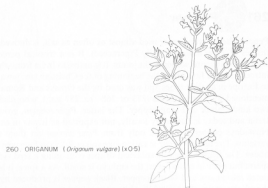
Although nutmeg (and mace) are commonly used spices they have a toxic effect if taken in quantities equivalent to one or two nutmegs. They have been used in the past as a panacea for a variety of ills but the side-effects such as nausea, tachycardia, constipation, etc. were very serious. However, nutmeg

and mace are deliberately taken by some for their hallucinogenic effects, which become manifest in 1–6 h and end with depression of the central nervous system. Complete recovery takes about 24 h. At "nutmeg parties" 2–3 tablespoonsful of nutmeg are consumed in drinks as a hallucinogenic drug. It appears that the toxic constituent is myristicin, a compound occurring in the volatile oil. Nutmeg contains 8–15% of essential oils of which 4% is myristicin. Myristicin is also present in the seeds of many members of the Umbelliferae, e.g. celery, dill, etc.



260. Origanum

There are two distinct plants known as origanum. One was formerly known as wild marjoram and is native to the Mediterranean region and western Asia; its botanical name is *Origanum vulgare* and it belongs to the family Labiatae. This is the milder origanum, while the more pungent type is



Mexican origanum or OREGANO, a shrub of the family Verbenaceae. It belongs to the genus *Lippia*, usually *L. graveolens* but sometimes other species, e.g. *L. berlandii*. *Lippia* spp. are indigenous to warmer parts of the western hemisphere. Formerly, origanum and marjoram were included in a single species, *Origanum majorama*, but marjoram has now been split off as *Majorana hortensis* (see 257).

The dried leaves and flowering tops of *Origanum vulgare* are used particularly in Italian dishes (e.g. pizzas) while Mexican origanum is utilized in Mexican cookery (in chilli powder, *chilli con carne*, etc.).

Origanum vulgare reaches 60–90 cm in height and has small purplish flowers in clusters on short spikes. It is a perennial plant but is usually grown as an annual. The exporting countries are France, Italy, Turkey, Greece, Mexico and the Dominican Republic.

[95.] Parsley

In Britain parsley, *Petroselinum crispum* or *P. hortense* (family Umbelliferae) is only known as a condiment, the green tops being used for this purpose. Pieces of fresh leaves are added to soups, stuffings, omelettes, etc., while entire leaves or larger pieces are used to garnish various savoury dishes. The use of parsley as an edible plant dates from Roman times, and the Greeks used it only as a medicine. It seems that it was introduced into Britain in 1548 and from there was taken by colonists to the New World in the seventeenth century.

261. Pepper

Pepper, the everyday spice used almost as often as salt, is derived from the drupes of *Piper nigrum* (family Piperaceae). It is a tropical perennial vine with a woody stem swollen at the joints. It is native to India from where it was introduced into Java about the beginning of the Christian era; it was brought to Europe in ancient times and was used by the Greeks and Romans. It was mentioned by Theophrastus (373 or 368—ca. 287 B.C.), who distinguished two kinds, black and long pepper. The latter, *Piper longum*, grows wild in India and today is used only locally, not exported as it was in early times. Nowadays pepper is derived only from *Piper nigrum* but there are many varieties. The flowers occur in catkin-like spikes 3–25 cm long, arising at the nodes. The fruits are sessile spherical drupes containing a seed rich in perisperm but poor in endosperm; the embryo is small. As a spice, it is differentiated into BLACK and WHITE pepper. Black pepper is produced by grinding the whole, unripe drupes, while white pepper is obtained from grinding ripe

or nearly ripe drupes deprived of the outer covering (most of the pericarp). Thus white pepper is almost entirely derived from the seed. However, it is mostly special varieties of *P. nigrum* that are used for the production of white pepper, which is greyish in colour and less pungent than the black. The pungency is caused by the presence of various resins and an alkaloid called piperine.

The largest producers of pepper are still India and Indonesia. It was introduced into America, but of all the American countries and states, Brazil only contributes a small quantity to the world trade in pepper.

Apart from *Piper* spp., there are numerous other spices which are given the name pepper. For example the spice derived from capsicum and known as paprika (a corruption of pepper), red pepper, chilli pepper, Cayenne pepper and belle pepper are all derived from a different family. Furthermore, in many languages allspice is called pepper—in Italian *pepe de Giamaica*, in Spanish *pimienta* and in Portuguese *pimenta*. *Aframomum* (syn. *Amomum*) *melegueta*, a member of the Zingiberaceae is known as Melegueta pepper or grain of paradise, and in the Middle Ages it rivalled pepper in popularity. Thus at least four different spices have acquired the name which was originally derived from the Sanscrit *pippali*, meaning long pepper.

In spite of the fact that pepper is not, and never was, too expensive a spice, it is adulterated by admixture of the pericarp which is removed for the preparation of white pepper, and also with foreign materials, e.g. ground shells of walnuts, almonds and coconuts.



261c. Drupe, entire (Ridges shown white) (x3)



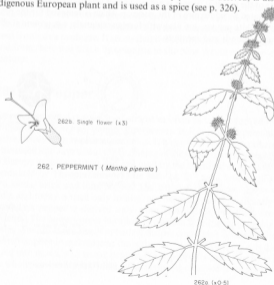
261d. White pepper (Almost mere seed) (x3)

262. Peppermint

Peppermint, *Mentha piperata* (family Labiatae) is a perennial herb derived from a cross between *M. aquatica* and *M. spicata*. It grows wild or under cultivation in the temperate parts of Eurasia and America. Its dried leaves and flowering shoots form the spice appreciated for its aroma and refreshing aftertaste. It is used for domestic culinary purposes, while the essential oil expressed from the whole flowering shoot immediately after drying is used chiefly in confectionery and for flavouring liqueurs and tobacco. Peppermint camphor or menthol is a constituent of the essential oil and in Japan, the U.S.A. and Brazil it is distilled from another species, *M. arvensis* var. *piperascens* or JAPANESE PEPPERMINT. This type of peppermint has a higher yield of essential oil but is cheaper because it has a bitter taste. In China another variety of the same species is cultivated for the essential oil—*M. arvensis* var. *glabrata*.

Mentha piperata is a European plant, a perennial 30–90 cm tall, arising from an underground sucker. It occurs in two varieties distinguished according to colour of the flowers, which may be purple or white.

SPERMINT, *M. spicata*, from which *M. piperata* is derived, is also an indigenous European plant and is used as a spice (see p. 326).

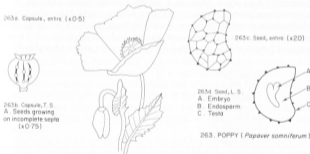
262. PEPPERMINT (*Mentha piperata*)

262c (x0.5)

263. Poppy

The poppy *Papaver somniferum* (family Papaveraceae) is an annual and occurs in many cultivated varieties derived from wild poppies indigenous to Asia Minor. It is well known as the source of opium but it is also used for culinary purposes, as a condiment or as a source of edible oil. Opium is obtained from the latex of the plant, while it is the seeds that are used in the two latter cases. The seeds are tiny and develop in huge quantities within a capsule derived from a single terminal flower. The capsule is septate but the septa are not complete and do not join in the centre; the seeds grow on these septa, and when they are mature they become detached and fall to the bottom of the capsule. Simultaneously the capsule opens by means of pores at the apex, and as the capsule is shaken by the wind the seeds escape through the pores. The minute, endospermous seeds are kidney-shaped with a sculptured testa.

Poppy seeds are a very popular flavouring in continental Europe, particularly central European countries. They are used as a topping for rolls, breads and cakes, or crushed with sweetening as a filling for cakes and pastries.

263b. Capsule, T.S.
A. Sides growing on incomplete septa (x0.75)263. POPPY (*Papaver somniferum*)

[107.] Roselle

Roselle or RAMA is a variety within the family Malvaceae known as *Hibiscus sabdariffa* var. *sabdariffa*. It is a small shrub native to India but it was introduced into Central America and the West Indies, where it became particularly popular in Jamaica. For this reason roselle is also known as JAMAICAN SORREL. (Sorrel is the common name of *Rumex acetosa*, growing in northern temperate regions. It belongs to the family Polygonaceae and has edible leaves with a taste reminiscent of the acid calices of roselle.)

The solitary flowers, borne on short peduncles, have five petals and a five-

lobed calyx accompanied by a so-called epicalyx consisting of ten fleshy bracteoles. The epicalyx and calyx are usually bright red, but they may alternatively be whitish or green according to the subvariety. The fleshy, succulent calyces are edible and for this reason the whole fruit must be harvested. The collected fruit should be tender and fleshy, and the calyces are separated off for preparation of a drink known as sorrel drink by boiling them in water with sugar. The calyces are also used as a flavouring for various sauces or for the preparation of a jelly or preserve.

The tender, young leaves are eaten as pot herbs or as a salad vegetable, as has already been described in Chapter III. The distribution of the plant spreads throughout Africa and some authors consider that its origin was in West Africa rather than India. It seems to have been introduced into America at the beginning of the eighteenth century and it was first recorded in Jamaica in 1707.

264. Rosemary

Rosemary, *Rosmarinus officinalis*, a member of the family Labiatae, is a perennial evergreen shrub reaching 5 m or more in height. It is native to the Mediterranean region. Its name is derived from the Latin *ros* (dew) and *marinum* (of the sea). The leaves, which are used as a spice, are 1.5–3.0 cm long and 2–4 cm wide in the fresh state; they are green on the adaxial surface



264. ROSEMARY (*Rosmarinus officinalis*) (x10-5)

and whitish on the abaxial surface owing to a covering of hairs. The leaves are used fresh or dried, whole or ground, to flavour soups, sauces, meat dishes, vegetables and salads.

France, Spain, Portugal, Yugoslavia and North Africa are the largest producers. Rosemary was also introduced into America, where it is successfully cultivated in California. The ancient Romans knew it as a medicine and Pliny ascribed many medicinal properties to it. In the Middle Ages rosemary became associated with a legend that gave a fanciful derivation to the name. According to the legend, the Virgin Mary, fleeing from Herod's soldiers, hung her blue cloak on a white blossoming bush; next morning all its flowers were as blue as the cloak and from that time on the blue blossoming bush was called rosemary.

265. Saffron

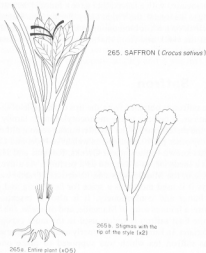
The spice saffron is obtained from the tips of the style of the saffron crocus, *Crocus sativus*. It belongs to the monocotyledonous family Iridaceae and is native to the eastern part of the Mediterranean region, although it is cultivated in many other parts of Europe as well as in India and China. As a spice, saffron was known to the ancient Greeks, Romans and Hebrews who also used it as a medicine, as a dye and as a perfume. As a dye, saffron became fashionable in the Middle Ages and its demand greatly increased its price. Nowadays it is used mostly as a spice for flavouring and colouring cakes, cheeses, butter and confectionery. It is also an essential constituent of *bouillabaise*, a famous soup of Marseille, and of *paella*, the Spanish national dish. In the East saffron is widely used in the more expensive curries, e.g. chicken biriana. In Europe it was formerly used for the preparation of a drink known as saffron tea which was supposed to make one vivacious and optimistic!

The saffron plant arises from a corm and reaches a height of 15–30 cm. The stem, growing up among the strap-like leaves, terminates in a single flower. The carpels are joined together (the syncarpous condition) but the tips are separated, the free ends of the style representing the three carpels of which the pistil consists. The free apices of the style bearing stigmata are collected, and this will explain why saffron has always been a very precious spice.

The name saffron originates from the Arabic *zafaran*, meaning yellow. Since the Europeans adopted the name from the Arabic, it suggests that their knowledge of the spice came from the Arabs, who introduced it into Spain, and with whom Europeans came into contact during the Crusades.

The expensiveness of saffron led to frequent adulteration of it. It is recorded that in 1444 a citizen of Nuremberg by the name of Findeker was burned

alive for adulteration of saffron, and in 1456 a woman called Ellis Pfragnerin was buried alive for the same offence. Saffron is often adulterated with the flowers of safflower (*Carthamus tinctorius*), the petals of marigold (*Caltha palustris*) and flowers of *Calendula officinalis*, all belonging to the family Compositae. In South Africa the flowers of two plants are used as substitutes: these are *Tritonia aurea* (Iridaceae) and *Lyperia crocea* (Scrophulariaceae).

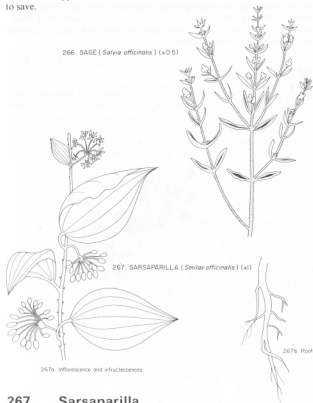


266. Sage

Sage, *Salvia officinalis* (family Labiatae), is a shrubby plant about 60 cm tall and its hairy, grey-green leaves are 4-5 cm long. It is native to the Mediterranean region and today is grown under cultivation in Dalmatia, Italy, Greece and Turkey. Outside the Mediterranean area, it is cultivated in the U.S.S.R. and U.S.A., and in western Europe on a domestic scale. It was used as a medicinal plant by the ancient Greeks and Romans and was mentioned by Theophrastus, Dioscorides and Pliny. Its dried or fresh leaves with the petiole are used whole, chopped or crushed, chiefly for stuffing poultry, meat or sausages. A beverage was also prepared from sage which, after the introduction of tea, was called sage tea. The expressed essential oil is used for

flavouring sausages, canned meat and liqueurs, while the fresh sage is normally used to flavour pickles, salads and cheeses.

The name appears to be derived from the Latin *salvere*, meaning to heal or to save.



267. Sarsaparilla

Sarsaparilla is the dried root of several tropical species of the genus *Smilax* which belongs to the monocotyledonous family Liliaceae. In particular the Central American species, *S. aristolochiaefolia* of Mexico, *S. officinalis* of

Honduras and *S. regelli* of Jamaica are used. The roots have a bitter taste, and for this reason they are normally used as a mixture with other spices and very rarely alone. Sarsaparilla is chiefly used as a beverage condiment for the preparation of soft drinks. The roots from which the spice is produced are enormously long and thin, reaching a length of 3–4 m and arising from a stout rhizome. The plants of *Smilax* spp. are vines with prickly stems and are found in dense tropical forest.

268. Sassafras

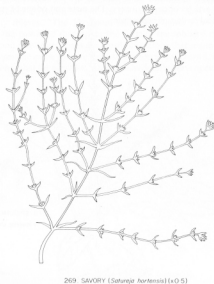
Sassafras is obtained from the bark of the roots of *Sassafras albidum*, a member of the family Lauraceae. It is a tree 20–30 m tall, native to North



America. The bark is gathered in spring or autumn and is deprived of the outer cork layers. The spicy roots of *Sassafras* were already used by American Indians before the white man settled in America. Sassafras is used chiefly for flavouring tobacco, root beer and other beverages, and the volatile oil obtained from the distillation of the root bark is used in perfumery and cosmetics.

269. Savory

There are two kinds of savory—SUMMER and WINTER savory. The summer type, *Satureja hortensis* (family Labiatae) is an annual plant about 30 cm tall and native to the Mediterranean region. It was used as a flavouring by the ancient Romans. As a spice, only the dried leaves are used, but as a fresh material the whole aerial part of the plant is utilized. The other species, *S. montana* or winter savory, also a native of the Mediterranean region, is a small perennial shrub of which the leaves and flowering shoots are used. Both

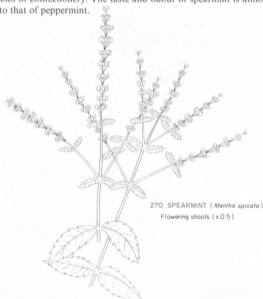


summer and winter savory were formerly very popular flavouring materials in Europe but today they are cultivated mainly in America and are used there as spices for cakes, puddings and candies.

Summer savory is more popular than winter savory. The narrow ovate leaves are dark green, bearing in their axils small flowers which are bluish, pinkish or white. The essential oil produced by distillation of the leaves is used mainly in the food industry. Summer savory is also cultivated in France, Yugoslavia and Spain but these countries export it mainly to the U.S.A.

270. Spearmint

Spearmint, *Mentha spicata*, is a similar species to *M. piperata* and is a parent species to it. Spearmint, which was known in Biblical times, is native to the temperate parts of Europe but it has now spread throughout the world. Fresh or dried leaves, commonly about 35 mm long and about 13 mm wide, as well as the flowering shoots, are used for flavouring sauces, jellies and other food materials. Spearmint oil is used for the production of chewing gums and other articles of confectionery. The taste and odour of spearmint is almost identical to that of peppermint.



270. SPEARMINT (*Mentha spicata*)
Flowering shoots (x 0.5)

[198.] Sesame

Sesame, *Sesamum indicum* or *S. orientale* (family Pedaliaceae) is an erect annual herb 60–120 cm tall. It is mainly used for extraction of oil from its seeds which are borne in a capsule, but it may also be considered as a flavouring material. In the latter case sesame is marketed in the hulled form, the seeds being deprived of the testa. After removal of the testa they are of a uniform whitish colour; they are pear-shaped and up to 3 mm long. They are mainly used in the Middle East and in Chinese and Indian confectionery and are often scattered on the top of cakes, pastries and bread, much as poppy seeds are used in Central Europe. The main producer of sesame is China and it is also produced in India, Ethiopia, Sudan, Nicaragua, Mexico, Guatemala and the U.S.A.

Sesame is native to the hot, dry tropical parts of East Africa. In Africa and India the seeds are eaten as a flavouring or as a food while in other countries they are mainly used for the extraction of edible oil. Its cultivation spread very quickly throughout the world and the first record of it as a cultivated plant dates from about 1600 B.C. in Mesopotamia. The name sesame is taken from the ancient Egyptian *sesemt*. In the traditional story of Ali Baba and the forty thieves, "The Thousand and One Nights", the word sesame is used as the password that opens the door of the robbers' den—"Open sesame"—and most Europeans are hardly conscious that sesame is a useful plant. How sesame came to have this association is not known, but a possible explanation is that the capsules, when ripe, suddenly burst open with a sharp sound.

271. SUMAC (*Rhus coriaria*) (x 0.5)
(text on p. 328)



271a. Fructescence



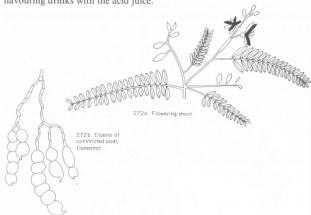
271b. Leafy shoot

271. Sumac

Sumac, also spelt SUMACH, is a tree of the family Anacardiaceae called *Rhus coriaria*. It produces terminal clusters of tiny drupes 5-7 mm across. The drupes deprived of the stone and calyx are used in Turkey with onion and salt as a spice for roast meat. Sumac was already known in ancient times and was mentioned by Dioscorides. Its name is of Arabic origin.

272. Tamarind

Tamarind, *Tamarindus indica* (family Leguminosae), originated in tropical Africa and was introduced from there into India at an early date. It still grows wild in the drier savannas of Africa and forms trees up to 20 m tall. The racemose inflorescence produces etaerios of schizocarpic fruits, lomenta, i.e. septate and constricted pods. The fleshy mesocarp is acid and is eaten fresh or preserved in syrup. In this way tamarind is eaten as a fruit but it is more often used in other ways. Firstly, the seeds are eaten as nuts, after removal of the testa and boiling or roasting; and secondly (and this is the most frequent use) tamarind is used as a flavouring. The leaves and flowers are used for seasoning soups, salads, etc. and they are also used as constituents of curries. The fruit is used as a condiment in curries, chutneys and preserves or for flavouring drinks with the acid juice.

272. TAMARIND (*Tamarindus indica*) (x0.25)

273. Tarragon

Tarragon, *Artemisia dracunculoides*, is a perennial shrub belonging to the family Compositae. The first record of tarragon as a flavouring herb dates from Arab sources of the thirteenth century. Its English name is a corruption of the French *estragon* which in turn is derived from the Arabic *tarkhun*, meaning little dragon. According to some authors it acquired this name because it was supposed to heal the bites of venomous snakes, but others claim that the name refers to the resemblance of its roots to coiled snakes. Two species of tarragon are cultivated: both are perennial shrubs but the harder Russian species, *A. dracunculoides*, grows up to 1.5 m in height while the more popular French tarragon reaches only half this height. Tarragon was introduced into Europe from Russia and western Asia and its aromatic leaves, or even the entire young shoots, are used for flavouring soups, salads and meats. However, the most popular use is for tarragon vinegar which is produced by saturation of the fresh or dried leaves in vinegar.

273. TARRAGON (*Artemisia dracunculoides*) (x0.5)

274. Tea-Scenting Flowers

The Chinese often use tea scented with the flowers of other plants, the flowers being mixed in with the dried leaves of the tea plant. The most commonly used flowers are obtained from the following species:

Aglaiia odorata (Meliaceae) is an evergreen shrub 2.5–3.0 m tall producing small yellow flowers that are borne in cymes. It is native to China and Indonesia.

Chloranthus inconspicuus (Chloranthaceae) is a small shrub with pale green flowers. It is native to tropical Asia.

Gardenia jasminoides var. *florida* (Rubiaceae) is a native of China. It grows as a shrub with fragrant white flowers.

Jasminum sambac (Oleaceae) is an evergreen twiner native to the Far East and producing white fragrant flowers.

Murraya exotica (Rutaceae) is a shrub up to 3 m tall. It has white flowers and is native to India and neighbouring countries.

Osmanthus fragrans or *Olea fragrans* (Oleaceae) forms a small tree or shrub with white flowers and is native to China and Japan.

275. Thyme

Thyme, *Thymus vulgaris* (family Labiatae) is a low shrubby plant native to the Mediterranean region and Asia Minor. It has stems 20–45 cm long and



275a. Flowering branches (x4.5)



275b. Single leaf showing of gland (x4)

275. THYME (*Thymus vulgaris*)

tiny leaves not more than 1 cm long and about 2.5 mm wide. Its leaves and flowering shoots are used as a spice for flavouring soups, gravies, sauces, poultry stuffings, meats, sausages and also liqueurs (e.g. Benedictine). The ancient Romans also used thyme as a flavouring for cheeses. The thyme marketed in Germany and known as French or Spanish thyme is claimed to be another species, *T. zygis*.

276. Turmeric

Turmeric, *Curcuma longa*, is a member of the monocotyledonous family Zingiberaceae. It is a perennial plant with rhizomes from which the spice is derived. The plant has leaves 60–90 cm long, erect and acute at both ends. The flowers are borne in spikes and are yellowish-white. The earliest record of turmeric comes from Assyria in about 600 B.C.; in the Middle Ages it was known in Europe as INDIAN SAFFRON because it was also used as a dyestuff. It is native to southern Asia.

The rhizomes are carefully dug up and cleaned of all soil. They are then boiled in earthenware or metal pots over a very slow fire for about 3 h, and after boiling they are cured by drying in the sun for several days. The processes of boiling, drying and curing cause them to lose three-quarters of their original weight. The cured rhizomes are ground into a fine, yellowish, aromatic powder which is used for flavouring or for dyeing cotton, silk, etc.

Turmeric is cultivated mainly in India where its use as a spice is most often as a constituent of curries, together with other spices including cardamom, cinnamon, cloves, coriander, cumin, fenugreek, ginger, nutmeg, capsicum and black and long pepper. European food factories use turmeric more as a dyestuff for food products than as a spice.



276b. Rhizome (x10.5)

276. TURMERIC (*Curcuma longa*)

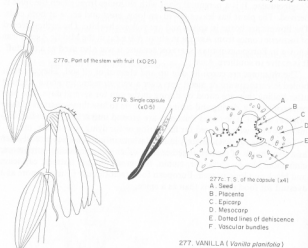


276a. Entire plant (x25)

277. Vanilla

Vanilla, *Vanilla planifolia*, a member of the monocotyledonous family Orchidaceae, is a tropical climbing orchid of American origin. It is a native of Central America. The useful part is the fruit, a pod-like capsule, which is harvested before it is ripe. The capsule is triangular, about 15–20 cm long and 0.8–1.0 cm in diameter. When ripe it is yellow in colour and splits into two valves.

The unripe capsule does not have the characteristic aroma of vanilla because this develops during curing. The harvested capsules are spread on blankets and exposed to the sun for a whole morning. At midday they are



wrapped in the blankets and stored until next morning in airtight boxes. This procedure is repeated many times until the capsules are properly cured. They contain a glucoside which is broken down during this sweating process by an enzyme into vanillin, a crystalline substance responsible for the aroma of vanilla.

The Spaniards became acquainted with vanilla when they conquered the Empire of Montezuma. They brought it to Europe but did not introduce it into any countries where it could be grown successfully. It was not until 1819 that vanilla was introduced into Java and from there it spread further.

Originally vanilla was used by American Indians for flavouring chocolate drinks, but in Europe it became a condiment with multiple uses. Sugar and ice cream are flavoured with it, it is used in the production of cakes and sweet desserts, and it is also used in the manufacture of solid chocolate.

Vanillin, which often crystallizes during curing to form a dark brown substance, has since 1874 been synthesized from eugenol which is present in clove oil (the oil extracted from the floral buds of *Syzygium aromaticum*). Nevertheless, the use of natural vanilla still survives today.

Apart from its countries of origin, vanilla is cultivated in Madagascar, Mauritius, Réunion, the Seychelles, Indonesia, Tahiti, Tanzania, Brazil and Jamaica. The largest producer is Madagascar which harvests 90% of the entire world crop. At first cultivation of vanilla in alien countries was a failure; the introduced vanilla plant grew normally and blossomed but did not bear fruit. However, the puzzle was solved when the Belgian botanist Charles Morren introduced hand pollination, and it was later discovered that in America vanilla is pollinated by a special bee and a special humming-bird, neither of which occurs in the fauna of tropical Asia.

278. Wormwood

Wormwood is the common name of *Artemisia absinthium*, a member of the family Compositae. It is native to Europe, North Africa and northern Asia, and is the most bitter plant known. Its dried leaves and flowering shoots are used for extraction of a green-coloured essential oil, chiefly used for flavouring a liqueur known as absinth. In larger doses this essential oil is poisonous and for this reason the French government has prohibited the production and consumption of absinth. It had become a very popular drink in France but was considered harmful on two counts—its alcohol content and the wormwood extract.

In the past, wormwood was added instead of hops as the bitter principle in beers. Nowadays, wormwood is mainly used for flavouring vermouths which were originally called *vins d'absinthe*. The name vermouth is derived from the German *vermut*. It was first produced on a commercial scale in Italy in 1786 by Carpano and his firm still survives today.

Wormwood is never used as a spice.

(Illustration on p. 334)

279. Wormwood, Roman

Roman wormwood, known as PETITE ABSINTHE, is similar to the true wormwood but belongs to another species, *Artemisia pontica*. It grows from a rhizome, producing a stem about 30–100 cm tall. The tiny, brownish flowers

form globular heads 3-4 mm across. The plant is native to central and eastern Europe and also Asia Minor. Roman wormwood is used for flavouring spirits (aperitifs, cordials) and also for the preparation of pontic vermouth.



278. WORMWOOD (*Artemisia absinthium*) (x0.5)
Flowering shoot

Morphological Survey of Flavouring Plants (FLA)

FUNGI

Entire thallus

218. *Penicillium*

Fungal fructification

219. Truffle

GYMNOSPERMAE

Aril

220. Juniper

VII. FLAVOURING PLANTS

ANGIOSPERMAE

Root

Fleshy adventitious root

251. Horseradish
254. Liquorice (see also
216. DYE)
267. Sarsaparilla

Bark of the root

268. Sassafras

Stem

Stem (and other parts)

222. Angelica

Rhizome

232. *Calamus*
246. Galangal
248. Ginger
276. Turmeric

Stolon

254. Liquorice (see also
216. Dye)

Bulb

247. Garlic

Bark of the stem

223. Angostura
239. Cinnamon

Leaf

Leaf entire

226. Balm
228. Bay
230. Borage
231. Borage, Indian
237. Chervil
238. Chive
244. Dill
255. Lovage
[95.] Parsley
264. Rosemary
266. Sage
269. Savory
272. Tamarind
273. Tarragon

Leaf (contd.)

Shoot

- [107.] Roselle
273. Tarragon

Leaves and flowering tops

227. Basil, Sweet
257. Marjoram
258. Mugwort
260. Origanum
262. Peppermint
269. Savory
270. Spearmint
275. Thyme
278. Wormwood
279. Wormwood, Roman

Flower

Solitary flower or inflorescence

272. Tamarind
274. Tea-scenting flowers
Aglala odorata
Chloranthus inconspicua
Gardenia jasminoides
Jasminum sambac
Murraya exotica
Osmanthus fragrans

Flower bud

233. Caper
241. Clove

Calyx

- [107.] Roselle

Stigma with the tip of the style

265. Saffron

Fruit, Simple

DRY

Capsule

235. Cardamom
277. Vanilla

Fruit, Simple (contd.)*Schizocarpic***Lomentum**

272. Tamarind

Cremocarp (non-splitting)

242. Coriander

Mericarp

224. Anise

234. Caraway

[69.] Celery

243. Cumin

244. Dill

[81.] Fennel

FLESHY

Berry

221. Allspice

[64.] Capsicum

Hesperidium

240. Citron

252. Lemon

253. Lime

Drupe

236. Cassia bud

261. Pepper

271. Sumac

Aggregate fruit**Etacrio of follicles**

225. Anise, Star

Multiple fruit, dry

250. Hops

Inflorescence, fruiting tops

244. Dill (cremocarpis)

Seed**of a capsule**

235. Cardamom

249. Grain of paradise

263. Poppy

[199.] Sesame

of a legume (pod)

245. Fenugreek

of a lomentum

272. Tamarind

of a siliqua

259. Mustard

of a berry

[256.] Nutmeg

of a drupe

229. Bean, Tonka

Aril

256. Mace

VIII. BEVERAGE PLANTS

There are many beverages derived from plants but only some of them originate from specific beverage plants. For example, fruit juices represent only one of the ways in which fruit can be consumed, thus pure fruit juices are derived from a food plant rather than a beverage plant. Fruit juices became popular after the Second World War but, owing to their relative expensiveness, they are not so popular as drinks based on the dilution of fruit juices or other extracts, sweetened with sugar or saccharine, in water. The vegetable materials used in this way are flavourings and the beverages prepared from them are called flavoured drinks. Today the most popular of such drinks is orangeade; formerly, in continental Europe, the preference was for *grenadine*, a raspberry beverage in which raspberry syrup is mixed with water. The French term *grenadine* in fact means a drink prepared from pomegranates, but this went out of fashion and was substituted by raspberries. In Britain the soft drink that was formerly the most popular was ginger ale which, in spite of its name, does not usually contain any alcohol but is merely water flavoured with the rhizome of ginger.

Apart from the pure fruit juices and flavoured drinks we can also distinguish drinks that are derived from true beverage plants. These plants either contain alkaloids, mainly caffeine (e.g. the plants from which coffee, tea and maté are prepared), or they supply the materials for alcoholic beverages. Both alkaloidal and alcoholic beverages affect the nervous system and may therefore collectively be called stimulative beverages. Alcoholic drinks are derived from cereals and fruits as well as from sugar and starch plants, i.e. from parts of beverage plants containing starch or sugars, which may be used for this purpose if the structures are crushed and fermented. The mash is fermented by yeasts (*Saccharomyces* spp.) which hydrolyse sugars into ethyl alcohol and carbon dioxide. Alcoholic beverages produced in this way normally contain up to 16% alcohol. They are generally classified as beers or wines according to the type of vegetable material from which they are derived: if they are produced from fermented cereals they are called beers, whereas wines are fermented fruit juices (e.g. juices of grape, apple, pear, blackcurrant, cherry). The alcohol content of beers varies from 3% to 7% while that of wine is 7-16%.

However, vegetable materials other than grains and fruits are also used for the production of fermented alcoholic beverages. Such materials include the sap from the inflorescences of many palms (palm wine); honey (mead—

methu is the Greek name for wine); rhizomes and adventitious roots of gentian, etc. All such alcoholic drinks are wrongly called wines and in Britain, where grapes are normally not cultivated, many other alcoholic drinks have misleadingly been given the name wine. Examples of such drinks are parsnip wine, cowslip wine, dandelion wine and rhubarb wine, in which the alcohol is derived from sugar added initially and not from the plant which gives it its name. Thus dandelion wine is a beverage flavoured with the fluid expressed from the dandelion flowers while the alcohol is obtained by fermentation of added sugar. Ginger wine is another example in which the alcohol is derived from added sugar and not from ginger. Another misnomer is the term "rice wine" given in the West to the Japanese drink *sake*. As the product of fermented rice, a cereal, sake should be called beer in spite of the fact that it has an unusually high alcohol content (18%).

It should perhaps be mentioned that ginger beer and ginger ale, which are actually soft drinks, can sometimes accidentally contain a small proportion of alcohol, but even then it is derived from the sugar rather than from the ginger. It is fermented by a special yeast, *Saccharomyces pyrififormis*, which is enclosed in the gelatinous capsule of the bacterium *Lactobacillus vermiciformis*, introduced into the prepared beverage with the rhizome of the ginger. For this reason, ginger cannot be considered as a beverage plant but only as a flavouring used like many other plants as an additive in drinks.

Beverage plants that are used for fermentation can also yield stronger alcoholic beverages if the fermented material is distilled. By distillation of the fermented mash, distillates containing up to 70–75% alcohol can be obtained. The drinks produced in this way include whisky, brandy, rum, gin, vodka, etc., the specific name usually indicating the vegetable material from which the beverage is derived. In the original sense brandies are only the distillates derived from grapes, but the name is also given to distillates produced from all sorts of fruit, e.g. plum brandy, apricot brandy, cherry brandy, etc. Whiskies are distilled from fermented cereals, either malted or unmalted, and rums are distilled from fermented sugar cane juice. However, in Indonesia rum is called *arrack*; this is an Arabic name meaning sweat or sweating, and is applied by Arabs to distillates of palm wine or for any other kinds of distillate.

Vodka (the name means "a little water") was originally derived from the fermented mash of cereals, distilled to pure alcohol and then diluted with water to give a palatable drink. Thus vodka may be derived from the same vegetable material as whisky but it is merely a diluted form of alcohol lacking the distinctive taste of whiskies, brandies and other distillates. The finest vodkas are completely without taste, because the alcohol used for their manufacture is carefully filtered through charcoal. Nowadays vodkas are prepared mainly from potato alcohol diluted to 40%.

Gin is another type of distillate not classified according to the source of

the alcohol. The distillates called gins are derived from cereals distilled together with an added flavouring; some authors limit the name gin to distillates flavoured with juniper seeds while others use it for all flavoured distillates. English *gin*, Dutch *genever* and German *Wacholderedelbranntwein* or *Steinhäger* are all flavoured with *Juniperus*, and the English as well as the Dutch name is derived from the French word for juniper, *genevri*. While the first German name originates from *Wacholder*, meaning juniper, its other name is from the name of the town Steinhägen in Westphalia. But there is, after all, a difference between *Wacholderedelbranntwein* and *Steinhäger*: the alcohol of the former is entirely derived from juniper while that of the latter comes mostly from added sugar. Among other gins are: *aquavit*, originally a Danish product flavoured with many spices and condiments; *zubrowka*, a Polish distillate—a vodka flavoured with a grass, *Hierochloe australis* or *H. odorata*; and *raki*, a Turkish distillate from dried grapes (raisins) to which aniseid is added—a similar drink produced in Greece is called *ouzo*.

Distilled pure alcohol is also used as the raw material for the production of other kinds of alcoholic beverages. Alcohol is mixed with wines which are then known as fortified wines and have an alcoholic concentration of 18–22% (e.g. port, sherry, vermouths), or pure alcohol may be used for the production of liqueurs with an alcoholic concentration of 30–65%. Liqueurs consist of water, alcohol, sugar and flavourings and may be prepared by the cold method, that is merely by mixing the ingredients together. Various fruits, spices and other condiments are used as flavourings for liqueurs, imparting characteristic flavours by which they can easily be identified. Grand Marnier, Curaçao and Cointreau are the best known orange-flavoured liqueurs. Generally bitter (Seville) oranges are used: the variety *Citrus aurantium* var. *curassaviensis* is used for genuine Curaçao while the Kaiser liqueur, an Austrian product, is flavoured with the variety *C. a. var. bergamia*. Mint is the flavouring for crème de menthe, anise for anisette liqueurs, caraway for kuemel and marasca cherries, formerly grown in Dalmatia near Zadar (Zara) for an Italian liqueur known as maraschino. Since the incorporation of Zadar into Yugoslavia maraschino has been produced in the Italian peninsula, where marasca cherries are now cultivated near Padua. A mixture of spices and many herbs are used for the preparation of such liqueurs as Chartreuse and Benedictine, the best known digestives.

Apéritifs or alcoholic appetizers are either fortified wines or various bitters such as Angostura bitters, the French Amer Picon and the Italian apéritif Campari. Flavouring is added to the alcoholic beverages mainly in the form of essential oils extracted from flavouring materials.

Beverage plants supply us with both alkaloidal and alcoholic beverages, and sometimes these drinks are mixed together—alcoholic beverages are often added to alkaloidal ones, e.g. whisky is added to coffee (Irish coffee), rum and brandy to tea, etc. Moreover, stimulative drinks are also used in

ways other than as beverages. Maraschino is a liqueur but it is also used simply as a flavouring for fruit, fresh or preserved; and coffee, an alkaloidal beverage, is often used as a flavouring for pastries, creams, liqueurs or ice creams. Furthermore, stimulative beverages derived from beverage plants may also be mixed with other kinds of beverages such as fruit juices or flavoured drinks. For example, "Bloody Mary" is a drink made by mixing tomato juice with gin; gin fizz is a mixture of gin and lemonade; and shandy (in French *bière panachée*) is a mixture of beer and lemonade or sometimes, in Britain, beer and ginger beer.

Some alkaloidal or alcoholic drinks lose almost all their stimulative content by special methods of preparation and dilution. The different types of "cola" drinks are actually soft drinks, if we neglect the small amount of caffeine which is introduced into them from cola seeds or from a cheaper source of this alkaloid. The borderline between the stimulative and non-stimulative drinks is in some cases difficult to delimit. Perhaps the best example of a borderline case is cocoa: in the preparation of cocoa powder all the caffeine is lost and only a small amount of theobromine remains. The greatest difficulty, however, arises in the classification of beverages that are used to simulate alkaloidal drinks, mainly coffee and tea; they simulate the appearance and to some extent also the flavour of coffee and tea, but they normally contain no alkaloids. This means that plants supplying materials used as substitutes for alkaloidal drinks are actually flavouring plants. However, we may allow an exception and consider such drinks as stimulative because they do at least resemble the alkaloidal beverages. These plants are therefore included in this chapter under the headings "coffee substitutes" and "tea substitutes".

With the exception of cocoa, the food value of the alkaloidal beverages would be negligible if man did not add to them various highly nutritive additives such as sugar and milk. In contrast, in alcoholic drinks it is the alcohol that has the nutritive value, and this is derived from the beverage plants themselves. In Table VIII below the chemical composition as well as the calorific value of beverage plant products is shown. The calorific value is calculated on the basis that 1 g of protein yields 4.1 kcal, 1 g of fats yields 9.3 kcal, 1 g of available carbohydrates yields 3.75 kcal and 1 g of alcohol yields 7.0 kcal.

Table VIII
Chemical composition and calorific value per 100 g of some beverages

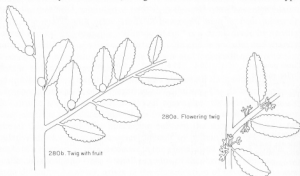
Name	Water or Alcohol	Pro- teins	Fats	Carbo- hydrates	Vitamins (mg)				Calorific value	
	%	%	%	%	A	Thia- mine	Ribo- flavin	Niacin	C kcal	
	<i>Water</i>									
Cocoa powder	2.5	20.4	25.6	35.0	0.04	0.08	0.3	4.7	—	452
Coffee, roasted and ground	4.1	12.5	15.4	28.5	—	—	0.2	10.0	0	301
Tea, Indian	9.3	14.1	0.0	0.0	0	—	0.9	6.0	0	58
Chocolate, plain	tr	5.6	35.2	52.5	—	—	—	—	—	544
	<i>Alcohol</i>									
BEER										
Bitter ale, draught	3.07	0.25	tr	2.25						31
Pale ale, bottled	3.34	0.31	tr	1.99	tr	0.004	0.05	0.7	0	32
Stout, bottled	2.87	0.31	tr	4.20						37
Strong ale	6.69	0.69	tr	6.13	tr	0.01	0.10	0.15	0	73
CIDER										
Cider, dry	3.78	tr	0.0	2.64	tr	tr	0.02	0.07	tr	37
Cider, sweet	3.68	tr	0.0	4.28						42
WINE										
Beaujolais, red	9.44	0.19	0.0	0.25						68
Chianti, red	9.12	0.13	0.0	0.19	tr	0.005	0.02	0.07	0	65
Port, tawny	16.13	0.13	0.0	12.50						160
Haute Sauternes,										
white	10.15	0.19	0.0	5.89						93
Champagne	9.85	0.25	0.0	1.40	tr	0.003	0.01	0.08	0	74
Sherry, dry	15.69	0.19	0.0	1.36						114
Sherry, sweet	15.63	0.31	0.0	6.88						135
SPRITS										
70% proof	31.46	tr	0.0	tr	0	0	0	0	0	222

BEVERAGE PLANTS USED FOR ALKALOIDAL DRINKS

280. Cassine

Cassine, *Ilex vomitoria*, is a member of the holly family, Aquifoliaceae. It is a shrub or small tree of American origin growing along the coast from Virginia to Mexico. It was first reported in 1562 from Florida, where the natives used cassine for preparation of a beverage which they called *yaupon*, the black drink. This is prepared from the leaves and shoots which, after harvest, are dried in the sun or over an oven. The drink itself is prepared

similarly to tea, and like tea it contains caffeine, tannins and an essential oil. Cassine never became popular among the white settlers and today it is used almost exclusively as a stimulant, being added to some drinks of the cola type.



280. CASSINE or CASSENA or YAUPON (*Ilex vomitoria*)
(x0.5)

[191.] Cocoa

Cocoa, *Theobroma cacao*, has already been described as an oil plant, yielding cocoa butter which is used for the production of solid chocolate. It was used originally for the preparation of a nutritive beverage consumed by American Indians long before America was discovered. The drink was called *chocolatl* by the natives and was usually prepared from roasted seeds crushed together with maize and capsicum (red pepper). The Aztecs also used vanilla to flavour chocolate, and the Spanish colonizers found this more palatable than the other additives. The Spaniards built the first chocolate factories in Europe, where they prepared imported cocoa seeds flavoured with vanilla and sweetened with sugar.

The habit of drinking chocolate spread in the sixteenth century from Spain to France and Italy and then from France to Britain. The first record of drinking chocolate in England dates from 1650 and mentions the use of chocolate in Oxford. By 1657 the first cocoa house had been opened by a Frenchman in Bishopsgate Street in London. Chocolate drinking rapidly became fashionable but the first popular drink prepared from cocoa beans was cocoa, a defatted product of ground cocoa seeds. It was a Dutchman, van Houten, who in 1828 succeeded in extracting a large quantity of fat from cocoa seeds. Defatted cocoa powder contains only 25-6% fat, while the cured and dried nibs (broken parts of the cotyledons of the cocoa seeds) contain

57-3% fat. Despite the fact that cocoa powder is deprived of a large proportion of its fat, the drinks prepared from it are still enormously nutritive by comparison with other alkaloidal drinks. On the other hand, caffeine present in the fresh cotyledons amounts to 0.8% while in chocolate and cocoa drinks it is completely lost and only a reduced amount of theobromine remains. The theobromine content of cured and dried nibs is 1.7% and of cocoa powder 1.3%.

The flavour of cocoa develops during the fermentation of the seeds. After fermentation and drying the seeds are deprived of the testa (known as the shell) by the initial milling in which the germ, killed by curing, is also lost. The cotyledons broken into so-called nibs are thus the actual raw material from which cocoa and chocolate is derived.

Cocoa is also used for flavouring liqueurs, cakes, pastries, ice creams, etc. The original type of chocolate drink is nowadays substituted by a drink prepared from solid chocolate and the modern chocolate industry also produces powdered chocolate for drinking. Powdered, grated or melted chocolate is used for flavouring the same items as cocoa.

281. Coffee

The most important species of coffee plant in the family Rubiaceae is *Coffea arabica*. It is a shrub or small tree native to Abyssinia though the Arabs consider it to be a native of south Arabia: according to legend, coffee was discovered in the ninth century by an Arab goatherd by the name of Kaldi who noticed that some of his goats, after eating the leaves of a particular shrub, became more energetic than the rest of the flock which were feeding on other plants.

The part of the coffee plant from which the drink is produced is the seed, which develops within a drupe. The drupes have two stones, each containing a single seed. The drupes are oval, about 1.5 cm long and deep red when ripe. The exocarp surrounds a soft, yellow mesocarp and the endocarp is fibrous, forming the so-called parchment, a membranous structure which separately surrounds each of the seeds. The seeds are greenish, ellipsoidal and flattened where they come in contact with each other; on this flattened surface a deep groove occurs. The whole seed is covered by a silver skin which is known as the silvery testa. Exceptionally, only one seed is present in the drupe. This happens in the variety *monosperma* owing to abortion of one of the ovules. The single seed is round, since it has more room for symmetrical development, and it is therefore known as pea-berry. The embryo of the coffee plant is very small and covered by a thick, hard endosperm which stores food mainly in the form of hemicellulose like the endosperm of the date seed.

It seems that the use of coffee as a beverage originated in Arab countries as

late as the fifteenth century and that it spread rapidly through the Arab world during the sixteenth century. Coffee as a drink appeared first in Cairo in 1510 and it reached Constantinople in 1550. By the seventeenth century coffee drinking had spread over the whole of Europe; in 1615 it was taken to Italy, in 1644 to France, and the first coffee house was established in England (in Oxford) in the year 1650. As the commemorative plaque opposite Queen's College says: "Nearby stood the Angel Inn where one Jacob opened the first coffee house in England." Two years later, in 1652, a Levantine of Smyrna (Izmir), Pasqua Rose (Rosco), started to run a coffee house in St. Michael's Alley, London EC 3. By 1675 about 3000 coffee houses had been opened in London. In Abyssinia, its country of origin, coffee seeds have been used since time immemorial, but only as a masticatory.

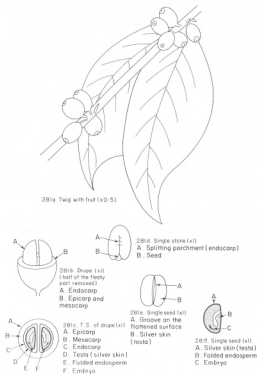
When the coffee habit first spread across Europe, coffee was imported solely from Mocha in the Yemen. However, the Dutch introduced the coffee plant into Ceylon in 1658 and into Java in 1699, where large plantations were soon established, and the Dutch dominated the coffee trade for about 100 years. Coffee was introduced into Brazil in 1727 but until 1800 none was exported from there. After that it took forty years for Brazil to become the largest producer and exporter of coffee in the world. Colombia first appeared among the leading coffee exporting countries in 1935 and today it is the second largest. Mexico and many of the small republics of Central America including El Salvador, Guatemala and Costa Rica are also important. The Dutch East Indies (Indonesia) were the largest pre-war suppliers of coffee in the Old World, while Ceylon ceased to be an important supplier towards the end of the nineteenth century when its coffee plantations were completely ruined by a parasitic fungus, the leaf rust *Hemileia vastatrix*. This rust first appeared in Ceylon in 1869 and as it spread, destroyed the plantations throughout the entire island. The cultivators did not risk replanting coffee and instead turned to the cultivation of tea. Thus Ceylon, originally a coffee-producing country, became the world's second largest producer of tea.

Africa, in spite of the fact that coffee is native there, produced only 1% of the total world supply until the outbreak of the First World War; but today it produces 20%. The Ivory Coast, Angola, Uganda and Abyssinia are the largest Africa coffee producers.

Ninety per cent of harvested coffee is derived from the species *Coffea arabica* which occurs in two varieties: *C. a. var. arabica* which was described by Linnaeus and *C. a. var. bourbon* which the French brought in 1718 to Réunion, an island in the Indian Ocean at that time known as Bourbon. From there it was introduced into the New World. In Brazil most coffee plants are of the cultivar 'Mundo Novo' which was developed there from a cross between *C. a. var. arabica* and *C. a. var. bourbon*. Peaberry coffee (*monosperma*) is a subvariety occurring in both varieties while Blue Mountain, a coffee well known in Britain, is a special kind of the variety *arabica* which was

developed and grows in Jamaica. Mocha coffee, which is appreciated as the best coffee of all, is the original variety, *C. a. var. arabica* produced in the Yemen in comparatively small quantities. It received its name from the port of Mocha in the Yemen from which it was originally exported.

Coffea canephora, previously called *C. robusta*, is another species of coffee plant. It is native to Uganda and most of its varieties are immune to *Hemileia vastatrix* as well as to other parasites. It yields about 9% of the total world production, and is cheaper than most other types, but its aromatic quality is

281. COFFEE (*Coffea arabica*)

of a lower grade. *Coffea canephora*, because of its cheapness, is used as the basis for coffee blends, especially in France where it forms more than 70% of the blends.

One per cent of the total world production is derived from the third economically important coffee species, *C. liberica*, native to Liberia which is also its largest producer.

Coffee drupes, after harvest, are either dried and then deprived of the pericarp and silvery testa, or are immediately pulped. Pulping consists of removal of the exocarp and most of the mesocarp, after which the stones, still paired, are placed into water, where the remaining mesocarp is destroyed by fermentation. The stones are then dried and after drying the fermented endocarp and most of the testa are removed. The fermentation occurring in both methods of treatment also improves both the quality and the appearance of the seeds. Most coffee is cured by the dry method but the better quality material is cured wet. The separated seeds, deprived of the testa, are exported and marketed. However, before coffee seeds are used they must be roasted and it is during this process that their aroma develops. The aroma depends on an essential oil called caffeol which is volatile and evaporates if roasted coffee beans are exposed to the air for any length of time. For this reason only freshly roasted coffee should be used for the preparation of the beverage. The stimulant agent of coffee is the alkaloid caffeine which is present in the seeds at an average concentration of 1.3%.

Although coffee is a tropical plant, it is mostly consumed in temperate regions. The largest importers are the U.S.A. followed by West Germany, France, Italy, Sweden, the Netherlands and Britain. The Latin nations seem to be the most fond of coffee and the French are proud of their 11,000 coffee houses in Paris.

Coffee is used mainly as a beverage but occasionally also as a flavouring for pastries, creams, ice creams, chocolate and liqueurs. The method of its preparation as a beverage depends on the local custom. The Arabs, Turks and Latin nations prefer black coffee prepared by boiling the roasted and powdered seeds in water (e.g. Turkish coffee) or by infusing the ground coffee (e.g. café filtré); in this way the aroma and flavour can be best appreciated. In Germany and the English-speaking countries milk or cream is often added to the coffee, or it is even boiled with milk instead of water. After the Second World War the use of instant coffee spread to those countries accustomed to drinking coffee mainly with milk. In this process the prepared beverage is dehydrated; caffeine is bound in the resulting powder but the volatile oil, and thus the aroma, was completely lost in the original type of processing. More recently, the production of instant coffee has been somewhat improved so that it has some degree of aroma. However, instant coffee does tend to be made mainly from cheaper kinds of coffee beans, those of *C. canephora*.

282. Coffee Substitutes

The high price of coffee led to the discovery of many of its substitutes. In Arab countries the fleshy part of the coffee drupes is often used in place of the seeds. This contains 12-18% sugar and 0.75% caffeine, making it the only coffee substitute which contains a stimulant. The drupes without the seeds are roasted like true coffee and the infusion that is obtained is called *sakka* or *sultan coffee*.

In Europe, the most commonly used substitute for coffee is chicory (*Cichorium intybus*, a member of the family Compositae). The part used is its fleshy taproot which is brown externally but yellowish-white within. Like many members of the Compositae, it contains inulin instead of starch, but the reason it was chosen as a coffee substitute was its bitterness.

Chicory is cultivated in fields and harvested when the taproot is properly developed. After harvest the fleshy root is ground and roasted and is then ready for preparation of a coffee-like drink. It was introduced as a coffee substitute during the eighteenth century. Up until the Second World War it was produced on a large scale in continental Europe but it was never cultivated in Britain, the small demand being satisfied by imported chicory. In Britain the use of chicory was originally forbidden by a law passed in 1832, but the law was repealed in 1840. Chicory may be used either alone or as an additive. In the latter, more common, case it adds body and colour to a drink that would otherwise only be slightly brown water owing to the small quantity of coffee used. The huge factories in Europe established for the production of chicory were brought to a standstill when the affluent society that developed after the Second World War was able to promote the drinking of pure coffee. Chicory almost died out as a coffee substitute and disappeared from the grocers' shops.

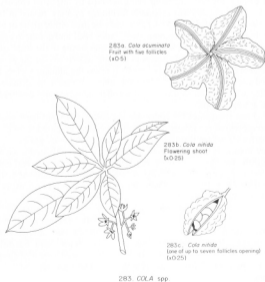
Other cheap substitutes for coffee are rye coffee, prepared from roasted grain (caryopses) of rye (*Secale cereale*); malt coffee, prepared from germinating barley (*Hordeum* spp.); and barley coffee from barley grains.

A more luxurious substitute is *Ficus carica*, the fig, cultivated since 4000 B.C. in Egypt; the figs are roasted and ground for mixing with real coffee. The custom of mixing coffee with figs is usual in Austria and Bavaria, using figs imported from Italy and Dalmatia. However, figs are an expensive substitute and for this reason they are themselves adulterated.

Other materials used most commonly as admixtures with coffee are: pea (*Pisum sativum*); chickpea (*Cicer arietinum*); oats (*Avena sativa*); maize (*Zea mays*); carob (*Ceratonia siliqua*); and dates (*Phoenix dactylifera*), of which only the pulverized seeds are used. Sugar beet is also used, but only as an additive to chicory at a maximum of 25%. The roasted acorns of *Quercus* spp. (oaks) or roasted beechmast (*Fagus sylvatica*) may also be used in emergency.

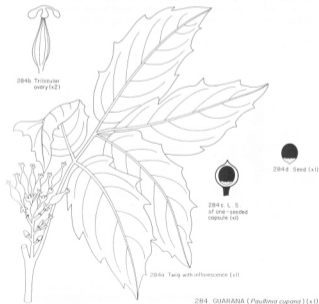
283. Cola

Cola species, belonging to the family Sterculiaceae, are tropical West African trees of which the fruits are aetarios of ovoid follicles each containing several seeds that are erroneously called nuts. In the best known species, *C. nitida*, the fruit is up to 12.5 cm long, up to 7.5 cm thick and contains 4–10 seeds per carpel. The seeds are used mainly as a masticatory but they are also used for the preparation of a drink. In the latter case the seeds are ground and the powder added to water and boiled. The exalbuminous seeds of *C. nitida* have two cotyledons while in other species 3–6 cotyledons occur. They are pink or red but *C. nitida* sometimes has white cotyledons. *C. nitida* is mainly cultivated in Nigeria and Ghana and it has also been introduced into India and some parts of tropical America; the large American producers are Jamaica and Brazil. The seeds contain about 2% of caffeine, a trace of theobromine and an essential oil, as well as a glucoside called colanin which is a heart stimulant. In the countries of Western civilization cola type drinks are really soft drinks rather than stimulant beverages.



284. Guarana

Guarana is a woody vine (liane) native to the Amazon basin. Its botanical name is *Paullinia cupana* and it is a member of the family Sapindaceae. The fruits are capsules, one-seeded owing to the abortion of the other two seeds. From the seeds a beverage is prepared which is up to three times stronger than coffee, in that the seeds of *Paullinia* contain up to 4–6% of caffeine. The seeds are flattened, globular, 1 cm in diameter, and surrounded at the base by a fleshy aril. They are dried, deprived of the aril and then ground. The ground material, mixed with cassava flour, is used for the production of a paste which is formed into sausage-like pieces and dried in smoke. These pieces, which are as hard as stone, are the actual material used for making guarana drinks, and have the advantage that they can be kept in this form for many years without deterioration. They are grated and then added to water, either boiling or cold. Guarana is drunk chiefly in the Mato Grosso region of Brazil where it is also cultivated. The cultivated form is a small shrub.



285. Khat

Khat, *Catha edulis*, is a native of East Africa and is a shrub belonging to the family Celastraceae. It was cultivated in Arab countries long before the introduction of coffee. Khat grows wild in Ethiopia but is also cultivated in other parts of north-east Africa. The shrubs resemble those of tea (287) and the leaves of khat are also used for the preparation of a beverage. Khat contains not caffeine but an alkaloid similar to it. The fresh or dried leaves are often used also as a masticatory.



285. KHAT (*Catha edulis*) (x0.25)
Flowering shoot

286. Maté

The most popular stimulant beverage of South America is maté, known also as *yerba maté* or Paraguaya tea. The plant from which it is prepared is a member of the genus *Ilex*, belonging to the holly family, Aquifoliaceae. Many



286a. Flowering shoot (x0.375)



286b. Bud
(x2.25)



286c. Flower
(x2)



286d. Fruit
(x0.5)

286. MATÉ (*Ilex paraguayensis*)

South American species of *Ilex* are used for the preparation of maté drinks but the most popular is the species *I. paraguayensis*. It is native to the mountainous areas of southern Brazil, Paraguay, Uruguay and northern Argentina and grows in the form of a shrub or small tree, being cultivated for domestic consumption as well as for export. Each second or third year, the young shoots are harvested and dried over a fire. The shoots are then beaten with sticks so that the leaves, which are up to 5 cm long with serrate margins, are separated for further drying in special ovens. Finally the dried leaves are crushed and are then ready to use for a beverage, which has stimulant properties because the leaves contain about 1% caffeine. Millions of South Americans prefer maté to coffee and its importance as an alkaloidal beverage is overshadowed only by coffee, tea and cocoa. It is prepared like tea and has a light green colour, a pleasant aroma and a slightly bitter taste. Sugar and lemon are often added to maté which is normally drunk from "cups" with a narrow opening by means of a long tube with a sieve at its distal end. This tube is given the name *bombilla* and is usually made either of metal (brass or silver) or of a plant stem. *Maté* in fact means a gourd, from the shell of which the *yerba* (herb) was originally drunk; alternatively a coconut shell or cow's horn may be used while more civilized people drink it from a metal container shaped like a gourd. Maté is consumed as such almost solely in South America, while in other countries it is used for addition to other flavoured drinks, giving them stimulant properties.

287. Tea

Tea is the most popular alkaloidal drink in Britain and many other English-speaking countries. It is obtained from the tea plant, *Camellia sinensis*, a member of the family Theaceae. Tea was introduced into Britain during the period when coffee drinking had already become fully established. However, during the eighteenth century Britain changed from a coffee-drinking to a tea-drinking nation because the British East India Company had an almost complete monopoly on the tea trade. This monopoly also explains why other European countries remained coffee drinkers; they were reluctant to buy tea from a foreign company and hence to swell the profits and power of Britain. The British East India Company thus only found a trade outlet at home and in the West it was only the English who became tea drinkers.

Tea was first brought to Europe by the Dutch in 1610 and in Britain it was first served almost fifty years later (1657) in the city of London, in a coffee house owned by Thomas Garraway and situated in Exchange Alley.

If the history of tea drinking in Europe is comparatively short, it is a great deal longer in the Far East, and in China it began long before the Christian era. It is believed that tea drinking was already widespread in China during

the rule of the Emperor Shen-nung (2737–2697 B.C.). However, the first authentic record of it is by Lo-yu who wrote about its production in A.D. 780. From China, where tea is called TE, CHAI or CHA, according to the dialect, the custom of drinking it spread to Japan, apparently in A.D. 552, and it also spread from China into the other eastern Asiatic nations including Mongolia; the Mongols later acquainted the Russians with tea during the build-up of the Russian Empire. Like the English-speaking people, the Russians became a tea-drinking nation but they were supplied with tea from China overland by Mongolian caravans. Tea brought by land to Europe was known as Russian tea and was of a better quality than that imported by ship because it was free from the flavour of sea water or of other materials carried in the cargo. However, tea carried by the caravans ceased to have this advantage when proper packing in aluminium foil was introduced.

The habit of tea drinking in North America has an interesting history. The English settlers in America introduced the custom, but, when the government began to tax tea heavily, they revolted and seized the newly arrived shipment from China, throwing it into the water of Boston harbour. Such was the fate of 342 chests of tea worth £10,000. This event, known as the "Boston Tea Party", happened on 16th December, 1773, and sparked off the War of Independence. The free American nation that was created was obviously prejudiced against tea and rejected it largely for political reasons. The U.S.A. has never really become a tea-drinking nation again and even now tea has to compete hard against coffee for popularity.

The tea plant, *Camellia sinensis*, occurs in two varieties, var. *sinensis* and var. *assamica*. It appears that the tea plants growing wild in China, Indochina, Burma and Assam are probably mere escapes from cultivation of var. *sinensis* (China tea). This variety was originally introduced by the white man to India and Indonesia. However, the cultivation of tea in these colonies did not start on a commercial scale until the introduction of the variety *assamica* in the nineteenth century. This variety was found wild in Assam, and was also introduced into Russia where the tea plantations of Transcaucasia had already begun in 1846. For many years, up to 1895, these plantations had no economic importance, but today Russia has become quite a large producer of tea.

According to statistics, most tea is produced by India, Ceylon, China, Indonesia, Japan, the Philippines and Formosa (Taiwan). It is also cultivated in Africa and America, but there the tea plantations are limited to very small areas. India and Ceylon, the largest tea producers, are also the main exporters of it to Britain.

The botanical synonyms for the officially accepted name *Camellia sinensis* are *Thea sinensis*, *Thea bohea*, *Thea viridis*, *Camellia thea* and *Camellia theifera*. The generic name *Camellia* is derived from the name of a Moravian Jesuit, Kamel, a missionary in the Philippines who described many cast

Asiatic plants. The common names in English (TEA), French (THÉ) and German (TEE) are derived from the Chinese name TE. The Russians, on the other hand, took over the other Chinese word, CHAI, as did other Slavonic nations, and also Turkey and Greece. The exception is in Polish, in which the name HERBATA is derived from "herb".

Tea as a drink is made from the young leaves of the tea plant which is either a shrub or a small tree, in extreme cases reaching 17 m in height. Harvesting of tea involves plucking, i.e. picking, the tips of the shoots. For a good quality tea only the tips of the shoot, consisting of a bud and two leaves, are plucked.



287. TEA (*Camellia sinensis*) (x0.25)
Flowering twig

The type of tea known as Golden Tips consists only of buds, while tea containing the youngest leaves is known as Orange Pekoe. Pekoe tea is produced from second leaves, while the third leaves are used for Pekoe-Souchong tea and the fourth leaves for Souchong tea. Sometimes even the fifth leaves are used for a tea known as Congou. The shoots are first plucked when the tree (or shrub) is 5 years old. Harvest may take place 25–30 times during the year, as happens in Ceylon where growth is continuous. The leaves of *Camellia sinensis* are elliptical, acuminate, and have a thickened short petiole and a slightly hairy abaxial surface. When mature, the leaves are up to 30 cm long, leathery, bright green and their margins are partly dentate. The leaves and buds are normally picked off from the plucked shoots and exposed to the sun or heated for a few hours in drums. Next the fleshy leaves are rolled; the rolled leaves can then be dried, yielding the green tea popular mainly in northern

China. Alternatively the dried leaves are processed further to yield black tea, preferred in southern China and by the European nations. In the latter case, the rolled leaves are left covered and kept warm, facilitating a process of fermentation which changes both the colour and flavour of the leaves. Fermentation is prevented in the production of green tea by rapid drying. Oolong tea is a type which is only partially fermented; it has the colour of green tea but the taste of the black type. Oolong tea is produced almost entirely in Formosa (Taiwan). Japan produces mainly green tea, India and Ceylon black tea, while in China both black and green are produced. The Russians are accustomed to drinking black tea which must for the most part still be imported. Chinese tea exported from China to Russia as well as to Mongolia and Tibet was largely the so-called brick tea, an inferior form consisting of bits of leaves and stems pressed together into a brick after addition of rice flour. The grading of tea mentioned above (Golden Tips, Orange Pekoe, Pekoe, etc.) is used only for black tea, while green tea is graded into Young Hyson, Hyson No. 1 and No. 2, Gunpowder, Twankay, Fannings and Dust.

Tea is sometimes scented by the addition of dried flowers, e.g. the blossoms of jasmine (see Flavours (274)—Tea-scenting flowers). The preparation of the drink from dried tea leaves differs from one country to another: in Britain fresh milk is added to a strong extract of black tea and the drink is often sweetened. In Russia black tea is usually sweetened with sugar or honey, and lemon juice may be added to it. Green tea is neither sweetened nor flavoured and milk is not added to tea in any of the Asiatic countries, but in Tibet it is "flavoured" with rancid butter. On the European continent, except in Russia, tea is not a very popular drink. It is consumed mainly in winter or during illness. Moreover, it is preferred mixed with a strong distillate, such as rum, cognac or whisky.

Tea is a stimulant beverage because its leaves are rich in caffeine. The dry leaves contain 2.5–4.5% caffeine and 25% of polyphenols wrongly referred to as tannins. These are rendered insoluble by the addition of milk, and so are the essential oils and other substances responsible for the aroma and flavour.

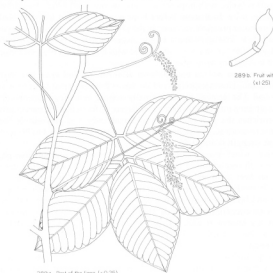
288. Tea Substitutes

There are many tea substitutes but, except for the "tea" prepared from coffee leaves (*Coffea arabica*), none of them contains alkaloids. The most closely related tea substitute is *Camellia japonica* which is cultivated in Europe as an ornamental (and expensive) plant. The leaves are used like tea leaves, as are the leaves of the orchid *Angraecum fragrans* which yields the infusion called FAHAM or BOURBON TEA. These are the exotic substitutes for tea, while the others are mainly the leaves of the commonest European plants. Examples include: leaves of bilberry (*Vaccinium myrtillus*); blackberry (*Rubus fruticosus*);

cranberry (*Vaccinium vitis-idaea*); morello cherry (*Prunus cerasus*); mulberry (*Morus alba*); peppermint (*Mentha piperata*); raspberry (*Rubus idaeus*); strawberry (*Fragaria vesca*); walnut (*Juglans regia*); and woodruff (*Asperula odorata*). Another example is the linden tree (*Tilia cordata*): linden tea is made from the inflorescences together with their bracts and peduncles.

289. Yoco

A species of the genus *Paullinia*, *P. yoco* (Sapindaceae) is used by the American Indians of southern Colombia and adjacent parts of Ecuador and Peru for the preparation of a drink containing caffeine. It is a liane native to those regions, and its bark (all the layers of the stem overlying the xylem) is scraped off and then extracted in cold water. The extracted material contains 3–6% caffeine, in comparison with 1.30% caffeine in coffee. The Indians are so dependent on the drink that they will abandon their settlement if they can find no more yoco lianes in the vicinity. *Paullinia yoco* is not cultivated.



289a. Part of the liane (x0.25)

289. YOCO (*Paullinia yoco*)

BEVERAGE PLANTS USED FOR FERMENTATION

A. CEREALS (beers, whiskies, gins, etc.)

[1.] Barley

Barley (*Hordeum vulgare*) is the main raw material for the production of beer. Caryopses are allowed to germinate, and when the germ reaches about one-third the length of the grain the germinating grain is dried; at this stage it is known as malt. The colour of malt is dependent on the heat applied and varies from light brown to black. The dried malt is then crushed or coarsely ground and mixed with water heated to a temperature of 170°F. The hot water extracts sugars from the malt and this sugary water (the wort) is drawn off. The wort is boiled with hops (or formerly wormwood) which are added for their bitter taste. In Britain, before hops were introduced from the Netherlands, no bitter principle was used in the production of beer and the beverage was called ale. The name beer was introduced into the English language from Dutch and signified that it was flavoured with hops, but in modern usage the name ale is synonymous with it.

The flavoured wort is cooled down after boiling and yeast is added for fermentation. This is a special kind known as Brewer's yeast (*Saccharomyces cerevisiae*). The fermentation is normally stopped before completion and the beer is strained into casks where some degree of fermentation may continue. This enriches the beer with carbon dioxide which is responsible for its foaming properties. The alcohol content of beer varies from 3 to 8% and the average strength is about 5%.

Barley "wine" was already drunk by the ancient Egyptians and papyrus dealing with regulations for beer shops date from 1300 B.C. Herodotus also mentions beer drinking in Egypt and Pliny speaks of it in Germany and Spain. In modern times the consumption of beer has spread with industrialization and beer is now drunk in ever increasing quantities even in the wine-producing countries like France, Italy, etc. The beers mostly consumed in Britain are known as ales, e.g. pale, bitter, light, Scotch and brown ales. Stouts are heavy beers, dark in colour because the barley is roasted or owing to the addition of caramelized sugar or liquorice. Porter is a weaker stout of poorer quality produced almost only in Ireland. It acquired its name from the fact that it was drunk mainly by porters. Lagers are beers that are aged for several months before they are ready for consumption. The best lager is Pilsner, brewed in Pilsen in Bohemia, a very pale beer made from very lightly

dried malt, while before the Second World War Munich beers were considered to be the best dark lagers. Today the production of dark Munich beer has completely ceased and the famous Munich breweries produce only pale lagers. The largest producers of beer are the U.S.A. and West Germany, followed by Britain.

Fermented barley malt is also used for distillation to produce the world-famous Scotch whisky. Whisky may be used as the basis for liqueurs and the best known of these is the Scottish Drambuie. Whisky is a distillate which originated in Ireland in the twelfth century A.D. and its production began in Scotland in the fifteenth century. However, the name whisky (or whiskey), derived from the Gaelic *uisge beatha* meaning "water of life", was first used for Scotch whisky at the beginning of the seventeenth century. Its alcohol content varies from 45% to 55%.

Barley malt is, furthermore, a source of malt vinegar which in Europe is used only in Britain.

[2.] Maize

Maize (*Zea mays*) may only be used in beer production if its caryopses are deprived of fat. Occasionally the defatted grain is added to malt for brewing purposes, as are some other cereals, but as a beverage plant maize is used mainly for the distillation of whisky, in which case up to 51% of maize is added to barley malt. Maize is used for this purpose mainly in the U.S.A. and the whisky produced known as Bourbon whisky because it was at first produced only in Bourbon County in Kentucky. Before the discovery of America, maize was used by the Incas for the production of a beer called *chicha* and this drink is still popular in Andean and Central American countries. Since ancient times the maize grains have been chewed so that the saliva initiates hydrolysis of the starch into sugars, and the mash is then fermented. Chicha, which has a brown appearance, is often quite a strong drink and is kept in huge ceramic jars buried in the ground.

[7.] Millet, Proso

Proso millet (*Panicum miliaceum*) was probably used for brewing beer before barley and other cereals. It is still used for this purpose in India and Africa.

[8.] Oat

Oat (*Avena sativa*) is very seldom used as a beverage plant, but it is occasionally added to barley malt during the brewing of stout.

[9.] Rice

Rice (*Oryza sativa*) is used in the Far East for the production of sake, a drink containing up to 18% alcohol. It is a popular Japanese and Chinese beverage but is little known in the West. Sake is spoken of as a wine because of its high alcohol content but it should, strictly speaking, be considered as a beer since it is prepared by the fermentation of a cereal.

[10.] Rye

Rye (*Secale cereale*) can be used either in the malted or in the unmalted state for beer production, being added to barley malt, but it is chiefly used for distillation. Rye distillates are popular in many countries, both pure distillates and those that are flavoured during distillation. Rye, alone or mixed with barley malt, is also used for the production of gins flavoured with the "berries" of juniper. Gin was invented in the Netherlands where it is called *genever*, or *Schiedan*, after the town that was its main centre of production. Rye distillates also form the basis for good aquavits. Aquavit was originally produced in Denmark and is flavoured with cinnamon, coriander, caraway, dill seeds, fennel and lemon rind. At one time vodka was also derived from rye but today it is produced from potatoes; it consists of absolute alcohol diluted with water. For this reason vodka can be drunk immediately after distillation and is always colourless like water. In contrast, other distillates such as whisky and brandy are brownish because they are left to age in wooden vats for some years; however, the addition of caramel is often used to impart the yellow-brown colouring.

[11.] Sorghum

The grain of sorghum is sometimes used for brewing beer, and the varieties with brown to purple colouring are mainly used for this purpose. Their use is widespread in Africa, especially in Tanzania, central Africa and South Africa. The alcohol content varies from 2 to 4% but often much stronger beers are brewed (up to 10% alcohol).

[12.] Wheat

Wheat species (*Triticum* spp.) are less used for the preparation of alcoholic beverages, but in America wheat is added to barley malt for the distillation of whisky. Wheat is sometimes also added in small quantities to barley malt for

the production of beer. It is only in the production of a German beer (so-called *Weissbier*, brewed mainly in Berlin) that a large proportion of wheat, up to 75%, is used. In Belgium some beers are produced from the fermentation of half wheat, half barley. The best of these are Gueuze and Lambic.

B. PSEUDO-CEREALS**[16.] Quinoa**

Quinoa or *Chenopodium quinoa* is used like maize for making chicha beer. Chicha is also made in the Orinoco region from the leaves of the plant *Bignonia chica*.

C. FRUITS (wines and brandies)**[121.] Apple**

The apple wine known as cider is produced from the fermented juice of apples (*Malus sylvestris*). Cider has an alcohol content of 3.5-7.5% and the best type is produced in Normandy (France). Cider was, however, already produced by the Ancient Romans and an apple or pear wine was also mentioned by Pliny. Palladius (fourth century A.D.), in his "de re rusticana", calls apple wine *sicera* (cider) and pear wine *piracium*. Thus the term cider should be used only for apple wine, while the proper name for pear wine is perry. Calvados is a distillate from apple wine, an excellent brandy from Normandy famous throughout the world.

Apples used for the production of cider are divided into three groups which determine the fundamental qualities of the cider. Sweet cider is made from sweet apples such as 'Sweet Alford', while dry cider is made from sharp apples with plenty of acid, e.g. 'Kingston Black'. Bittersweet cider, of an intermediate quality, is produced from apples such as 'Dabignet' and 'Knotted Kernel'. The apples used for making cider are inferior to dessert apples.

[122.] Apricot

Apricot (*Prunus armeniaca*) is used for the distillation of apricot brandy, a drink popular mainly in Hungary where it is called *barack pálinka*. The centre of *barack* production is Keszketem in southern Hungary.

[132.] Cherry, Sour

Cherries (*Prunus* spp.) are used for producing a brandy called *Kirsch* or *Kirschwasser*. Kirsch is produced mainly in Alsace and Lorraine. Cherry brandy is not a brandy at all, but a liqueur which the French call *griotte* produced from sour cherries.

[141.] Grape

True wines are derived from the juice of grapes (the fruit of *Vitis vinifera*). The grapes are fermented by *Saccharomyces cerevisiae* var. *ellipsoideus*, which does not need to be added to the juice because it is always present adhering to the skin of the grapes. Wines are distinguished by their colour as white, red, rosé, pellure d'oignon, golden yellow, green and black. White wines are derived from both white and red grapes, but if red ones are used, the juice must be deprived of the pigmented skin by straining during fermentation. The best dry white wines (hocks) are produced in Germany from the grapes of the Rhineland vineyards. Good dry white wines are also yielded by the vineyards in the valleys of the Moselle, Neckar and Main. In France dry white wines are produced in Alsace and the best white Burgundy is Chablis. Sweet white wines of French origin are produced chiefly in the region around Bordeaux, e.g. Graves and Haute Sauternes. Sweet wines, white or red, are those in which not all the sugar has been fermented. The degree of sweetness varies, and a white wine that was perhaps the sweetest and best was produced until the outbreak of the Second World War in Hungary, in the hilly district of Tokay. It was made from specially selected over-ripe grapes called *Trockenbeeren*, which were infected with grey mould. The juice expressed from these grapes solely by their own weight was the basis for the *eszencia*, otherwise called Hungarian Imperial Tokay, which had a golden-yellow colour and during the Austro-Hungarian monarchy was reserved exclusively for the Imperial Court; hence the name. An excellent but less expensive sweet wine is Tokay aszu, produced only partly from *Trockenbeeren*. In this case, crushed *Trockenbeeren* are added to a cask containing 136–140 l of ordinary most or wine in quantities of 2, 3, 4 or 5 puttonyos (one puttonyos contains 12–15 kg of *Trockenbeeren*). The sweetness of Tokay aszu depends on the quantity of *Trockenbeeren* added to the cask: 2 puttonyos of *Trockenbeeren* gives the least sweet wine, while the sweetest results from the addition of 5 puttonyos. The ordinary Tokay wine is called Tokay szamorodni and is derived from grapes poor in *Trockenbeeren* or even completely devoid of them. Tokay szamorodni may be sweet or dry. In Italy, the district of Orvieto produces a high quality semi-sweet white wine called Orvieto abbato. Orvieto secco is a good dry white wine, as are Frascati (from the neighbourhood of Rome) and Lacrimae Christi (from the vineyards on the slopes of the volcano Vesuvius).

The best available dry red wines come from Burgundy. As is the case for all red wines, the red colour is derived from the pigment of the skins of black grapes which are not removed from the juice during fermentation. The particularly famous vineyard area of Burgundy is Côte d'Or which produces the world's greatest wines. These are named after the settlements in the vicinity of the vineyards: Pommard, Beaune, Volnay, Vospe-Romanée, Nuits St. George, etc. Beaujolais is a red wine of less excellent quality but is nevertheless famous; it is the product of the vineyards of the Beaujolais region in the Saône valley, north of Lyon, and the most renowned Beaujolais wine is Moulin de Vent. In addition, some of the red wines produced on the slopes bordering the valley of the Rhône (Côte du Rhône) are of top quality, e.g. Chateaufort du Pape, named after the town near Avignon. In Britain the most popular of the French red wines are those from the vicinity of Bordeaux known in English as clarets. The best clarets come from St. Julien, St. Emilion, Moulis, Pauliac, etc. in the Médoc region and are called after the chateaux: Latour, Chateau Mouton-Rothschild, etc. Italy does not produce any really high quality red wines, but among the best may be mentioned Chianti from Tuscany.

Rosé wines, of a pink colour, are produced in such a way that the red skin of the grapes is left in the fermenting juice for only a limited time. The best known rosé wines come from Tavel, Bandol and Anjou. The type of wine known as pellure d'oignon, however, is produced mainly in French Jura in the vicinity of Arbois. As its name suggests, it has the colour of the tunic of the onion bulb. It is not a rosé but a red wine which gradually turns tawny. Green wine is white wine with a greenish tint, known in Portugal as *vinho verde*. Very dark red wines, e.g. the Italian *vino nero*, are called black wines. Green, pellure d'oignon, black and rosé wines are not greatly esteemed by connoisseurs.

Grapes were brought to the transalpine countries by the Romans and today these countries produce the best wines in the world, despite the fact that the vineyards of Burgundy and the Rhine are covered with snow in winter. The countries of the Mediterranean region, on the other hand, where the cultivation of vines began, nowadays yield comparatively poor wines. In Europe, wines are produced in all countries except the most northerly parts of France, Belgium, the Netherlands, northern Germany, Denmark, Poland, Norway, Sweden, Finland, the Baltic states, White Russia and the U.S.S.R. which produces wine only on the southern borders, mainly in the Crimea. In Britain, also, grapes are hardly grown at all and it was recorded by the Roman historian Tacitus (A.D. 55–120) that grapes would not ripen there because of the rough climate. However, not long after the death of Tacitus grapevines were grown and harvested in England, as is proved by the edict of the Emperor Probus who in A.D. 280 relaxed the protection of imported wines, allowing the cultivation of grapevines in England, perhaps to give attractive occupation to the allied garrison. During the whole of the Middle

Ages wine was produced in England, although towards the last centuries of the medieval era most of the wine that was consumed was imported because the cultivation of vines in England remained scanty and economically unviable.

Nevertheless, viticulture in England prospered to a limited extent until the twelfth century, when the most important centre was Gloucester, near the mouth of the river Severn. After this time it underwent an almost complete decline, owing to the occupation of south-western France by the British army which lasted 300 years, from 1154 until 1453, and brought under British rule the vineyards of the Bordeaux region where the famous and cheap wines were produced. The popularity of claret among the British people dates from this time.

The final blow to viticulture in England was the dissolution of the monasteries in 1536 when the monks, almost the sole remaining viticulturists, were deprived of their vineyards. Since then, grapes have been cultivated in England sporadically and more or less as a curiosity, and today they are grown for wine production only on a few acres of land. One such vineyard is in Essex and another in Hampshire.

According to statistics, in 1960 France was the largest producer of wine among the European countries and also among all the nations of the world: it yielded 6069.5 million litres of wine per year. France is followed by Italy (5525.2 million litres), Spain (1947.7 million litres), Algeria (1584.5 million litres), and fifth place is held by Argentina with a yearly production of 1362 million litres.

In 1880 the vineyards of France were almost completely destroyed by an insect pest called *Phylloxera*. Since that date, the American species of grapevine have been used as a stock, because they resist the parasite more effectively, and onto this is grafted the scion from the European grapevine. Thus the famous French vines were saved and the American species utilized at least as a stock, although the grapes that they yield are not good either for eating or for wine production.

The best known wines in France are derived from black grapes called *pinot noire* and *gamay*, while the varieties *pinot*, *pine* and *chardonnay* yield the best white grapes. These varieties are typical of Burgundy while the best from the Bordeaux region are *cabernet franc* and *malbec* (black), and *sauvignon* and *semillon* (white). Famous wines of other parts of France are derived from the following types of grapes: Roussillon wines from *grenache*, Alsace wines from *le burger blanc*, Loire wines from *l'altesse verte* and wines of the South of France from *le mourvedre*.

The alcoholic strength of true wines varies in general from 7% to 16%, but some wines are fortified with brandy and contain up to 20-22% alcohol, while ordinary table wines usually have no more than 10%. The well known fortified wines include Spanish sherry and Malaga, Portuguese Port from

the valley of the Douro, Madeira from the island of that name, Marsala from Sicily and the French and Italian Vermouths. Wines may also be enriched with carbon dioxide, but such wines are artificial sparkling wines, while natural sparkling wines are those which are bottled and corked before fermentation has ceased, so that carbon dioxide remains in them. Champagne wines are natural sparkling wines produced from grapes grown in France in the region between Reims and Epernay.

The true brandies are distillates from fermented grape juice and the best of these are Cognac and Armagnac. Cognac is produced only from grapes grown in the region around the town Cognac, north of Bordeaux. The Cognac region is subdivided into sub-regions according to the quality of the grapes, and the best cognac comes from the sub-regions La grande Champagne (or La fine Champagne) and La petite Champagne. The other regions are Les Borderies, Fins Bois, Bons Bois and Bois ordinaire. By law, cognac labelled V.O. (very old) or V.S.O.P. (very superior, old, pale) should be at least four years old, while the so-called Napoleon cognac has to be at least five years old. The industrial production of cognac began in the eighteenth century and was organized by foreign businessmen: in 1715 the Englishman Martell came to Cognac and in 1765 another English businessman, Hennessy, settled there. Armagnac is the fine brandy produced from grapes growing in the region Armagnac between the river Garonne and the Pyrenees. The French authorities strictly supervise the production of Cognac and Armagnac and do not permit brandy from grapes of any other origin to be sold under those names. Cognac and Armagnac have a high alcohol content, ranging up to 65%.

Brandy can also be produced from raisins (dried grapes) as in the preparation of the Turkish drink *raki*, which is perfumed with aniseed. A similar drink is called *ouzo* in Greece, *mastica* in Bulgaria, *arack* in Syria and the Lebanon, *zibil* in Egypt, but in Yugoslavia "rakija" has lost its original meaning and is the name for true brandy. Raki, ouzo, etc. become milky when they are mixed with water.

The residue of wine batches containing grape skins and stalks is often also distilled and this type of brandy is called in French *marc*.

Brandy is used for the preparation of liqueurs and fortified wines. Good liqueurs of French origin are based on Cognac or Armagnac, e.g. Grand Marnier, Benedictine, Chartreuse, etc.

It should finally be mentioned that wine may be used for the production of vinegar. The conversion is achieved by aerobic respiration of *Acetobacter aceti* which hydrolyses alcohol into acetic acid and water. Vinegar used in Britain is mainly produced from malt but other materials may also be used, e.g. cider, perry, honey, etc. Vinegar, however, is not a beverage but a condiment used for flavouring salads, sauces, meats and other foods. (See also p. 387).

[160.] Peach

Peaches, the fruits of *Prunus persica*, are also used for alcoholic beverages. Their juice is fermented and then distilled. In this way peach brandy is obtained. Alternatively, peaches are used as a flavouring for liqueurs known as *persico*.

[164.] Plum

The fermented juice from many kinds of plums is used for the distillation of plum brandy. The best known is derived from the variety *Prunus domestica* var. *oecconomica* and is known in German as *Zwetchken* or in Serbo-Croat as *slivj*. This brandy is marketed as *slivovitz* and is produced mainly in the countries of the former Austro-Hungarian monarchy.

Mirabelle brandy from Alsace is another popular plum brandy produced from the golden-yellow mirabelle plums.

D. SUGAR PLANTS**[200.] Sugar Beet**

Sugar beet (*Beta vulgaris* var. *altissima*), which yields sugar, may be considered indirectly as a beverage plant because alcohol may be obtained by distillation of any sugar solution. Pure sugar is often added to fruit juices before they are fermented. The reason why sugar is not used industrially as a source of alcohol is that pure alcohol can be obtained from much cheaper materials, e.g. potatoes.

[201.] Sugar Cane

Sugar cane (*Saccharum officinarum*) is a very important plant economically, for its function as a beverage plant as well as a sugar plant. The juice or molasses from sugar cane is fermented and then distilled, to produce rum with an alcohol content varying from 45 to 70%. Rum is a New World distillate and the best is produced in Cuba and Jamaica as well as in the French colonies of Martinique and Guadeloupe. A similar drink is also prepared from sugar cane in the Old World tropics, mainly in Indonesia, where it is called *arrack*. The name rum seems to be derived from *rumbullion*, probably meaning "big noise". It appears that rum was first documented in 1661 in an order issued by the Governor of Jamaica.

[203.] Sugar Palms

Sugar palms include the wild date palm (*Phoenix sylvestris*), palmyra palm (*Borassus flabellifer*), coconut palm (*Cocos nucifera*), toddy palm (*Caryota urens*) and gomuti palm (*Arenca pinnata*). They are also beverage palms because the juice tapped from the developing inflorescences is often fermented into a palm wine known as *toddy*. A distillate produced from toddy is called *arrack*. *Raphia vinifera* and the well known oil palm, *Elaeis guineensis*, also belong to the wine palms.

[204.] Nectar Plants

Nectar plants visited by bees supply the raw material for honey, which may be fermented like any other sugary or starchy material, and fermented honey was the first alcoholic drink of many nations. This drink is known as mead, a name derived from the Sanskrit *madhu*, meaning either honey or a sweet drink. The Scandinavians introduced mead to Britain and it was drunk there on special occasions, particularly at wedding festivities which might last for a whole month. For this reason the name honeymoon was given to the holiday that newly married couples spend together after the ceremony.

Mead was the most popular drink of the ancient Germanic and Slavonic nations (*Met* in German, *mede* in Dutch, *medovina* in Slavonic languages). Today, mead is produced by some Western countries but only in very small quantities, more or less as a curiosity, but in many parts of Africa it is still a popular drink, wine-like in nature.

E. STARCH PLANTS**[69.] Cassava**

Cassava (*Manihot esculenta*), a starch plant, is also used for the preparation of a fermented drink. The starchy juice expressed from the root tubers is fermented into a "wine" or "beer", or a strong alcoholic drink may be obtained by distillation of the fermented juice. Alternatively, the crushed or chewed roots, or special cakes made from the starch, may be used as the basis for fermentation.

F. VEGETABLES

[102.] Potato

Potato (*Solanum tuberosum*) is today the most important plant yielding alcohol for industrial as well as for consumption purposes. The starchy juice of potatoes (stem tubers) is fermented and then distilled until absolute alcohol is obtained. This is the cheapest kind of alcohol, in Europe at least, and it may be diluted with water and drunk as vodka or it may be used as a cheap method of producing fortified wines and liqueurs. Most of the cheaper alcoholic drinks are now prepared from potato alcohol, frequently by the cold method.

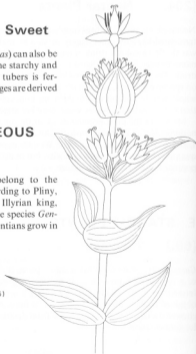
[103.] Potato, Sweet

Sweet potato (*Ipomoea batatas*) can also be used as a beverage plant. The starchy and sugary juice from the root tubers is fermented and alcoholic beverages are derived from it.

G. MISCELLANEOUS

290. Gentian

Gentians, *Gentiana* spp. belong to the family Gentianaceae. According to Pliny, they were named after an Illyrian king, Gentius, who introduced the species *Gentiana lutea* into medicine. Gentians grow in

290. GENTIAN (*Gentiana lutea*) (x0.5)

the mountain regions of the northern hemisphere and usually have blue or purple flowers, but the species *G. lutea*, a native of the southern and middle European mountains used for the production of alcoholic beverages, has yellow flowers. It is a giant species, 90–120 cm tall; its useful parts are the rhizome and its adventitious roots. The rhizome may weigh up to 25 kg and the roots developing from it are at least as thick as a finger, but in extreme cases they may reach the thickness of the human arm. Other species of gentian, *G. pannonica*, *punctata*, *purpurea* and *cruciata*, are also used for the preparation of gentian drinks.

The underground parts are dug out and a mash is prepared from them and then allowed to ferment. The fermentation is possible because the rhizome and roots contain a large quantity of the trisaccharide gentianose—7–15% fresh weight and up to 30% dry weight. Gentian distillates are produced mainly in the German-speaking alpine countries and German law only allows such distillates to be labelled as true gentian distillates or *Edelenzian* (*Enzian* is German for gentian) if they contain no alcohol from other vegetable sources. However, gentians are rare plants and would become extinct if they were used to excess in this way. Thus most of the Enzian drinks are only flavoured with gentian and their alcohol is derived from other sources. The taste of Enzian drinks is bitter, because gentians contain a bitter principle, a glucoside called gentiopicrin. A special alkaloid, gentianine, and also an essential oil, are also present.

291. Maguey

Maguey or *Agave* spp. belongs to the monocotyledonous family Amaryllidaceae, and a Mexican alcoholic drink called *pulque* is derived from it. Pulque is obtained from the sap of the developing flower stalk and this sap is known as *aguamiel*, meaning "honey water". An agave plant yields from 300 to 1000 l of aguamiel during its flowering period and then dies. Aguamiel, a

291. MAGUEY (*Agave attenuata*)
(leaves up to 3m long)

milky sap, is induced to ferment by a starter called *madre pulque* which is previously fermented sap. Pulque is a drink often containing only a small amount of alcohol, usually less than 1%, and in the event of drought is used as drinking water. However, it may also be as strong as beer, having about 5% alcohol and in this case is called *pulque fuerte*.

The sap of maguey may also be used to prepare a distillate called *tequila* or *mescal*. Tequila is the name of a Mexican town renowned for the production of the distillate, and only if it is actually produced there is it called tequila; otherwise the distillate is known as mescal. For its production it is customary to use an agave that starts flowering after 10–12 years, at which stage it develops in the midst of its leaves a structure similar to a pineapple, a heart full of sap. The hearts are cut out and sent to the factory where they are first steamed, causing most of the aguamiel to run off, and the rest is expressed by mechanical methods. This juice is then fermented and distilled.

Another Mexican distillate is *sotol*, which is derived from *Yucca* sp., a member of the monocotyledonous family Liliaceae and similar to agave.

Morphological Survey of Beverage Plants

(ALC (alcoholic beverage)—ALK (alkaloidal beverage)—COFSUB (usually non-alkaloidal substitute for coffee)—TESUB (mainly non-alkaloidal substitute for tea))

ROOT

- Root**
290. Gentian (ALC)
- Swollen taproot**
282. Chicory (COFSUB)
[200.], 282. Sugar beet (ALC, COFSUB)
- Root tuber**
[69.] Cassava (ALC)
[103.] Potato, Sweet (ALC)

STEM

- Stem**
[201.] Sugar cane (SUG, ALC)
- Stem tuber**
[102.] Potato (ALC)
- Rhizome**
290. Gentian (ALC)
- Bark of the stem**
289. Yoco (ALK)

LEAF

- whole leaf**
280. Cassine (ALK)
285. Khat (ALK)
286. Maté (ALK)
287. Tea (ALK)
288. Tea substitutes (TESUB)
Angraecum fragrans
Bilberry
Blackberry
Camellia japonica
Coffee
Morello cherry
Mulberry
Peppermint
Raspberry
Walnut
Woodruff

FLOWER

- Whole flower or inflorescence**
288. Tea substitute (TESUB):
Linden tree (Inflorescence with bract and peduncle)

FRUIT

- Simple**
DRY
Achenial
Caryopsis
[1.] Barley (ALC)
[2.] Maize (ALC)
[7.] Millet, Proso (ALC)
[8.] Oats (ALC)
[9.] Rice (ALC)
[10.] Rye (ALC)
[11.] Sorghum (ALC)
[12.] Wheat (ALC)
282. Coffee substitutes (COFSUB):
Barley
Maize
Oats
Rye
Wheat

Capsular

- Legume**
282. Coffee substitute (COFSUB):
Carob

SEED

- of a nut**
282. Acorn (COFSUB)
282. Beech (COFSUB)
- of a capsule**
284. Guarana (ALK)
- of a legume**
282. Pea, Chick (COFSUB)
282. Pea, Garden and Field (COFSUB)
- of a follicle**
283. Cola (ALK)
- of a berry**
[191.] Cocoa (ALK)
282. Date (COFSUB)
- of a drupe**
281. Coffee (ALK)

SAP

291. Maguey (ALC)
[203.] Sugar palms (ALC)

NECTAR

- [206.] Nectar plants (ALC)

IX. FUMITORIES AND MASTICATORIES

Plants yielding materials which are smoked and chewed, usually for their stimulative and narcotic effects, form the category of fumitories and masticatories. Some of them produce effects on the central nervous system, caused by alkaloids present in the plants, but there are other plant materials chewed and smoked that do not contain alkaloids. Examples include dried herbs smoked as tobacco substitutes during emergencies such as wartime or as a medicinal measure. In the case of masticatories, man chooses non-alkaloidal plant materials deliberately and not as a substitute. Chewing gum, for example, is derived from chicle, the latex of *Manilkara achras* and contains no alkaloids. The chewing gum itself is tasteless, but the flavours added by the manufacturers make it more attractive for chewing.

Plant materials may sometimes be used for smoking as well as chewing: tobacco leaves, may be used for either purpose, and although chewing tobacco is a somewhat outdated commodity it is still sold today.

Fumitories and masticatories often assume other uses as a result of their stimulative properties. For example coffee, in Abyssinia which is its area of origin, was first used as a masticatory and was later adopted by the Arabs as a beverage plant.

By definition, fumitories are inhaled in the form of smoke while masticatories are only chewed; however, masticatories are often finally swallowed instead of being spat out after chewing. This is the way in which the dried fungus *Amanita muscaria* is used: it is chewed until it becomes sufficiently soft and is then swallowed.

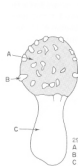
FUNGI (Macrofructifications)

292. Fly Agaric

Fly agaric, *Amanita muscaria*, is a poisonous fungus of the family Agaricaceae and is a native of temperate regions of the northern hemisphere. Its fructification is very attractive even though it is poisonous; the pileus (cap) is scarlet with white warts which are the remnants of the universal veil, and the gills and stipe (stem) with an annulus that is the remnant of the velum, a partial veil, are white. The specific epithet *muscaria* dates from the thirteenth century, when Albertus Magnus described its fructification and mentioned

that it kills flies. In remote villages fly agaric is used as a fly trap today, the most common way in which it is used being to slice the fungus and soak it in milk which the flies can take up.

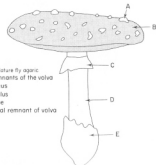
Fly agaric is used by Mongolian tribes in north-east Siberia (Samoyeds, Kamchadals, Ostyaks, etc.) as a masticatory, producing an effect similar to intoxication with alcohol. It affects the human nervous system by the action of two alkaloids called muscarine and mycoatropine, the latter alkaloid being similar to atropine. Fly agarics, usually dried, are chewed until they become soft and then are swallowed; two small fructifications are normally sufficient to cause severe intoxication lasting the whole day.



292a. Fructification with protruding pileus
A. Pileus
B. Remnants of volva
C. Stipe covered with volva



292b. Young fructification, L. S.
A. Universal veil or volva
B. Volva
C. Pileus
D. Gills
E. Stipe

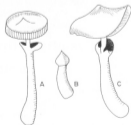


292c. Mature fly agaric
A. Remnants of the volva
B. Pileus
C. Annulus
D. Stipe
E. Basal remnant of volva

292. FLY AGARIC (*Amanita muscaria*) (x0.5)

293. *Psilocybe* and *Stropharia*

From ancient times up to the present day, American Indians have used certain of the Agaricaceae for intoxication in a similar way to that in which some Asiatic tribes use the fly agaric. This custom, associated with religious rites, was reported in the sixteenth century by the earliest explorers of America and evidence also comes from archaeological discoveries—ancient sculpture depicting fungi belonging to the genera *Psilocybe* and *Stropharia*. The many species used for intoxication include *P. mexicana*, *P. zapotecorum*, *P. aztecorum* and *S. cubensis*. In general they produce fructifications with a bell-like cap attached to a comparatively long, thin stipe. *P. mexicana* has a cap 12–20 mm in diameter and a stipe 8 cm long but only 1.0–1.5 mm thick. *P. zapotecorum*, on the other hand, is much larger: its cap reaches 4–11 cm in diameter while the stipe may be about 25 cm long and 8 mm thick.

293a. *Psilocybe zapotecorum* (x0.165)293b. *Psilocybe mexicana* (x0.5)293c. *Stropharia cubensis* (x0.165)
A, B, C. Mature fructifications
B. Young fructification293. *PSILOCYBE* and *STROPHARIA*

ANGIOSPERMAE

294. Betel Nut

Several hundred million of the inhabitants of Tanzania, India, Ceylon, Indonesia, Malaysia and Oceania chew betel "nuts", which are in fact the seeds of a palm, *Areca catechu*, a member of the family Palmae. This palm is native to Malaya but is cultivated everywhere in the tropics where the chewing of betel is customary.

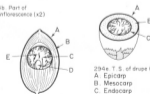
The palm produces an inflorescence consisting of a much-branched spadix that bears many more female than male flowers. The fruit is an ovoid drupe, up to 5 cm long and orange in colour when ripe. Its mesocarp is fibrous and its endocarp, forming the stone, is thin. The main stimulative alkaloid present in betel seeds is arecoline.



294a. Palm with inflorescence (2-15m tall)

294b. Part of the inflorescence (x2)

294c. Drupe (x0.5)

294d. T.S. of drupe (x0.5)
A. Epicarp
B. Mesocarp
C. Endocarp294e. L.S. of drupe (x0.5)
A. Epicarp
B. Fibrous mesocarp
C. Seed
D. Embryo
E. Ruminant endosperm294f. Betel nut (x0.5)
A. Epicarp
B. Seed
C. Ruminant endosperm294. BETEL NUT PALM (*Areca catechu*)

The seeds are used either half-ripe and cured, or fully ripe. Normally they are sliced and mixed with other materials for chewing, and the preparation may be very elaborate. Various spices, such as cinnamon, cloves, cardamom and nutmeg, are added to the sliced betel seeds and the whole is wrapped in a betel leaf smeared with lime. This leaf, however, is not a leaf of *Areca catechu* but of the betel pepper, *Piper betle* (Piperaceae), a perennial vine related to pepper (*P. nigrum*) and native to Malaysia. Sliced betel seeds may alternatively be mixed with tobacco before wrapping, or they may be wrapped in the betel pepper leaf without additives.



(294a) Female flowering twig (x10/17)

(294b) Female inflorescence (x1/5)

(294) BETEL PEPPER | *Piper betle* |

The chewing of betel seeds has a mildly stimulant effect and its most unpleasant results seem to be blackening of the teeth and red staining of the saliva. On the other hand, it sweetens the breath and for this reason betel is often chewed after meals as a breath deodorant.

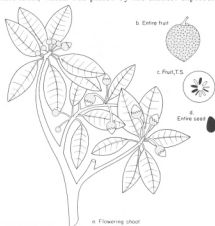
The use of betel as a masticatory dates from earliest antiquity and was first mentioned by Herodotus in 340 B.C.

[170.] Chiku or Sapotilla

Chiku, also frequently called sapotilla, is known botanically under the name of *Manilkara achras* (syn. *M. zapotilla*, *Zapotilla achras*). It belongs to the family Sapotaceae and is a tropical tree 20 m tall, native to Mexico and other parts of Central America. The main economic value of chiku is for its latex, called chicle and used for the production of chewing gum. The latex is collected by tapping the trunk of the tree, and contains 20–40% of a gutta-percha-like material. In the manufacture of chewing gum, the latex (chicle) is first boiled and evaporated. However, only about 15% of the chewing gum consists of chicle; the bulk of it is substituted by jelutong, the latex of *Dyera costulata*, a large Malayan tree formerly used as a substitute for rubber production. During the Second World War, when the import of jelutong latex from Malaya was cut off, chewing gum in the U.S.A. was mainly produced from the latex of *Gouma macrocarpa*, a tree native to the upper Amazon.

Chicle itself is supplied to the U.S.A., the largest producer and consumer of chewing gum, by Honduras, Guatemala and Mexico. In Mexico the use of chicle has a very long history and was already used as a masticatory by the Aztecs.

Chiku has economic value not only as a masticatory but also as a tree bearing edible fruit, which was prized by the earliest explorers of America

[170] CHIKU or SAPOTILLA (*Manilkara achras* or *Achras zapotilla*)

and considered as the best of all fruit. The Spaniards took it at an early date to the Philippines and from there it spread to Malaysia. The fruit of chiku measures 5-10 cm in diameter and is rusty brown in colour, but the flesh under the epidermis is yellowish-brown.

295. Coca

Coca, *Erythroxylum coca* (family Erythroxylaceae), is a shrub native to tropical and subtropical South America. It grows at high altitudes in the Andes while at the lower altitudes of the same regions another species, *E. novogranatense* thrives. This species is also known as coca and is used in the same way as *E. coca*. Both species have small ovoid leaves containing the

295. COCA (*Erythroxylum novogranatense*)
Flowering shoot (x0.5)



alkaloid cocaine at an average concentration of about 1%. The leaves are dried and chewed, together with unslaked lime and the alkaline ash of certain herbs, e.g. *Chenopodium quinoa* (Chenopodiaceae). The chewing of coca was at one time a royal privilege among the Incas but by the time America was discovered, the habit had already spread throughout the American Indian tribes inhabiting the area where coca was grown.

The largest producers of coca are Peru, Colombia, Bolivia and Argentina, but in the East, Ceylon and Java also contribute to trade in the leaves. In Western countries coca leaves are used for extraction of cocaine for medical purposes; in spite of the fact that coca was discovered by Pizarro as early as 1553 it was not until 1860 that cocaine was isolated from the leaves and its usefulness in medicine as a local anaesthetic was discovered as recently as 1884. Eye operations were only made possible as a result of this discovery.

Extracted cocaine is misused by addicts, who use it as a snuff in the form of a white crystalline powder.

[283.] Cola

The fleshy seeds from the follicle of *Cola* spp., mainly *C. nitida*, are normally used fresh as a masticatory. The plant, a tree reaching 20 m or more in height, belongs to the family Sterculiaceae which also includes the cocoa plant, *Theobroma cacao*. However, while the cocoa plant is native to the New World, cola is native to the continent of Africa.

The seeds, SEMEN COLAE, wrongly called nuts, contain up to 2.4% caffeine, a trace of theobromine and a glucoside, kolanin, which is a heart stimulant. All these substances are responsible for the stimulant effect of the chewed seeds.

Cola is mainly consumed in West Africa by the natives, even by the Moslems in the north of West Africa who import cola "nuts" from the southern rainforest regions.

Sometimes a beverage is prepared from cola seeds, in which case the seeds are dried and ground into a powder which is then boiled in water. In all cases, from the whole exalbuminous seed, only the cotyledons of the embryo are used.

296. Hemp

Hemp, *Cannabis sativa*, a native of central Asia, belongs to the family Cannabaceae and is cultivated mainly for its fibres which are used for textiles and ropes. However, it is also the source of a powerful drug, cannabinol, which is

usually derived from a special variety of hemp, *C. sativa* var. *indica*. In the Middle East the drug is called *hashish*, meaning in Arabic a dry herb. Modern European nations became acquainted with this drug from the Arabs and also took over the Arabic name. The English word "assassin" and its equivalent in medieval Latin, *assasimus*, is also derived from hashish (hashishiyy = hashish eater) and it was originally used by the Crusaders as a nickname for fanatical Moslem Arabs. Nevertheless, the Arabs were not the discoverers of hemp: this drug was known to the ancient Assyrians and later, but before the Arabs, it was mentioned by Herodotus. It seems to have come to the West from China where it was cultivated at least as early as 3000 B.C.

Hemp is a stout annual reaching 1-5 m in height and developing large palmate leaves. It is dioecious and the female inflorescences or infructescences, together with the top leaves (the flowering or fruiting shoots) yield the drug in the form of a resinous exudate. This exudate, containing several powerful alkaloids, was formerly harvested in a very primitive way: men ran through the hemp field and the resin stuck to their bodies or clothes from which it was then scraped off. This resin, when fresh, is a sticky greenish material but when dried it becomes solid and brittle. The dried and pulverized resin is known as *hashish* in the Middle East while in India, in the solid form, it is called *charaz* or *churuz*. Both hashish and charaz are fumitories.



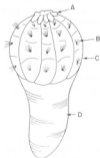
296. HEMP (*Cannabis sativa*) (x0.25)
Flowering top of a female plant

Another kind of hemp drug is obtained from male and female flowering shoots of wild green hemp boiled in milk or water, and the infusion is drunk (thus hemp is also a beverage plant). The young flowering shoots of the wild plant, or *bhanga*, are also smoked. Bhang as a fumitory is also used in Western countries but is known there by the name marijuana. A further kind of hemp drug is *ganja*, derived from a special kind of cultivated hemp; it is used both for smoking and for the preparation of a beverage.

The use of hashish and other strong hemp materials is addictive and causes severe physiological harm to addicts; even the use of milder narcotics derived from hemp, such as marijuana, is not without noxious effects. *Cannabis* induces hallucinations and a pleasurable state of mind, but because of its damaging effects on health its use is prohibited by law in most parts of the world. However, it is still smoked in Mongolia, India, the Middle East and North and East Africa, apart from its illegal use in Western countries. It is smuggled into the country or cultivated secretly and illicitly.

297. Peyote

Peyotes or mescal buttons are the shoots of *Lophophora williamsii*, a member of the family Cactaceae native to Mexico. The Aztecs called them *octli*. The major part of the cactus is an underground structure, a taproot similar to a large carrot, and only a short stem 4-5 cm high and 5-8 cm in diameter appears above the ground. The surface of the stem is divided into areas in the centre of which occurs an areola and from this arises a tuft of silky hair.



a. Entire plant
A. Blossom
B. Tufts of hairs
C. Stem
D. Taproot

297. PEYOTE (*Lophophora williamsii*) (x0.5)



b. View from above

Lophophora is without spines. On the depressed top of the stem a large areola or trances if the dried or fresh cactus is chewed or if a beverage, prepared simply by boiling the cactus in water, is drunk. Only the stem is used for intoxication. The Mexican Indians are very fond of it, but today the chewing and drinking of peyote has spread to the U.S.A. also. It is smuggled in from Mexico despite the fact that the cactus grows wild in the south-western parts of the United States.

[263.] Poppy

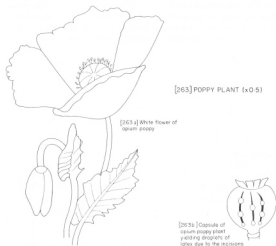
The poppy plant, *Papaver somniferum* (Papaveraceae) is probably a native of Asia Minor. It yields not only edible seeds and an oil expressed from them, but also a useful latex containing several alkaloids and known in the dried state as opium. The latex is harvested when the capsule has developed but is still green. Incisions are made into the capsules from which the white latex exudes; on exposure to the atmosphere this dries and is collected as opium.

Opium, the alcoholic solution of which was known from the sixteenth century as laudanum, contains 25 alkaloids, the most important of which are morphine and codeine. It contains 10-20% morphine and 0.3-4.0% codeine, both used in modern medicine. Narcotine constitutes 2-8% and thebaine 0.2-0.5%, while all other alkaloids appear in very small, almost trace, amounts and together form only 1% of the opium. These include papaverine, codamine, laudanine, narceine, cryptopine, protopine and neopine. When it is taken by addicts, opium is used mainly in the form of a powder, kneaded into a small ball which is then smoked in a special pipe. Opium smokers have pleasant dreams, falling into a trance, but their health is quickly and easily ruined by their addiction. Many millions of people, mainly Chinese, died from smoking opium imported to China by the Western powers, and when the Chinese authorities tried to stop the trade in opium, warships were sent to China to prevent the Chinese from interfering in any way with the trade into their own country. This led to the so-called Opium War, to the everlasting shame of the European allies.

In Western countries opium as such is not smoked but there are addicts to morphine which is extracted from opium. They use the liquid morphine for intramuscular injection. Another synthetic alkaloid based on morphine is heroin, or diamorphine hydrochloride, which is more powerful and also more dangerous than morphine. It is injected by addicts or taken as a snuff. However, its manufacture and import is forbidden in almost all countries. Only a small amount is allowed to be produced for scientific purposes and for

the production of nalorphine which counteracts the effects of excessive use of morphine, cocaine, metopone, etc.

Papaver somniferum is cultivated for opium mainly in India and East Asiatic states, but also in Turkey, Iran and some European countries including Yugoslavia, Greece and Bulgaria. The special variety cultivated for opium is derived from a cross between the white-flowered variety *P. s. var. album* and a violet-grey variety.



298. Tobacco

There are about 50 species of *Nicotiana*, the tobacco plant (Solanaceae), but only two of them, both native to America, are used as smoking materials.

Tobacco smoking was first observed among the American Indians by Columbus in 1492 and the earliest Spanish visitors to America described this habit as the inhalation of the burning herb through a forked stick. According to other records the American Indians smoked tobacco in the form of cigars, rough rolls of tobacco leaves. The genus *Nicotiana* is named after Jean Nicot, the French ambassador in Lisbon in about 1560, who introduced tobacco into France and the rest of Europe in the mistaken belief that it had medicinal qualities. He obtained the plants from sailors returning to Lisbon from America. The first tobacco plants reached Lisbon in 1558 and, despite Nicot's

efforts, tobacco began to be grown in Europe not for medicinal purposes but for smoking, and the craze for smoking tobacco had started by 1586. The use of tobacco as a fumitory and also as a snuff or a masticatory became the object of severe protests and punishments, and King James I himself wrote a pamphlet attacking its use, entitled "Contrablast to Tobacco" and published in 1604. Pope Urban VIII ordered the excommunication of all those who took tobacco snuff in church and the Greek church also completely forbade its use. The Russian Tsar, Michael I, even went so far as to order the execution of every smoker at the second offence. However, severe punishment could not prevent the use of tobacco. The habit of smoking spread continuously and the heavy taxes imposed on tobacco, after smoking ceased to be



296a. Portion of inflorescence (x0.5)



296b. Leaf (x0.165)
A. Winged petiole
B. Stem

punishable, were still less effective. Tobacco factories grew rapidly into a big industry and many colonies as well as some European countries soon based their economy on tobacco cultivation.

The species used for smoking, snuff or chewing are *Nicotiana tabacum* and *N. rustica*. The latter species was cultivated by American Indians, before the discovery of America, in Mexico and many parts of North America and the white settlers in North America took over its cultivation. Thus *N. rustica* was the first tobacco to reach British ports. Nowadays the smoking of this species is almost entirely restricted to some parts of India and possibly the Ukraine (Russia) where it was common at least until the end of the Tsarist regime. The Russian name for it is *makhorka*. *N. rustica* is also cultivated in Russia today as a source of the alkaloid nicotine which is used as an agricultural insecticide. It contains much more nicotine than *N. tabacum*, the cured leaves of some of its cultivated varieties having a concentration of up to 10%. In Western countries nicotine has largely been superseded by modern insecticides and *N. rustica* has almost completely lost its original importance. *N. rustica* has never been found in the wild state and is probably the result of a cross between *N. paniculata* and *N. undulata*. Both of these species still grow wild in Peru and it is probable that *N. rustica* originated there.

Nowadays *N. tabacum* is almost the only species of tobacco plant used for smoking. Its cured leaves contain only 1.5-4.0% of nicotine, which is the compound responsible for the stimulative effect of smoking, chewing and snuff-taking. This species, also, was cultivated by the American Indians long before Columbus arrived in America. Like *N. rustica* it is an annual herb native to America and it was cultivated in pre-Columbian times in the West Indies, Central America, Venezuela, the Guianas and Brazil. *N. tabacum* has never been found in the wild state and some reports to the contrary are erroneous. The errors are probably the result of mistaken identification as wild *N. tabacum* of escapes from cultivation.

Nicotiana tabacum is a stout annual or sometimes a limited perennial herb, 1-3 m tall. It has large leaves, the blades of which reach 50 cm in length and which are usually sessile. If they are petiolate, the petiole is generally winged. *N. tabacum* is cultivated all over the world where the conditions are suitable, and in the U.S.A. its cultivation quickly replaced the original plantations of *N. rustica*. The first plantations of *N. tabacum* were established in Virginia in 1612 and in Maryland in 1631. The Portuguese introduced it into India and China and up until the Second World War China was the world's largest producer. Today, however, the largest producer is the U.S.A., followed by China, India and Indonesia. In Africa the largest tobacco plantations are in Rhodesia, which, before its independence, was the largest exporter of tobacco to Britain. In Europe the most important tobacco producers are the Balkan states, including Turkey.

Tobacco is now almost entirely smoked, but in earlier times it was also often chewed and taken as snuff. As a fumitory, tobacco is used in the form of cigars, cigarettes and cuts for pipes. Cigarettes are the most popular whereas cigars lost some of their popularity during the First World War. Before that, the upper classes smoked cigars and cigarettes were popular among the workers. Cigars are still regarded in many countries as a luxury item.

Tobacco products are all derived from the leaves. At harvest the mature leaves start to change from green to yellow and must be cured by various methods. Flue-curing using heated air is the most modern and also the quickest method. The older methods were to allow the leaves to cure in barns (air curing) or over a smoky fire (fire curing), and sun curing is used mainly in the Middle East and Rhodesia. The type of tobacco depends very much on the method of curing. 75% of tobacco exported from the U.S.A. today is flue-cured.

After curing the leaves are stored in heaps and are left to ferment for 4-6 weeks. The curing and fermentation change the chemical composition of the leaves: the remaining chlorophyll disintegrates and the amount of nicotine which in fresh leaves is present in two forms, fixed and volatile, decreases as the volatile form is given off. Also, most of the proteins are lost. The typical aroma of tobacco is the result of these chemical changes.

Special types of tobacco are used for the production of cigars; there are three kinds known as fillers, binders and wrappers. Fillers are the leaves used for the core of the cigar, which is bound together by the binders, while the wrappers form the outermost layer. The best cigar tobaccos come from tobacco plants cultivated in Cuba. The various kinds of tobacco are usually blended and also flavoured, particularly in America. The commonest flavourings are liquorice paste, honey, sugar, molasses, rum and Tonka beans.

Since the times when smoking was discouraged in the belief that the Devil enters the person in the form of smoke, new objections have arisen against the practice. Up to the end of the Second World War the campaign against cigarettes was based on the assumption that nicotine is a danger to health, and to diminish this danger denicotinized cigarettes were produced. Recent evidence suggests that cigarettes are especially detrimental to our health because by smoking tobacco in this form we inhale a large amount of tar which, according to contemporary opinion, stimulates the development of lung cancer, bronchitis and heart disease. For this reason abstention from smoking is recommended, or at least changing from cigarettes to cigars from which the smoke is not inhaled, or to a pipe, which has a duct where the tar settles before it reaches the mouth and respiratory system.

Morphological Survey of Fumitories and Masticatories

FUNGI (Macrofructifications)

292. Fly agaric (MAST)
293. *Psilocybe* spp. (MAST)
293. *Stropharia* spp. (MAST)

ANGIOSPERMAE

Stem

Stem, entire

297. Peyote (MAST)

Leaf

Leaf, entire

294. Betel (*Piper betle*)
(MAST)
295. Coca (MAST)
298. Tobacco (FUM)

Fruit

of a follicle

283. Cola (MAST)

of a drupe

294. Betel (*Areca catechu*)
(MAST)

Latex

- [170.] Chiku (MAST)
[263.] Poppy (FUM)

Resin

296. Hemp (FUM, ALK)