

## 86. Kale and Collard

Kale, *Brassica oleracea* var. *acephala* (family Cruciferae), is very closely related to the cabbage, but instead of forming a compact head it is open-leaved and the leaves arise from a simple, erect, stout stem. Kale appears to be the oldest variety of *Brassica*, being the closest to wild cabbage and already known in Roman times. Cato (Marcus Porcius, 234–149 B.C.) described in his "De Agricultura" several types of kale.

The edible parts of kale are the leaves, which differ in size, shape and colour. Many forms of kale, usually those that most closely resemble the wild cabbage, are used for animal fodder, while others are cultivated for human consumption. The latter group are mainly kales with curled leaves, e.g. the cultivars 'Dwarf Curled Siberian' and 'Dwarf Green Scotch'. The dwarf forms are mostly preferred to the tall ones, but there are also some tall curled cultivars up to 2 m in height, and some branching cultivars the young shoots of which bear especially delicious leaves. The leaves are usually green, silver-green or purple.

There is a separate group of cultivars belonging to *B. o. var. acephala* that form a rosette of leaves similar to the cabbage but this rosette never develops into a compact head. In the U.S.A., where they are cultivated in the southern states, such cultivars are distinguished from the kales as COLLARDS, a corruption of the name colewort.

Kale, and particularly collard, is the hardiest variety of cultivated *Brassica* and can withstand not only frost but also a very warm climate.

## 87. Kohl-rabi

Kohl-rabi is a variety of cabbage botanically known as *Brassica oleracea* var. *gongylodes* or *caulorapa* (family Cruciferae). Kohl-rabi may have been known to the Romans, if this is the correct identification of the cabbage of Pompei described by



86. KALE (*Brassica oleracea* var. *acephala*) (x0.1)  
Entire aerial part of the plant

Pliny. It is first mentioned in the Middle Ages in the Capitulare de Villis of Charlemagne (about 794) and here kale (*caulos*) is distinguished from RAVACAULOS (*kohl-rabi*). *Rava* is the word for turnip (*B. rapa*), in French still called *rave*, while *caulos* or in Latin transcription *caulis* means cabbage and this has given rise to the archaic English name *cole* and the German name *Kohl*. Thus the German term *Kohl-rabi*, carried over into modern English, and appearing in German literature as late as 1678 in the form CAULERABI, actually means "cabbage turnip".

Kohl-rabi is cultivated for its edible storage organ, a swollen turnip-like short stem from which arise large leaves with petioles. The rind of the swollen stem, and the petioles with the midribs, are either greenish or purple, but the flesh of the swollen stem is always white. The colour of the rind does not affect the quality, but the purple kohl-rabi is harder than the greenish type. The leaves are not eaten, although they are fit for human consumption and have appreciable nutritive value. The tubers should be harvested when they reach 5–8 cm in diameter, because larger ones are mostly woody. The rind is removed and the white flesh is eaten either raw or sliced and cooked. Cooked kohl-rabi is generally served in place of cabbage. It is widely used in continental Europe, but in Britain and other English-speaking countries it is consumed only rarely. The best known cultivars are 'White Vienna', 'Green Vienna', 'Purple Vienna' and 'Early Erfurt'.

## 88. Leek

Leek—*Allium porrum* or *Allium ampeloprasum* var. *porrum*—is a perennial plant of the monocotyledonous family Liliaceae and has been cultivated



87. KOHL-RABI (*Brassica oleracea* var. *gongylodes*) (x0.5)  
A. Stem  
B. Remnants of leaves  
C. Root



88. LEEK (*Allium porrum*)  
Base of the leaf (x0.5)

since prehistoric times. It is probably native to the Mediterranean region, and was eaten by the Egyptians in the Pharaonic period as well as by the ancient Greeks and Romans. The leek was distributed by the Romans across Europe, and became the national plant of the Welsh people early in their history. Tradition has it that the Welshmen led by their king Cadwallader in A.D. 640 in a victory over the Saxons, adorned their hats with leeks grown in a nearby garden in order to distinguish themselves from the enemy warriors. As a result the leek was adopted by the Welsh as their national plant, but today it has been substituted by a more decorative plant—the flowering daffodil.

The edible part of the leek is formed by the fleshy bases of the broad, strap-like leaves; these form together into a cylinder in which the inner leaf bases become etiolated by lack of light. However, good quality leeks have to be blanched artificially, and for this purpose they are cultivated in trenches or furrows and the cylindrical leaf bases buried in the soil. Leek may be eaten raw, alone or mixed into salads, but more often it is boiled. It may be served like asparagus, and for this reason it is sometimes given the name "poor man's asparagus", since it is comparatively cheap. It is also used as a flavouring for soups and stews.

## 89. Lentil

Lentil or *Lens esculenta* (syn. *L. culmaris*) is a leguminous plant of the family Leguminosae. It is an erect annual, 25–40 cm tall and native to south-western Asia, from where it was introduced to the ancient Mediterranean civilizations. The edible part of the plant is the seed, which is normally brownish or greyish and about 6 mm in diameter. The seeds develop in one- or two-seeded pods, rarely longer than 1.3 cm, and they contain, next to soya beans, the highest percentage of protein of all vegetables (24.7%). The lens-like shape of the seeds is responsible for their name. Lentils used to be



89a. Pods, entire and L. S.  
(x1)

eaten in Roman Catholic countries chiefly during Lent (this word means lengthening of the day) when the consumption of meat was forbidden.

Lentils are used in numerous ways. Like other pulses, they are used for preparation of soups or as a vegetable, entire or split, alone or with meat. Flour is sometimes prepared from lentils, but usually is only used mixed with cereal flour. In some countries the whole young pods are eaten fresh.

Lentils are run on a particularly common pulse in India, the Middle East and most of the Eastern European countries. They have been introduced into tropical countries, where they thrive at high altitudes, e.g. in the Andes.

The cultivars of lentil belong to two varieties: *Lens esculenta* var. *macroserma* and *L. e.* var. *microserma*. The former has larger pods with larger seeds about 6–9 mm in diameter, while the latter variety has small seeds, about 3–6 mm in diameter, and small pods.

## 90. Lettuce

Lettuce or *Lactuca sativa* is a member of the family Compositae and its leaves form one of the commonest salad vegetables used in Western countries. *L. sativa* is a cultivated plant derived from the wild species, *L. scariola*, a biennial of uncertain origin. It may be native to Asia, Eurasia or the Mediterranean region. Lettuce has possibly been cultivated for several thousands of years, if we can believe that this is the plant depicted on the tombstones of ancient Egyptians dated at about 4500 B.C. The first written record is from 550 B.C. and tells that lettuce was served to the Persian King. Later it was cultivated by the Moors who developed many new



89b. Seed  
(x2)



89c. Seed, edge view (x2)  
A. Radicule  
B. Microcotyle  
C. Hilum

89. LENTIL (*Lens culmaris*)



90a. Normal varieties  
(x0.125)

90. LETTUCE (*Lactuca sativa*)

varieties, and in China it has been cultivated since the seventh century A.D. But the first description of lettuce which refers without any doubt to this plant occurs in European literature and is dated 1543.

Cultivated lettuce is an annual or biennial plant and its commonest cultivars belong to the variety *L. s. var. capitata* in which the rosette of leaves forms a rounded head, an enlarged main bud similar to cabbage. Such a type of lettuce is called CABBAGE or HEAD LETTUCE and is the most popular type. Lettuces forming oblong heads and called

COS or ROMAINE are botanically specified as *L. s. var. longifolia*. The cultivars of cos lettuce are distinguished according to their colour: they are either whitish or deep green. Another variety, *L. s. var. crispata*, is a heterogeneous group of

cultivars producing not a head, but only a loose rosette without a heart; one type of cultivar produces leaves on a stem up to 30 cm tall from which the leaves are successively cut off for use, and this is sometimes distinguished as a separate variety, *L. s. var. seculina*. The leaves of the variety *crispata* are sometimes extremely curled, and it is therefore given the commercial name of CURLED lettuce, or, because it does not produce heads, LEAF lettuce. Not all lettuces are cultivated for their leaves, and there is a variety, *L. s. var. asparagifolia*, in which the leaves are not palatable and only the fleshy stem is consumed. Such cultivars are known as STEM lettuces, but they are almost unknown in Western countries and their cultivation is in fact limited to China.

The name lettuce is derived from the French *laitue*, of which the root *lait* means milk; the etymology of the botanical name *Lactuca* is the same, being derived from the Latin name for milk, *lac*. The reason is that *Lactuca* spp. contain a milky fluid, latex, which is collected from the species *Lactuca virosa* and used in the dried state as a soporific drug known as *Lactucarium germaniflimum* or lettuce opium. Its soporific effect is due to the presence of triterpenoid alcohols.

Lettuce is used for salads, eaten raw either alone



90b variety COS ( $\times 0.15$ )

90 LETTUCE (*Lactuca sativa*)

or with various types of dressing. It is consumed as separate leaves or the main bud is cut into parts and served as single pieces. Its use as a salad vegetable has spread all over the world and many cultivars of both cabbage lettuce and cos thrive even in tropical regions. It is occasionally served cooked.

An apparently similar plant to lettuce, called CORN LETTUCE, is botanically a completely different plant. Its name is *Valerianella olitoria* (syn. *V. locusta*) and it is a member of the family Valerianaceae. It grows wild in Europe in fields but it is also cultivated and used as a substitute for true lettuce in winter and early spring. Its leaves are comparatively tough and much less palatable.

## 91. Lotus

The sacred lotus, *Nelumbo nucifera* or *Nelumbium nuciferum*, of India and China is an aquatic plant that bears its leaves and flower above the water. It belongs to the family Nymphaeaceae and has an edible rhizome which is eaten as a vegetable, either boiled or fried, and is even pickled. The fruit, an achene, is also used as a source of flour. The rhizomes are available in the U.S.A. where they are served in Chinese restaurants. Another lotus of the same family, the Egyptian lotus—*Nymphaea lotus*—has pink blossoms and floating leaves. Its rhizome is also eaten, as is that of *Nymphaea stellata*, a similar plant with blue flowers which grows in India. However, the rhizomes of the latter plant are generally eaten only in times of famine.

The name lotus is also given to a totally different plant in Greek mythology. This is the shrub *Ziziphus lotus* of the family Rhamnaceae, a native to the Mediterranean region, or its close relative *Ziziphus jujuba* which is a tree or shrub native to Asia and eaten in China (CHINESE DATE) but also naturalized along the Mediterranean coasts. Lotus bears small, deep yellow drupes borne in cymes.

91. LOTUS (*Nelumbo nucifera*)



91a. Aerial part of the plant ( $\times 0.05$ )



91b. Seed ( $\times 0.5$ )

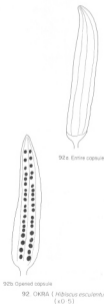
91c. Receptacle with developed seeds ( $\times 0.5$ )

They can be used for making bread or wine from the mealy flesh, but these products are of poor quality and were only considered as bread and drink fit for the poorest people. However, in ancient Greek literature, Homer's *Odyssey* mentioned lotus as an excellent food for the legendary lotophages, the Lotus Eaters. *Ziziphus lotus* is a fruit but according to its actual use it should be classified among pseudo-cereals and beverage plants.

## 92. Okra

Okra or GUMBO is known botanically as *Hibiscus esculentus* (family Malvaceae) and is native to tropical Africa. It is a stout annual herb cultivated for its capsules. The capsules are many-seeded, long, pyramidal, beaked structures arising in the axils of the leaves. They may be 10–30 cm long and 2–3 cm thick. When ripe, they dehisce longitudinally to release the dark green or dark brown seeds, which are spherical and tuberculate, measuring about 0.5 cm in diameter. However, it is the unripe green capsule, which is highly mucilaginous, that is consumed. The capsules may be eaten entire, either fresh or dried, but more frequently they are sliced and boiled or fried. The capsules are often used for the mucilage, as a thickening and flavouring agent for soups and sauces. The leaves of okra may also be consumed as a pot herb.

Okra is not mentioned in the ancient literature and it has been cultivated in Egypt only since the twelfth or thirteenth century A.D. It is now grown in all tropical regions and also in the warmer parts of the temperate zones, e.g. in the U.S.A., where okra has only recently become very popular, although it has been cultivated there since the eighteenth century.



92. OKRA (*Hibiscus esculentus*)  
(x0.5)

## 93. Olive

Olive, botanically *Olea europaea* (family Oleaceae), is a small tree native to the eastern part of the Mediterranean region. Olives were cultivated by the ancient Egyptians, Greeks, Romans and other Mediterranean nations for the oily drupes. The part used for human consumption is the fleshy mesocarp, from which is expressed an edible oil, or the fruit may be pickled and the mesocarp and ectocarp eaten. Olives for pickling are harvested either unripe, in which case they remain green, or ripe, when they are dark blue and turn black during the pickling. Pickled olives are used either as a condiment in various hors d'oeuvres and baked dishes, e.g. pizzas, or alone as a relish. Green olives used as a relish are often, after the removal of the stone, stuffed with nuts or spicy materials such as the sweet red pepper, Spanish capsicum.

It is permissible to list olives as vegetables because in countries where they are cultivated they are often consumed as part of a dish, in large quantities.

Green olives contain less oil than the ripe ones. The largest producing countries are Spain, Italy and Greece, followed by France and the formerly French colonies of North Africa.

## 94. Onion

Onion or *Allium cepa*, of the monocotyledonous family Liliaceae is native from Palestine to India. It was cultivated very early by the ancient Egyptians, and its use as a food plant can be traced as far back as 3000 B.C. It is also recorded by the Jews before their exile from Israel. The use of the onion was adopted by Europeans from the Eastern nations and its use persists to this day. There is now no Western civilization where it is not used, but in some cases it should properly be considered as a condiment rather than as a vegetable.

The edible part is the bulb, a shortened stem

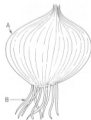


93a. A twig with fruits



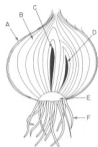
93b. L.S. of the fruit

93. OLIVE (*Olea europaea*) (x0.5)

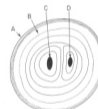


94a. Entire harvested onion bulb (x0.5)  
A. Coloured membranous scales  
B. Adventitious roots

94. ONIONS (*Allium cepa*, etc.)



94b L.S. of onion bulb (x0.5)  
A. Membranous scales  
B. Fleshy scales  
C. Main bud  
D. Lateral bud  
E. Stem  
F. Roots



94c T.S. of onion bulb (x0.5)  
A. Membranous scales  
B. Fleshy scales  
C. Main bud  
D. Lateral bud

94. ONIONS (*Allium cepa*, etc.)

bearing thick, fleshy, colourless leaves full of food reserves. The leaves are actually the thickened bases of the normal leaves from the previous season; the outermost leaf bases do not swell but form a covering for the fleshy inner ones, becoming dry, thin and coloured. The colour may be whitish, brownish, purplish or reddish, depending on the variety as well as on the size of the bulb. Intact onion is odourless but if it is cut it produces a distinctive odour and releases a lachrymatory substance. This substance is allicin, which is produced from *S*-allyl-L-cystein sulphoxide by the action of the enzyme allinase.

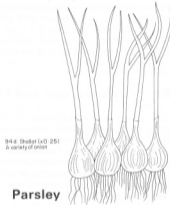
As a vegetable onion is consumed raw, stewed or fried. It is used similarly as a condiment and seldom is a meal or a soup prepared without it. Pickling onions are small ones artificially produced by planting them close together, i.e. by growing onion sets. Also used for pickling are the small bulbs called shallots and previously considered as a separate species, *A. ascalonicum*. However, it seems that shallot is merely a variety of *A. cepa* with its bulb multiplying freely and producing a cluster of bulbs; the tunic is brown like that of an ordinary onion. They are mainly a garden crop but are sometimes cultivated commercially for pickling.

The BUNCHING PEARL ONION, *A. ampeloprasum*, is cultivated in Germany and Italy for pickling; and the CHINESE ONION *A. chinense*, also forming clusters and used mainly for pickling, is known in Japan by the name RAKKYO and in China as CH'IAO T'OU.

Two varieties of *Allium cepa*, *A. c.* var. *proliferum* and *A. c.* var. *viviparum*, produce bulbils—small bulbs that develop instead of flowers in the inflorescence. The bulbils are used for vegetative reproduction.

Another species, *A. fistulosum*, is known as the WELSH ONION or CIBOULE. The name "Welsh" is in fact a corruption of its German name *welsche*, meaning foreign; it has nothing to do with Wales and is native to Siberia or the Far East. It is grown mainly in China and Japan; it was introduced into

England in 1629 but without much success. It does not form true bulbs but only an enlargement of the bases of its leaves. The name ciboule is derived from *cebula*, the Provençal name for onion which originated from the Latin diminutive for *cepa* (onion): *cepulla*. In many other languages, too, the name for onion is derived from the Latin. For example, in Italian it is called *cipollia*, in German *Zwiebel*; and even in Slavonic languages such as Polish (*cebula*) and Czech (*cibule*).



94d Shallot (x0.25)  
A variety of onion



94e Ciboule (*Allium fistulosum*) (x0.25)  
Plant with inflorescence



95. PARSLEY  
(*Petroselinum crispum*) (x0.5)  
Leaf only

## 95. Parsley

Parsley, a native of the southern part of Europe, is best known for the use of its green top as a flavouring and garnish. However, a special variety, *Petroselinum crispum* var. *tuberosum* (family Umbelliferae), is cultivated for its underground swollen whitish structure, which is derived mainly from the base of the taproot. This variety is called TURNIP-ROOTED PARSLEY or HAMBURG PARSLEY. Its origin is unknown but it seems likely that it was developed relatively recently in continental Europe, where it is consumed mainly in Germany and adjacent countries; it is not popular in Britain. Parsley root is used either as a flavouring or as a vegetable. In either case it is boiled and is never eaten raw.

## 96. Parsnip



Parsnip or *Pastinaca sativa* (family Umbelliferae) is a biennial native to Eurasia and it grows wild in most parts of Europe and in the Caucasus. It was known to the ancient Greeks and Romans but the fleshy forms used today were probably developed in the Middle Ages. It is grown as an annual, and before the introduction of the potato parsnip was a much more important vegetable than it is today. The swollen structure used for human consumption is mainly the base of the taproot and is, on average, about 15 cm long. Its colour is whitish or light brown. Only the "root" is used, either as a vegetable or as a flavouring material for soups, stews and sauces.

96. PARSNIP (*Pastinaca sativa*)  
Taproot only (xO 25)

## 97. Pea, Garden and Field

Pea is a leguminous annual climber, 30–150 cm tall, called *Pisum sativum* (family Leguminosae) and is native to the western parts of Asia. It occurs in two varieties: *P. s. var. arvense* (FIELD PEA) and *P. s. var. hortense* (GARDEN PEA). Both varieties are cultivated plants of which the wild ancestors are not known. It is doubtful whether the pea was known to the ancient Egyptians, as some authors claim, but it probably was cultivated by the Greeks and Romans. It became an important pulse in the Middle Ages but the first detailed description dates from the sixteenth century (France; 1536).

Until the sixteenth century only the ripe seeds were used. The pods in which the seeds occur are glabrous (hairless), straight or slightly curved, and they reach 4–15 cm in length and 1.5–2.5 cm in width. The pods (or legumes) open longitudinally along both sutures to release the seeds, which occur 2–10 per pod and are 8–10 mm in diameter. The flowers bear a distinct resemblance to butterflies and in the garden pea they are white, while in the field pea they are purple. The seeds of garden pea are yellowish or blue-green, wrinkled and richer



97a. Entire pod (x0 5)  
97 PE A (*Pisum* spp.)

in sugars, while seeds of field pea varieties are greyish and sometimes spotted, round and contain more starch. The dried seeds, like other pulses, are consumed boiled, and split peas (without the skin) are used for pease pudding.

Nowadays, however, dried peas are not so popular and unripe green seeds are used instead, boiled and served as a vegetable. The use of unripe peas was introduced into Europe in the sixteenth century and for a long time they were a luxurious, expensive delicacy; they were recorded as such for the Marquise de Maintenon (1635–1719), the second wife of Louis XIV, and even for the mistress of Louis XV, the Marquise de Pompadour (1721–1764). Today unripe green peas are eaten for preference, and apart from fresh peas which are marketed seasonally they are sold frozen or preserved in tins. In Britain they are preferred with a high sugar content and bright green in colour (in the preserved state this colour has to be achieved artificially), but elsewhere in Europe the so-called petits pois are preferred for preserving. This is not a special variety of garden pea, but is a culinary term for very young, immature garden peas. They are about 4 mm in diameter and lack the sugary taste and green artificial colour of English peas.

Very under-ripe peas where the pod is still flat may be eaten raw complete with the pod as a fruit, and the subvarieties eaten in this way are called sugar peas. Generally the stiff parchment membrane lining the inside of the pod and developing from the endocarp must be removed; but in one subvariety this stiff lining does not develop—this is called *P. s. var. hortense f. macrocarpon*.

The pea spread from Asia both westwards to Europe and eastwards to India, and via the Himalayas and Tibet to China. In the fourth or sixth century A.D. it spread to Abyssinia and thence into eastern and central Africa. Although it is a typical plant of temperate regions of the northern hemisphere, some of its subvarieties thrive in the tropics, even at the lower altitudes. Of the southern hemisphere regions, it is cultivated mainly in Australia



97b. Entire pod opened  
along both sutures and  
showing seeds (xO 5)



97c. Seed (x2)  
97 PE A (*Pisum* spp.)

and South Africa. It was introduced by early settlers into North America.

It should finally be mentioned that the pea was the experimental plant used by Gregor Mendel, the founder of genetics. His experiments on *Pisum sativum* led him to deduce the two general laws of genetics.

## 98. Pea, Chick

Chick pea or *Cicer arietinum* (family Leguminosae) is an erect or spreading leguminous annual 25–50 cm tall. It is probably native to western Asia, although the wild form has never been found, and the “wild” chick pea of Palestine and Mesopotamia is certainly an escape from cultivation. It spread to the Mediterranean region and was known to the ancient nations of that area; and simultaneously its distribution expanded eastwards, to India. The part most frequently eaten is the mature seed, which occurs in pods (legumes) 2–3 cm long and 1–2 cm thick. The pods are one- or two-seeded, swollen and beaked. The seeds are angular, beaked, and measure 0.5–1 cm in diameter, and they may be white, yellow, red, brown, or even almost black. The mature and dried seeds of chick pea are eaten boiled or baked and sometimes flour is produced from them. Chick pea flour is mainly used in North Africa as the major part of *couscous*, a special Arabic dish, and in India for confectionery. In almost all Mediterranean countries, a paste is prepared from chick pea mixed with garlic, paprika, lemon and oil, and called *houmous*; it is served as an hors d'oeuvre.

Apart from the mature seeds, unripe entire pods and even young shoots of chick pea are used as a vegetable. Chick pea has been introduced all over the world, including tropical America, Africa and Australia. However, at present it has only achieved importance as a crop in India, where it is called GRAM.



98a. Pod



98b. Peas

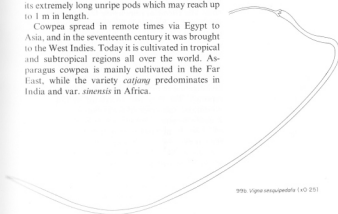
98. CHICK PEA  
(*Cicer arietinum*) (x1)

## 99. Pea, Cow-

Cowpea or *Vigna unguiculata* (family Leguminosae) is native to tropical Africa, where it still grows wild. It is a prostrate or climbing leguminous plant producing narrow, straight or slightly curved pods, 8–100 cm long, but not exceeding 1 cm in width. The seeds are of variable size, shape and colour, 2–12 mm long. The mature seeds are an important pulse, chiefly in West Africa, and they are often ground into a meal. The mature dried seeds are sometimes used as a substitute for coffee beans. The immature pods together with the underdeveloped seeds are also eaten, as well as the young shoots which may be prepared like spinach or used fresh or dried as a pot-herb.

Some authors distinguish three species of cowpea: *V. unguiculata*, as a separate species, *V. catjang* or *CATIANG*, *Vigna sinensis* or COMMON COWPEA and *Vigna sesquipedalis* which is also known as ASPARAGUS COWPEA and is cultivated for its extremely long unripe pods which may reach up to 1 m in length.

Cowpea spread in remote times via Egypt to Asia, and in the seventeenth century it was brought to the West Indies. Today it is cultivated in tropical and subtropical regions all over the world. Asparagus cowpea is mainly cultivated in the Far East, while the variety *catjang* predominates in India and var. *sinensis* in Africa.

99a. *Vigna unguiculata* (x0.5)99. PEA, COW-(*Vigna* spp.)99b. *Vigna sesquipedalis* (x0.25)

## 100. Pea, Grass

Grass pea or CHICKLING PEA is known botanically as *Lathyrus sativus* (family Leguminosae). Its area of origin is unknown but it is probable that it originated somewhere within its present area of cultivation, which spreads over southern Europe, the Near East and India. Grass pea is cultivated as fodder as well as for human consumption. Apart from the seeds, the vegetative parts are also consumed as a pot herb. The seeds are angular and may be white, brown, grey or mottled. The pods are 3-5 seeded, and are flattened and oblong, reaching 2.5-4 cm in length.

*L. sativus* is eaten only by very poor people, among whom a disease called lathyrism occasionally occurs if grass pea or related vetches (*L. cicera* or *L. clymenum*) form 30-50% of their diet. Lathyrism in man causes paralysis of the lower limbs, while in animals it has neurotoxic effects or it affects the bones. The animal diseases are therefore described as neuropathy and osteolathyrism. The chemical responsible for osteolathyrism was found to be  $\beta$ -aminopropionitrile, which was successfully isolated from *L. odoratus*, *L. hirsutus* and *L. roseus*.  $\beta$ -aminopropionitrile, however, is absent from vetches implicated in human lathyrism and neuropathy of animals, and research into neuropathy has been less successful than the investigation of osteolathyrism. Ressel *et al.* (1961) reported that they had succeeded in isolating a neurotoxic substance (diaminobutyric acid) from *L. latifolius* and *L. sylvestris wagneri* which has an effect on the nervous system of rats and chickens, but a toxic substance causing lathyrism in man was not found. More recently, two groups of Indian workers isolated a neurotoxic principle from *L. sativus* called  $\alpha, \beta$ -diaminopropionic acid, which is the only known toxic principle in this plant. It produces neurotoxic symptoms in chickens but whether it is also the cause of human lathyrism is yet to be proved. Lathyrism was at one time attributed to the high content of selenium and low

content of methionine in the seeds of *L. sativus*, while other authors tried to explain it by the contamination of *L. sativus* by another vetch, *Vicia sativa*, occurring as a weed in the grass pea crop. Human lathyrism is still a very incompletely known disease, despite the fact that it has been known from the earliest times. It is mentioned in an ancient Hindu book and is also quoted by Hippocrates. However, the modern term lathyrism was not applied until 1873 by Catani.

## 101. Pea, Pigeon

Pigeon pea or *Cajanus cajan* (family Leguminosae) is probably a native of Africa. It was cultivated in ancient Egypt at least 2000 years B.C., as is proved by the seeds found in the tombs of the Seventh Dynasty. It is also probable that pigeon pea was brought to India in prehistoric times, and it diversified there into many types.

It is a perennial shrub, 1-4 m tall, bearing 3-5-seeded pods, which are straight, beaked and show constrictions between the seeds. The colour of the pods is dark green or dark maroon. The young pods are sometimes eaten as a green vegetable, but more often the dry, ripe seeds are used as a pulse. *Cajanus cajan* is cultivated throughout the tropics because of its drought resistance; this is due to the taproot which produces a mass of small fibrous lateral roots bearing nodules. Two varieties can be recognized: *C. c. var. flarus* which has green glabrous pods, usually with three seeds and includes the TUR cultivars, extensively cultivated in India; and the variety *C. c. var. bicolor* which has hairy dark maroon pods, usually containing 4-5 seeds and including the AHAR cultivars, grown in northern India.



101. PEA, PIGEON (*Cajanus cajan*) (x0.35)

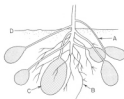


## 102. Potato

Potato, which in the U.S.A. is called IRISH or WHITE (also EUROPEAN) potato, to distinguish it from the sweet potato (103), is botanically identified as *Solanum tuberosum*, a member of the family Solanaceae. Research reveals that this identification is wrong because the modern potato appears to be derived from a cross between *S. tuberosum* and *S. antigonium*, and the potatoes immune to the disease potato blight are another type of hybrid derived from a cross between *S. tuberosum* and *S. demissum*.

Potato is native to mountainous parts of tropical America. At the time of the Discovery they were cultivated at altitudes above 2000 m, between the latitudes 10°N and 20°S, i.e. from New Granada (the former name of Colombia) up to the northern parts of Chile, where they were the staple food of the Incas. However, the wild species of potato are distributed from the southern parts of the U.S.A. to southern Chile. The American natives called the potato BATATA, which was corrupted by the Spaniards to PATATA, and the English name originated from this. The German name KARTOFFEL and its Russian corruption KARTOCHKI are derived from the Italian TARTUFULO, the original name for potato which in fact means truffle.

Potato is an annual plant 30–100 cm tall, cultivated for its underground tubers, the swollen tips of stem branches which may be considered as rhizomes or stolons. These underground stems arise from the base of the main stem and grow more or less diagonally into the soil. They become swollen at their tips to produce stem tubers which are the actual potatoes. The tuber is covered with cork, which develops from the cork cambium or phellogen, and which is converted from the epidermis and the first, superficial layer of the cortex. In the cork are numerous lenticels which facilitate the exchange of gases. The surface of the tuber is marked with "eyes", buds occurring in the axils of leaves that have degenerated into mere scales. The



102a. Underground part of the plant (x10, 065)  
A. Stem branches  
B. Adventitious roots (marked by a single line)  
C. Tubers  
D. Soil level



102b. Entire stem tuber (x10, 5)  
A. Bud in the axil of a scale  
B. Terminal bud  
C. Lenticels  
D. Scar of attachment

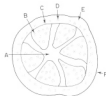
102. POTATO (*Solanum tuberosum*)

buds or eyes are arranged in a spiral formation; at the free tip is the terminal eye, while the opposite end of the tuber bears the scar of attachment. The thickening of the potato is formed by a single vascular cambium which divides inwards to form xylem elements and also phloem and pith. Thus the pith is ramified, the xylem discontinuous, and the phloem occurs not only outside the ring of cambium, as is normal, but also inside it. The latter type of phloem is distinguished as internal and the former as external.

The "skin" of potatoes, which is normally peeled off before use, is whitish, yellow-brown or reddish and the entire tuber is roundish or kidney-shaped. The size differs according to age and to cultivar. Under optimum conditions, giant tubers can be obtained, but usually the long axis reaches about 12 cm, or about 5 cm in the case of early harvested potatoes (new potatoes). They are propagated by means of tubers; normally only pieces of the tuber containing at least one eye (bud) are used, and thus many new plants can be derived from a single tuber. Even the pieces of tuber contain enough stored food for the developing new plant, while the seeds are so small that plants developing from them are unable to produce a large crop.

Potato plants are grown in fields on ridges which have to be maintained in order to keep the developing tuber covered by soil. If the tubers are exposed to the light they become green and unpalatable. Potatoes are now cultivated in all continents in temperate, subtropical and tropical regions, although in the tropics they can only be grown at higher altitudes. The largest crops are yielded by potatoes cultivated in countries with low summer temperatures (15–18°C), and although they will grow on heavy soils the best crops are obtained from light sandy soils; the soil should always be well drained.

The tubers start to develop when the plant begins to flower, and their formation ceases when the fruits are formed. The edible part of the tuber is the entire flesh, which is whitish or yellowish in colour,



102c. T.S. of the tuber (x10, 5)  
A. Pith  
B. Inner phloem  
C. Cambium, vascular  
D. Outer phloem  
E. Cortex  
F. Periderm

102. POTATO (*Solanum tuberosum*)

even in those with red skin. They are the most important vegetable throughout the world, except for the tropical lowlands. They are rich in starch and poor in proteins, but they have nevertheless become a major item in the diet of the poorer European countries or regions. Furthermore, potatoes contain oxalic acid, a poisonous substance, but it does not occur in a dangerous concentration in the tubers: potato poisoning could only occur if an enormous quantity, in the order of 8 kg, were eaten at once.

Potatoes are never consumed raw, but are boiled, fried, roasted or baked. They may be boiled either peeled or whole. Fried potatoes are raw pieces fried in dripping or vegetable oil (chips, French fried potatoes or *ponnmes frites*). Baked potatoes are cooked unpeeled, and served with the skin which then may or may not be discarded, and roast potatoes are cooked in the oven in oil or dripping. Boiled potatoes may be served whole or mashed. In Germany and some neighbouring countries dumplings are prepared from boiled or from raw potatoes, and potato pancakes are also produced. Boiled and sliced potatoes are often used for the preparation of potato salad. In addition, potatoes may be used as a source of flour: they are ground into farina, which is used for special culinary purposes, and in emergency it may be mixed with cereal flour. Lastly, potatoes are an important source of ethyl alcohol.

Potatoes were first introduced into Europe (to Spain) from America by the Spaniards in about 1570. It has often been claimed that they were brought to Ireland by Sir Walter Raleigh in 1589 and that he cultivated them on his estate near Cork. However, Raleigh was the founder of Virginia, and since potatoes were not cultivated there at that time the claims cannot be correct, and it seems that they were probably introduced into Ireland from England. Who brought them to England is not known, and the theory that they were introduced in 1586 by the navigators Drake and Hawkins was refuted by Sir John Banks (1763-1820) who was

convinced that the "potatoes" brought by them to England were in fact sweet potatoes. Nevertheless, the potato is described in Gerarde's "Herball" of 1597 and the Swiss botanist Carl Bauhin coined the name *Solanum tuberosum* as early as 1590. Ireland was the first European country where potatoes were cultivated to prevent famine among the poorest of the inhabitants; they were grown there probably during the first decade of the seventeenth century (1606-1607) and without doubt before 1663. In continental Europe it became an economically important plant much later. The first large production of potatoes was in Germany in 1744, when Frederick the Great ordered them to be cultivated in Silesia and Pommerania to provide the population with an adequate food supply. During the Seven Year War their cultivation spread to Bohemia and other Austrian countries (the Czech name BRAMBORY is a corruption of *Braniboři*, meaning the Brandenburgers). From the eighteenth century onwards, potatoes became known as the food of the poor, and as such they were excluded from the diet of royalty and the more well off, but they were re-introduced to the French court by Antoine August Parmentier (1737-1818) who became accustomed to eating potatoes when he was in prison in Hamburg. Potatoes were introduced into the U.S.A. via Ireland; they were first brought by Irish migrants and the first large area of cultivation was in Londonderry, New Hampshire, in 1719.

Today the relatively largest producer of potatoes is Poland, followed by Ireland and East Germany. Poland produces 1200 kg per head of population per year, Ireland 940 kg and East Germany 720 kg. It is an everyday vegetable in England (since the nineteenth century), as well as in all European countries, the U.S.A., Canada, etc. In 1933 the National Institute of Agricultural Botany listed over 600 cultivars but only a few of these are of any great importance in Britain; here 74% of the acreage was used for four cultivars: 'Majestic' (1911) 28%; 'Edward VII' (1902) 16%; 'Pentland

Dell' (1961) 11%; and 'Pentland Crown' (1959) 9%. The dates in parentheses indicate the year of introduction of the cultivar. The kidney-shaped cultivars are popular in all parts of Europe except Britain.

The most serious pest in wet conditions is potato blight, an infection caused by a downy mildew fungus called *Phytophthora infestans*. It produces zoospores, spores moving by means of flagella, which can easily spread from one plant to another through a film of water during rainy weather. In Ireland, potato blight resulted in the great famine of 1845-1849 and by the end of 1851 a million people had died and 1½ million Irishmen had emigrated, mainly to the U.S.A. Another serious pest is the Colorado beetle (*Leptinotarsa decemlineata*) which assumed political importance shortly after the Second World War, when the communist countries accused the U.S. Air Force of infecting communist territories with this parasite which feeds on potato leaves. There are also many viruses that spoil potato crops, but there is one virus that lives in almost harmless symbiosis with the potato. This symbiosis is found in the cultivar 'King Edward' which always appears to be infected with the virus known as paracrinkle virus. It affects the leaves, but to a scarcely discernible degree, and it has been discovered, since virus-free 'King Edward' potato tissue has been successfully produced in the laboratory, that the yield is lowered by the virus by about 10%.

### 103. Potato, Sweet

Sweet potato, or *Ipomoea batatas* (family Convolvulaceae), is a perennial herb with a twining or trailing stem and it reaches up to 5 m in length. It is cultivated for its root tubers which are used in a similar way to potatoes. The plant is native to tropical America but has also been cultivated in Polynesia since long before the arrival of the white man. However, it seems more likely that the sweet potato is not native to the Polynesian archipelago and that it was introduced from America by the

natives. The first sweet potatoes were brought to Europe from America by Columbus himself in 1492 and by the end of the fifteenth century they had already been introduced into the Philippines and China. The wild form is not known.

Sweet potatoes are propagated by stem cuttings or by shoots arising from the seed tubers, and only in breeding work are they obtained from seed. The shoots and cuttings produce adventitious roots and the swellings that develop on these are the edible tubers, which vary in size, shape and colour. They are usually elongated, but may also be globular or fusiform; their surface may be smooth or ridged, and the skin (periderm) may be white, yellow, orange, red, purple or orange-brown, although usually it is slightly red or purple in colour. The colour of the flesh is white, orange, red or purple. They are roughly the same size as white, European potatoes. The cultivation of sweet potatoes is limited to warm regions: the tropics, subtropics and warmer regions of the temperate countries. Thus in Europe they are grown up to the northern parts of Spain and also on the island of Jersey, and in North America in the southern states of the U.S.A. The largest producers are obviously the tropical and subtropical countries, and the largest plantations occur in Africa.

The tubers are normally eaten boiled or baked and the periderm is peeled off. They are sweet in taste owing to the presence of sugars, of which the quantity is increased by boiling or baking. However, starch is the major constituent, and flour is therefore also prepared from the tubers. The tender shoots are used in Africa, Indonesia and the Philippines as a pot-herb.

There are many cultivars of sweet potato, which can be divided into the general categories of food and feed types. The food cultivars may be subdivided into soft- and firm-fleshed cultivars according to their nature when cooked. The soft-fleshed sweet potatoes are often wrongly called yams, but this is an entirely different plant yielding root tubers (see 119).



103. POTATO, SWEET  
(*Ipomoea batatas*) (x0.25)  
Root tuber

Other species of *Ipomoea*, also, are edible but are not used for their root tubers. For example the young shoots of *I. aquatica*, a perennial water plant of the tropics, are used by Chinese in Malaysia as a substitute for spinach; and *I. eriocarpa*, a native of India, is used there in the same way.

## 104. Pumpkins and Squashes (Vegetable Marrows)

104a. *Cucurbita* (x0.5)

104. PUMPKINS and SQUASHES (MARROWS)

All species of *Cucurbita* (family Cucurbitaceae) yield pepo fruits which in American terminology are distinguished into pumpkins, winter squashes and summer squashes. There are about 25 species in the genus, and all of them are American in origin. Many of them are xerophytes, plants that thrive in arid regions, and are native to northern Mexico and the southern U.S.A. The commercial names do not correspond with the botanical species; some cultivars of a particular species may be considered as pumpkins while others are called squashes. There are actually no clear characteristics to distinguish pumpkins from winter squashes; both are the mature fruits of different *Cucurbita* species and are cooked and used as a table vegetable or as a filling for pies. The only distinction is that the flesh of the pumpkin is much coarser-grained than that of the winter squashes, which also have a milder taste. On the other hand, the summer squashes can easily be recognized, being the fruits only of *C. pepo* and used only in the immature state.

The edible species of *Cucurbita* to which the pumpkins and squashes belong are: *C. pepo*, *C. moschata*, *C. mixta* and *C. maxima*. *C. pepo* has been under cultivation the longest time and has been grown since pre-Columbian times in Mexico and the southern part of what is now the U.S.A. Remains of *C. pepo*, evidently used as food, have been found in excavations in Mexico dated at 7000-5000 B.C. The species is often subdivided

into three varieties: *C. p. var. pepo* which yields pumpkins, *C. p. var. medullosa* which produces summer squashes and *C. p. var. melopepo*, producing winter squashes and also some odd pumpkins.



104b. Pumpkin (x0.1)

*C. moschata*, according to the archaeological evidence, has been distributed in both North and South America for several thousand years (e.g. in Mexico since 5000 B.C.) and all its varieties are considered to be either pumpkins or winter squashes.

The third species, *C. mixta*, was formerly included in the species *moschata* but is now considered as an independent species. It is native to Mexico and Central America, and its remains found in excavations in Mexico are given as recent a date as A.D. 100-500. The fruits are classified by some authors as pumpkins, while in some growing areas all the varieties are generally called squashes; and elsewhere the varieties of *C. mixta* are distinguished into pumpkins and winter squashes.

The fourth species, *C. maxima*, is a monococious vine of which remnants have been excavated in Peru and dated at 1200 B.C. Its edible fruit, like the other cucurbits, is a pepo, but it often reaches giant proportions, a single fruit weighing up to 100 kg. Two varieties are sometimes distinguished: *C. m. var. maxima* and *C. m. var. turbaniformis*, separating turban squashes from ordinary winter squashes.

The terms winter and summer squashes are not used in England and instead of summer squashes, immature pepos of *C. pepo* are called vegetable marrows, while winter squashes are not distinguished at all.

The commercial divisions that cut across the botanical classification of the *Cucurbita* species may be summarized as follows:



104c. Summer crookneck (x0.2)

PUMPKINS include some varieties of *C. pepo* (e.g. the cultivars 'Connecticut Field', 'Small Sugar', 'Golden Oblong') and also some varieties of *C. moschata* (e.g. cv. 'Dickenson') and of *C. mixta* (e.g. 'Japanese Pie', 'Tennessee Sweet Potato' and 'White Cushaw'). The fruit is used fully ripe and its flesh is eaten cooked as a table vegetable or as a filling for pies. The seeds may also be eaten after being fried and salted; such seeds are known in Latin America as PEPITOS. In Britain pumpkins are not common, but the type most frequently seen is a large yellow pepo.

WINTER SQUASHES do not include the species *mixta*, since its fruit is considered exclusively as a pumpkin. The species represented are *C. maxima* (cultivars 'Green Hubbard', 'Golden Hubbard', 'Golden Delicious', 'Banana' and 'Turban'); *C. moschata* (cv. 'Butternut'); and *C. pepo* (cvs 'Table Queen', also called 'Des Moines', and 'Acorn'). The fruit is used in the same way as pumpkins and is therefore harvested at the same time, when it is fully ripe.

SUMMER SQUASHES differ from pumpkins and winter squashes in being consumed when they are underripe, and being developed from the single species, *C. pepo*. There are numerous cultivars: 'White Bush Scallop', 'Yellow Bush Scallop', 'Yellow Crookneck', 'Yellow Straightneck', etc., and also the well known European cultivar called COURGETTE in France and Britain, ZUCCHETTI in Italy and introduced as ZUCCHINI in America. Courgettes are sliced and boiled, stewed or fried, or are cooked whole when still very young. They are usually about 16 cm long, cucumber-like and green in colour; they have recently become very popular in Britain.

There is one further edible species of *Cucurbita* native to Mexico, Central and South America, which was cultivated there from about 4000-3000 B.C. This is *C. ficifolia*, to which the cultivar MALABAR GOURD belongs. The candied flesh and mature seeds are eaten, and also an alcoholic drink is prepared from the fermented flesh. *C. ficifolia* is



104d. Candied marrow (x0.2)

104. PUMPKINS and SQUASHES (MARROWS)

the only perennial species of *Cucurbita* consumed by man.

## 105. Radish

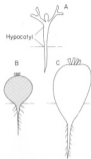
Radishes are species or varieties of the genus *Raphanus* (family Cruciferae); they mainly belong to the species *R. sativus* or *R. raphanistrum* and are biennials or annuals. The origin of *R. sativus* is obscure but it is thought to be native to western Asia. Radishes were cultivated by the ancient Egyptians in the Pharaonic period and also by the ancient Babylonians, Greeks and Romans. They have a pleasant "hot" taste which is due to mustard oil, produced by the breakdown of a glucoside.

The most popular variety is *R. s. var. radicata*; the edible part, which is actually the swollen hypocotyl, may be spherical and about 2 cm in diameter or long (6-7 cm), and it may be red, red and white, or completely white in colour. Especially popular cultivars are 'Sparkler' (red and white, spherical) and 'French Breakfast' (red, spherical).

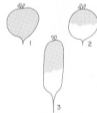
The variety *R. s. var. esculentus* consists mainly of somewhat elongated large radishes with a white, yellow or blackish surface. The best known cultivars are 'Strasbourg', 'Stuttgart' and 'White Vienna'. As the names suggest, they are popular mainly in central Europe.

*R. s. var. longipinnatus* provides the Chinese and Japanese radishes, and includes the cultivar 'China Rose' which has a cylindrical fleshy red root more than 20 cm long. Some of the other white cultivars, however, may reach a much larger size and weight, and some of the Japanese ones may weigh up to 25 kg.

Radishes are eaten raw, either entire or peeled. The peeling deprives them of most of the enzyme responsible for the production of mustard oil, and therefore removes the hot taste. In Western countries they are also used sliced as a salad vegetable, and in France, especially, they are eaten with butter as one of the cheapest hors d'oeuvres *tradés en*



105a. Development of radishes  
A. Cotyledon  
B. Swollen hypocotyl of *Raphanus sativus* var. *radicata*  
C. Black radish developed from the thickened hypocotyl and root

105. RADISH (*Raphanus sativus*)

105b. *Raphanus sativus* var. *radicata* (1-3) (x0.55)

beurre). Sometimes the leaves of radishes are eaten as a salad; or in the case of *Raphanus caudatum* (RAT-TAILED RADISH) grown mainly in India, the edible part is the fruit. This is a long, tomentose silique (having constrictions between the seeds), 30 cm or more in length, and it is eaten either raw or pickled.

## 106. Rhubarb

Rhubarb (*Rheum rhabarbarum*, family Polygonaceae) was given its name by the ancient Greeks who called it the vegetable of barbarians from beyond the river Rha (Volga). It is a native of the south-eastern Asiatic part of Russia, where it still grows wild. Only the long fleshy petioles are eaten and the consumption of the leaf laminae recommended during the First World War led to poisoning which in some cases was fatal. Many authors have suggested that the poison is oxalic acid, but this seems unlikely since it is present throughout the plant in almost uniform concentrations (the lamina contains 0.3–1.1% oxalic acid while the petioles contain 0.4–1.0%). Furthermore, it is argued that a fatal dose of rhubarb would have to be in the order of 4 kg and none of the people poisoned ate such a quantity. Man can also adapt to a very low level of calcium and thus oxalic acid, which binds with the calcium in the body, cannot be harmful. On the basis of this reasoning, it seems hardly possible that oxalic acid is responsible for the poisoning, and it has been suggested by Fawcett (1966) that the poisonous substances in rhubarb are anthraquinone glucosides.

The edible robust petioles have a red epidermis while the epidermis of the green lamina is colourless. The petioles are not eaten raw, but are boiled or stewed, and often a kind of purée is produced. The plant is used more like a fruit than a vegetable. Rhubarb is sometimes also used as a flavouring in the production of a "wine".

Rhubarb thrives in cooler parts of the temperate

106a. Petiole (x0.25)



106b. Entire leaf (x0.125)

106. RHUBARB (*Rheum rhabarbarum*)

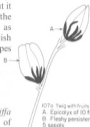
## III. VEGETABLES

zones and its earliest cultivation in Europe was in Italy at the beginning of the seventeenth century. In America it was mentioned as early as 1778 but it did not become a common crop there until the nineteenth century. The older cultivars, such as 'Victoria' and 'Linnaeus', lacked the reddish colouring and they gave way to the modern types which are much more attractive.

## 107. Roselle

Roselle or JAMAICAN SORREL (*Hibiscus sabdariffa* var. *sabdariffa*, family Malvaceae) is a native of India. Another variety, *H. s. var. altissima*, is cultivated for its fibres which are similar to those of jute, and is a vigorous annual, 3–5 m tall and practically unbranched, while the edible variety is a bushy subshrub. The tender young leaves and shoots are eaten as salad or as a pot-herb, but the main use of roselle is for the preparation of a drink from its calyces. *H. sabdariffa* occurs all over Africa and some authors maintain that West Africa rather than India is its area of origin. The plant is very popular in the West Indies and was brought to Jamaica at about the beginning of the eighteenth century; the first record is from 1707.

107. ROSELLE (*Hibiscus sabdariffa*)



107a. Twig with fruits (x0.25)  
A. Epicalyx of 10 fleshy bracts  
B. Fleshy persistent calyx of 5 sepals



107b. L.S. of the fruit (x0.5)  
A. Epicalyx  
B. Calyx  
C. Capsule dehiscing by 3 valves

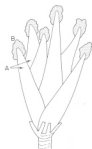
## 108. Salsify

Salsify or OYSTER PLANT (*Tragopogon porrifolius*, family Compositae) is native to Central Asia and was introduced into Europe in the Middle Ages, at least as early as 1436. It is an erect branching biennial, 60–120 cm tall, growing in cool, moist regions of the temperate zone, and today it is mainly cultivated in Russia. The useful part is the slender, fleshy, whitish taproot which is usually about 30 cm long. It is peeled, cut into pieces and boiled or baked for consumption as a table vegetable or a relish. Its flavour resembles that of the oyster, hence the name "oyster plant".



108. SALSIFY or OYSTER PLANT (*Tragopogon porrifolius*) (x0.2)  
Tap root with a single leaf

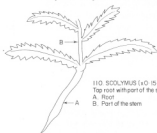
### 109. Seakale



Seakale (*Crambe maritima*, family Cruciferae) is native to the shores of western Europe and the shores of the Black Sea, and is cultivated for its blanched leaf stalks. It is propagated from seeds or cuttings which are left to grow under a flower pot or a wooden box. In this way the petioles develop with a tiny under-developed leaf at their tip. The petioles are harvested when they are 10–12 cm long and they are used as a vegetable like asparagus.

### 110. Scolymus

Scolymus or SPANISH SALSIFY (*Scolymus hispanicus*, family Compositae) is used for its fleshy taproot. It is native of Europe and is consumed in the same way as salsify and black salsify (see below).



110. SCOLYMUS (xO 15)  
Top root with part of the stem  
A. Root  
B. Part of the stem

### 111. Scorzonera

Scorzonera or BLACK SALSIFY (*Scorzonera hispanica*, family Compositae) is a perennial native to central and southern Europe. It differs from salsify in having a black rind to its taproot, although the flesh is white. The rind is removed before the root is cooked and eaten.

### III. SCORZONERA



1 Scorzonera hispanica 1 (x O 15)  
Black taproot with a single leaf

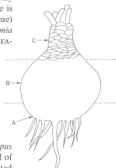
### 112. Spinach

Spinach (*Spinacia oleracea*, family Chenopodiaceae) is probably indigenous to south-western Asia, perhaps to Persia, but is now cultivated in temperate regions all over the world. It seems to have been introduced into Europe in the late Middle Ages (fifteenth century) and was first recorded in France in 1530. Spinach is an annual, producing first a rosette of leaves; at this stage the leaves are picked and are eaten either boiled or as a purée. If the leaves are not harvested at the rosette stage, the main shoot enlarges enormously and bears clusters of flowers while the rosette leaves become tough and unfit for consumption.

Various other plants are used as substitutes for spinach. In Britain the most common substitute is SPINACH BEET (*Beta vulgaris* var. *cicla*), and also the leaves of turnip (*Brassica rapa* var. *rapa*) are sometimes eaten as spinach. In tropical America the leaves of AMARANTH (*Amaranthus* spp., family Amaranthaceae) are used, while in India there is INDIAN SPINACH (*Basella alba*, family Basellaceae) which is a native of Asia. The plant *Tetragonia expansa* (family Aizoaceae), known as NEW ZEALAND SPINACH, thrives also in hot countries.



112 SPINACH (*Spinacia oleracea*)  
A leaf only (xO 15)



113. SWEDE (*Brassica napus* var. *napobrassica*) (xO 25)  
A. Tap root  
B. Hypocotyl  
C. Stem with leaf scars

### 113. Swede

Swede (*Brassica napobrassica* or *Brassica napus* var. *napobrassica*, family Cruciferae) is a hybrid of *B. oleracea* and *B. napus*, and probably originated in Bohemia in the seventeenth century. In the U.S.A. it is known as RUTABAGA. The vegetable is formed from the swollen hypocotyl united with the swollen stem and taproot, and it is eaten either raw or sliced and boiled. However, in many countries today the swede is only used as animal fodder.

## 114. Taro

Taro, EDDO and COCOYAM are local common names for the species *Colocasia antiquorum*, a herbaceous plant of the monocotyledonous family Araceae. It is today one of the major rootcrops of the humid tropics all over the world and many millions of people are dependent on it. It is native to south-east Asia, from where it spread to Polynesia and other Pacific Islands, and it was later introduced to America and Africa. The useful part of the plant is the spherical or slightly elongated corm. The corms reach 15–18 cm in diameter and are marked by rings representing internodes. The upper rings or internodes are associated with buds and the tops of the corms are therefore used for propagation. The cultivars of taro rarely flower, as a result of a long history of cultivation based on vegetative propagation. Those cultivars that do occasionally flower produce a spadix enveloped by a yellow spathe.

The corms of taro are the "potatoes" of the humid tropics and are superior to potatoes in nutritional value, containing a higher proportion of proteins, calcium and phosphorus. However, the main bulk is starch, which is present in the form of grains that are the smallest in the plant kingdom, and this makes them easily digestible. However, taro also contains calcium oxalate, a poisonous compound responsible for the unpleasant, bitter taste of the vegetable when raw. Calcium oxalate is destroyed by boiling or baking, and the skin must be discarded. The commonest dish prepared from taro in Polynesia is *poi*, a starchy paste. As well as the corms, the leaves are consumed as a spinach-like vegetable.

*Colocasia* cultivated in the West Indies is the species *C. esculenta*, but many botanists consider this as only a variety of the species *C. antiquorum*. It is known as DASHEEN and it differs from other cultivars of *Colocasia* in yielding numerous corms that develop along the main one. Dasheen is reported to be more palatable than taro and to have a nutty taste.



114 TARO (*Colocasia antiquorum*)  
Corm (x0.25)

## III. VEGETABLES

## 115. Tomato

Tomato is the fruit (berry) of *Lycopersicon esculentum* syn. *Solanum lycopersicum*, a member of the family Solanaceae. The plant is an annual with an erect solid stem and is native to America. It was brought to Europe in 1523 after the conquest of Mexico, where it had been introduced from its native area of what is now Peru and Equador. According to the records, the plant appeared in England at the end of the sixteenth century and was used as an ornamental bearing decorative fruits called LOVE APPLES, or in French, POMMES D'AMOUR. In earlier times, tomatoes were eaten only in Italy, and in other European countries their consumption as a vegetable started on a large scale in the second half of the nineteenth century. The berry is fleshy and develops from an ovary with two, three or up to nine loculi. The placenta contributes a large part of the fruit, which is green when immature and as it ripens becomes bright red owing to the presence of lycopen, a special carotenoid. The fruit is usually more or less spherical in shape but in one variety it is pear-shaped. There are five main varieties: the common tomato, *L. e. var. commune*; *L. e. var. grandifolium*, the large-leaved tomato; *L. e. var. validum*, the upright tomato; *L. e. var. cerasiforme*, the cherry tomato, which has small fruits about 2 cm in diameter; and *L. e. var. pyriforme*, the variety with pear-shaped fruits.

Although they are fruits, tomatoes are served as a vegetable, mainly raw as salads, but also cooked, e.g. mixed in omelettes or casseroles, on pizzas or as a vegetable with meat. Their juice is used for soups and sauces or as an appetizer, and a special kind of tomato sauce is known the world over by the name ketchup, derived from the Chinese *koe-chiap*, meaning brine of pickled fish. Tomatoes are often preserved, either canned or pickled; if ripe, they are peeled, while unripe green tomatoes are pickled entire or chopped and used as a constituent of pickles and chutneys.

Only when it is consumed in the form of a drink



115a Entire berry



115b L.S. of the berry  
A. Pericarp  
B. Placenta  
C. Seeds

115 TOMATO (*Lycopersicon esculentum*) (x0.5)



is the tomato used as a fruit. Tomato juice for drinks is preserved, and is sometimes mixed with alcohol; in English-speaking countries tomato juice mixed with gin is known as a "Bloody Mary".

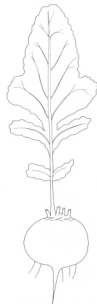
### 116. Turnip

Turnip or *Brassica rapa* (syn. *B. rapa* var. *rapa*, family Cruciferae) has been cultivated for at least 4000 years. Its swollen base is derived mainly from the hypocotyl and also the swollen taproot and stem, although the stem is negligible in comparison with the proportion of stem incorporated in the swede and celeriac. Turnip is a biennial, native to the temperate parts of Eurasia where it has been cultivated since early times and is an important source of food. It was an early introduction to America, arriving in Mexico in 1586.

Nowadays turnip is mainly cultivated as a fodder plant, but it remains a familiar vegetable in poorer parts of Britain and the U.S.A. The swollen base is eaten sliced and cooked, while the green top is used like spinach. The leaves contain various nutrients including iron and almost all the vitamins; they have even been claimed to contain vitamin B<sub>12</sub>, but this may be an artifact of the analysis.

### 117. Water Chestnut, Chinese

Chinese water chestnut is a completely different plant from *Trapa*, which is also called water chestnut and is discussed under pseudo-cereals. Its scientific name is *Eleocharis tuberosus* and it belongs to the monocotyledonous family, Cyperaceae—the sedge family. It is native to the Far East and its edible part is a corm, in contrast to the nut of the water chestnut. Chinese water chestnuts are cultivated mainly in China and Japan and the corms are eaten raw, boiled or roasted. Normally they are cut in small pieces and added to soup or other dishes.

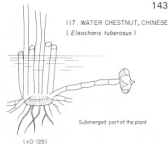


116. TURNIP (*Brassica rapa*) (x0.25)  
Underground swelling with a leaf

117. WATER CHESTNUT, CHINESE  
(*Eleocharis tuberosus*)



Corms (x0.5)



117. WATER CHESTNUT, CHINESE  
(*Eleocharis tuberosus*)

*Cyperus papyrus*, also belonging to the family Cyperaceae, was used for the papyrus of antiquity but also has an edible rhizome.

### 118. White Mustard

White mustard or *Sinapis alba* (syn. *Brassica alba*) belongs to the family Cruciferae and yields seeds from which mustard is produced. But the aerial part of the young seedling is also used as a salad vegetable; it consists of the hypocotyl bearing the two green cotyledons, the first photosynthesizing leaves of the plant. The seedlings of cress (77) are used in the same way and they are usually sold together as "mustard and cress". Cole seedlings (*Brassica napus*) are often sold under this name because they are more easily cultivated.

The seedlings of white mustard contain the glucoside sinalbin which, by the action of the enzyme myrosinase, is broken down to mustard oil and is responsible for their "hot" taste. The seedlings are frequently put into sandwiches or used as a garnish.

### 119. Yam

Yams are the root tubers of *Dioscorea* spp., climbing plants belonging to the monocotyledonous family Dioscoreaceae. The most important economic species is *D. alata*, which originated in



118. WHITE MUSTARD  
(*Sinapis alba*) (x0.5)  
Seedling

south-east Asia, and from there was introduced into all the tropical countries of the world. The tubers are rich in starch but deficient in protein, and they contain a poisonous alkaloid, dioscorine. The tubers must therefore be boiled or roasted to destroy the dioscorine and the unpleasant taste it causes; it is peeled before cooking. The tuber may be roundish or extremely elongated, straight or branched, and may also occur in large bunches. *D. alata* (GREATER YAM) grows to a very large size and it has been reported that tubers weighing up to 15 kg have been cultivated.

Other important species are: *D. rotundata*, the WHITE GUINEA YAM; *D. cayenensis*, the YELLOW GUINEA YAM, in which the tubers take about a year to mature; *D. esculenta*, the CHINESE YAM which yields small tubers in bunches below the stem; and *D. bulbifera*, which produces stem tubers, while the root tubers are of very inferior quality. *D. bulbifera* is cultivated for its aerial stem tubers which are called AIR POTATOES.

All the species of *Dioscorea* mentioned are native to the Old World tropics, but there is one economically important species that is a native of tropical America: this is *D. trifida*, which produces small tubers less than 18 cm long, borne in bunches.

The yams should not be confused with the sweet potatoes (103), despite the fact that certain varieties of sweet potato are given the name yam in the U.S.A. Sweet potatoes are also root tubers but are produced by an entirely different plant, a member of the dicotyledonous family Convolvulaceae.



119 YAM (*Dioscorea rotundata*)  
Root tuber (x0.25)

## Morphological Survey of Vegetables (VEG)

### CYANOPHYTA

18. Nostoc

### ALGAE

#### Leaf-like part of the thallus

19. Dulce
20. Kobo
21. Laver
23. Nori
24. Sea Lettuce

#### "Midrib"

22. Murlins

#### "Sporophyll"

22. Murlins

#### Stipe

25. Sugar wrack

### ANGIOSPERMAE

#### Root

##### Swollen taproot

68. Carrot
75. Chervil, Turnip Rooted
95. Parsley
96. Parsnip
105. Radish
108. Salsify
110. Scolymus
111. Scorzonera

#### Root tuber

59. Bean, Yam
69. Cassava
74. Chayote
103. Potato, Sweet
119. Yam

### FUNGI

#### Fungal fructification

26. *Boletus* spp.
27. Chanterelle
28. Club and Coral Fungi
29. Jew's Ear
30. Morel
31. Mushroom (White)
32. Orange Agaric
33. Ox tongue
34. Padi Straw Mushroom
35. Puff Ball
36. *Russula* spp.
37. Shiitake Mushroom

### PTERIDOPHYTA

38. Fiddlehead Fern

#### Stem

##### Swollen hypocotyl

60. Beetroot
105. Radish

##### Swollen hypocotyl with taproot and epicotyl

71. Celeriac
113. Swede
116. Turnip

##### Hypocotyl with cotyledons

77. Cress, Garden
118. White Mustard

##### Swollen epicotyl

87. Kohl-rabi

##### Stem sprout

42. Asparagus
45. Bamboo

**Stem (contd.)****Stem tuber**

- 39. Artichoke, Chinese
- 41. Artichoke, Jerusalem
- 102. Potato
- 91. Lotus, Sacred

**Corm**

- 114. Taro
- 117. Water Chestnut, Chinese

**Leaf****Whole leaf**

- 64. Cabbage
- 65. Cabbage, Chinese
- 73. Chard
- 76. Chicory
- 80. Dandelion
- 83. Endive
- 86. Kale
- 90. Lettuce
- 112. Spinach

**Midrib**

- 67. Cardoon

**Swollen base of the leaf**

- 88. Leek

**Petiole**

- 72. Celery
- 106. Rhubarb
- 109. Seakale

**Swollen base of the petiole**

- 84. Fennel

**Main bud**

- 64. Cabbage, var. *capitata*
- 90. Lettuce, var. *capitata*

**Axillary bud**

- 63. Brussels sprout

**Bulb**

- 94. Onion

**Leafy shoots**

- 77. Cress, Garden
- 78. Cress, Water-
- 107. Roselle

**Flower****Solitary flower (entire) or inflorescence (entire)**

- 82. Elder
- 82. Wattle

**Flower bud**

- 40. Artichoke, Globe

**Swollen (degenerate) inflorescence**

- 62. Broccoli
- 70. Cauliflower

**Fruit****Simple**

- 1. DRY
- capsular*

**Capsule**

- 92. Okra

**Legume (immature)**

- 48. Bean, Broad
- 49. Beans, French
- 50. Bean, Goa
- 52. Bean, Lablab
- 53. Bean, Lima
- 54. Bean, Moth
- 55. Bean; Mung
- 56. Bean, Scarlet Runner
- 57. Bean, Soya
- 89. Lentil
- 97. Pea, Garden and Field
- 98. Pea, Chick
- 99. Pea, Cow
- 101. Pea, Pigeon

**2. FLESHY****Berry**

- 43. Avocado
- 124. Banana, Baking (plantain)
- 66. Capsicum
- 81. Egg-plant (Aubergine)

**Pepo**

- 79. Cucumber
- 104. Pumpkin and Squash

**Fruit (contd.)****Drupe**

- 93. Olive

**Multiple**

- 61. Breadfruit
- 85. Jack-fruit

**Seed****of a legume (ripe or unripe)**

- 44. Bambarra Groundnut
- 46. Bean, Adzuki
- 47. Bean; Black Gram
- 48. Bean, Broad
- 49. Bean, French

**Seed (contd.)**

- 50. Bean, Goa
- 51. Bean; Horsegram
- 52. Bean, Lablab
- 53. Bean, Lima
- 54. Bean, Moth
- 55. Bean; Mung
- 56. Bean, Scarlet Runner
- 57. Bean, Soya
- 58. Bean, Tepary
- 89. Lentil
- 97. Pea, Garden and Field
- 98. Pea, Chick
- 99. Pea, Cow
- 100. Pea, Grass

## IV. FRUIT

Fruits in the botanical sense are represented in almost every commercial category of plants consumed by man. As examples one may list cereal grains, vegetables such as avocados, olives, tomatoes, etc., true nuts, and fruits used as flavourings (e.g. citrons, lemons, limes, capsules of vanilla and strobili of hop). Furthermore, fruits in the botanical sense are also found among plant materials used for extracts, beverages and masticatories. These fruits excluded from the commercial category of fruit are all the dry fruits, with the single exception of carob, and also a few fruits of the succulent, fleshy type. If we disregard the exceptional case of carob, the commercial fruits are restricted to those fleshy ones that have a considerable proportion of sugar and can usually be eaten raw. Thus the fruits of commerce are almost always botanically classified as fleshy fruits, although the converse is not always true. Fruits lacking a large sugar content (e.g. tomato and lemon), containing fats instead of sugar (e.g. olive and avocado), or having a particularly strong flavour (e.g. pepper and sumac) belong to the other categories of plant organs consumed by man. There are, however, some exceptions such as cranberries and cowberries which are not sufficiently sweet to be eaten raw and are yet considered commercially as fruit. They have to be cooked with a large quantity of sugar to make them palatable.

Commercial fruits (hereafter called merely fruit) contain minerals and vitamins as their micronutrients and many of them are particularly rich in vitamin C (ascorbic acid). This is their most valuable constituent; according to Table VI below, those most abundant in vitamin C are Barbados cherries (1000–4000 mg per 100 g), followed by the hips of *Rosa rugosa* (515 mg per 100 g), guava (242 mg per 100 g), blackcurrant (200 mg per 100 g) and orange (50 mg per 100 g). The fruit is also a source of roughage, and thus has the same general composition as vegetables, except for the high sugar content. Many vegetables contain, instead of sugar, starch which appears in fruit only seldom and in small quantities, causing for example the bland taste of bananas. Starchy fruits are really only unripe ones and for this reason such fruits as breadfruit or jack-fruit, eaten unripe, are considered as vegetables, while they are eaten as fruit when ripe. Completely ripe starchy fruits are not recognized commercially, because such fruits are considered as vegetables, e.g. plantains—"bananas" which must be cooked before they are eaten.

With rare exceptions, fruits can be eaten raw and alone as dessert fruit. They may also be consumed in the form of juices, compotes (fruits preserved

in syrup) or processed as jams, jellies, sauces, dried fruit, candied fruit or fillings for cakes and pastries. They are served raw for breakfast (e.g. grape-fruit), at the beginning of meals (e.g. melon) or after them as a dessert. Fruit salads and compotes are also served as dessert, and jams and jellies may be used with main dishes as well as for breakfast, afternoon tea etc., spread on bread or scones. Fruit juices are served as refreshing drinks with meals, or, like dessert fruit, at any other time.

In common with vegetables, fruit cannot always be distinguished merely by their function from flavouring or ornamental plants. Again it is the quantity that is the deciding factor. Fruit added in small quantities to cakes and pastries and also to savoury dishes may be considered as a flavouring, or as a decoration without any nutritive or organoleptic function if it is used solely for its visual effect.

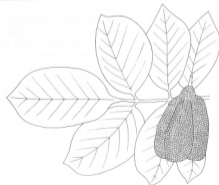
Table VI  
Chemical composition per 100 g edible part of fruit

Name of the fruit	Water	Pro- teins	Fats	Carbo- hydrates	Vitamins (Vitamin A in international units, others in mg)				
					A	Thia- mine	Ribo- flavin	Niacin	C
	%	%	%	%					
ANGIOSPERMAE									
120. Akee	—	—	—	—	—	—	—	—	—
121. Apple, raw, freshly harvested	84.8	0.2	0.6	14.5	90	0.03	0.02	0.1	7
122. Apricot, raw	85.3	1.0	0.2	12.8	2700	0.03	0.04	0.6	10
123. Bael	—	—	—	—	—	—	—	—	—
124. Banana, raw	75.7	1.1	0.2	22.2	190	0.05	0.06	0.7	10
125. Barbados Cherry, raw	92.3	0.4	0.3	6.8	—	0.02	0.06	0.4	1300
126. Bilberry, raw	83.2	0.7	0.5	15.3	100	0.03	0.06	0.5	14
127. Blackberry, raw	84.5	1.2	0.9	12.9	200	0.03	0.04	0.4	21
128. Carambola, raw	90.4	0.7	0.5	8.0	1200	0.04	0.02	0.3	35
129. Carob	—	—	—	—	—	—	—	—	—
130. Cashew Apple, raw	—	—	—	—	—	—	—	—	—
131. Ceriman, raw	—	—	—	—	—	—	—	—	—
132. Cherry, Sour, raw	83.7	1.2	0.3	14.3	1000	0.05	0.06	0.4	10
133. Cherry, Sweet, raw	80.4	1.3	0.3	17.4	110	0.05	0.06	0.4	10
134. Cranberry, raw	87.9	0.4	0.7	10.8	40	0.03	0.02	0.1	11

Name of the fruit	Water %	Pro- teins %	Fats %	Carbo- hydrates %	Vitamins (Vitamin A in international units, others in mg)				
					A	Thia- mine	Ribo- flavin	Niacin	C
135. Currants, white and red, raw	85.7	1.4	0.2	12.1	120	0.04	0.05	0.1	41
black, raw	84.2	1.7	0.1	13.1	230	0.05	0.05	0.3	200
136. Custard Apple, raw	71.5	1.7	0.6	25.2	tr	0.08	0.10	0.5	22
137. Date, dry	22.5	2.2	0.5	72.9	50	0.09	0.10	2.2	0
138. Durian	—	—	—	—	—	—	—	—	—
139. Fig, raw and fresh	77.5	1.2	0.3	20.3	80	0.06	0.05	0.4	2
140. Gooseberry, raw	88.9	0.8	0.2	9.7	290	—	—	—	33
141. Grape, raw dried (Raisins), uncooked	81.4	0.6	0.3	17.3	100	0.05	0.03	0.3	4
142. Grapefruit, pulp, raw	88.4	0.5	0.1	10.6	80	0.04	0.02	0.2	38
143. Guava, entire, raw	83.0	0.8	0.6	15.0	280	0.05	0.05	1.2	242
144. Huckleberry	—	—	—	—	—	—	—	—	—
145. Kumquat, raw	81.3	0.9	0.1	17.1	600	0.08	0.10	—	36
146. Litchi, raw	81.9	0.9	0.3	16.4	—	—	0.05	—	42
147. Loganberry, raw	83.0	1.0	0.6	14.9	200	0.03	0.04	0.4	24
148. Loquat, raw	86.5	0.4	0.2	12.4	670	—	—	—	1
149. Mamey, raw	86.2	0.5	0.5	12.5	230	0.02	0.04	0.4	14
150. Mandarin and Tangerine, raw	87.0	0.8	0.2	11.6	420	0.06	0.02	0.1	31
151. Mango, raw	81.7	0.7	0.4	16.8	4800	0.05	0.05	1.1	35
152. Mangosteen	—	—	—	—	—	—	—	—	—
153. Medlar, raw	74.5	0.5	tr	20.8	—	—	—	—	—
154. Melon (Cantaloop, etc.), raw	91.2	0.7	0.1	7.5	3400	0.04	0.03	0.6	33
155. Mulberry	—	—	—	—	—	—	—	—	—
156. Nectarine, raw	81.8	0.6	tr	17.1	1650	—	—	—	13
157. Orange, peeled, raw	86.0	1.0	0.2	12.2	200	0.10	0.04	0.4	50
158. Papaya, raw	88.7	0.6	0.1	10.0	1750	0.04	0.04	0.3	56
159. Passion fruit, raw	75.1	2.2	0.7	21.2	700	tr	0.13	1.5	30
160. Peach, raw	89.1	0.6	0.1	9.7	1300	0.02	0.05	1.0	7
161. Pear, raw	83.2	0.7	0.4	15.3	20	0.02	0.04	0.1	4
162. Persimmon (Kaki) raw	78.6	0.7	0.4	19.7	2710	0.03	0.02	0.1	11

Name of the nut	Water %	Pro- teins %	Fats %	Carbo- hydrates %	Vitamins (A in international units, others in mg)				
					A	Thia- mine	Ribo- flavin	Niacin	C
163. Pineapple, raw	85.3	0.4	0.2	13.7	70	0.09	0.03	0.2	17
164. Plum, Damson, raw Prune-type, raw	81.1	0.5	tr	17.8	300	0.08	0.03	0.5	—
165. Pomegranate, raw	78.7	0.8	0.2	19.7	300	0.03	0.03	0.5	4
166. Quince, raw	82.3	0.5	0.3	16.4	tr	0.03	0.03	0.3	4
167. Rambutan	83.8	0.4	0.1	15.3	40	0.02	0.03	0.2	15
168. Raspberry, Red, raw	—	—	—	—	—	—	—	—	—
169. Rosehip ( <i>Rosa ragosa</i> ), raw	—	—	—	—	—	—	—	—	515
170. Sapotilla, raw	84.2	1.2	0.5	13.6	130	0.03	0.09	0.9	18
171. Strawberry, raw	—	—	—	—	—	—	—	—	—
172. Watermelon, raw	89.9	0.7	0.5	8.4	60	0.03	0.07	0.6	59
Tangerine, see Mandarin and Tangerine	—	—	—	—	—	—	—	—	—
Watermelon, raw	92.6	0.5	0.2	6.4	590	0.03	0.03	0.2	7

## 120. Akee



120a. Twig and entire fruit (x0.5)

The generic name of akee, *Blighia sapida*, refers to Captain Bligh of the ship the "Bounty". It is a

shrub-like tree 7–25 m tall growing wild in the forests of West Africa and belonging to the family Sapindaceae. Akee is cultivated in West Africa as well as in the West Indies where it was introduced late in the eighteenth century—it was brought in 1778 to Jamaica. Its fruit is a capsule, either yellow or red when ripe and measuring 6 × 3 cm. At maturity, the ovoid, pendent capsule splits by means of three rounded valves which expose three shiny black seeds, each surrounded by a cream-coloured fleshy aril. The edible part of the fruit is the aril of the seed. It may be eaten fresh but it is normally cooked and in this form it resembles scrambled eggs. The pink tissue, the raphe, attaching the aril to the seed, is highly poisonous and care must be taken in separating it from the aril. The poison, the peptide hypoglycin A, also occurs in unripe arils and for this reason only naturally opened fruit should be eaten. The poisoning causes vomiting.

## 121. Apple

Apple is the fruit of many cultivated varieties of *Malus pumila* (Rosaceae), a small tree native to Europe and western Asia which yields wild crab apples. *M. pumila* itself occurs in two varieties: *M. p. var. sylvestris* is a native of northern parts of Europe and western Asia, while the other variety, *M. p. var. mitis*, had its origin in southern Europe and western Asia. Another species of *Malus*, *M. baccata*, is native to eastern Asia; this produces cherry-like fruits which, when ripe, do not possess the remnant of the calyx typical of all the other apples. The cultivated crab apples are a cross between *M. baccata* and the common apple.

The fruit of wild and cultivated apple trees is a special kind of fleshy fruit classified as a pome. This is a berry-like structure but most of its edible part together with the epidermis is derived from the receptacle in which the seedbox of the epigynous flower is embedded. Only a small part of the flesh



(120a) Opened fruit (x1)

A. Seeds

B. Aril

(120) Akee (*Blighia sapida*)

(121a) Crab apple (*Malus pumila*) (x0.3)



originates from the seedbox wall; this mainly forms the cartilaginous centre known as the core which contains the seeds. The core is not edible and sometimes the epidermis is also rejected and peeled off. Thus the part eaten is generally restricted to the flesh derived from the receptacle (torus). The transition between the fleshy part of the receptacle and the seedbox wall is marked by the vascular bundles which originally ran into the sepals and petals and which in the transverse section of the apple form a distinct circle.

Apples were already cultivated in Neolithic times, as is shown by the discovery of stored apple seeds in remains of settlements of the Lake Dwellers in central Europe. The ancient Romans grew about 20 varieties of apple, but today about 7000 varieties exist. Apples have been introduced from Europe and Asia to all other continents, but Europe remains the largest producer, yielding more than half of the world crop. Other large-scale producers include the U.S.A., Australia (especially Tasmania) and South Africa. The large woods of indigenous apple trees in Eurasia disappeared long ago and are found today only in the Caucasus and Turkestan.

In the U.S.A. red apples are the most popular; cultivars include: 'Baldwin' (medium red, usually round), 'Delicious' (medium red but oblong), 'Jonathan' (bright, uniform red, round), 'Rome Beauty' (medium red, round), 'McIntosh' (also medium red and round) and 'Winesap' (dark, uniform red, oblong). Striped red apples include 'Northern Spy' and 'Gravenstein', the latter having been brought from Europe, where it is considered the best apple of North Germany and Denmark. 'Golden Delicious', yellow, conical apples which grow only in warmer climates, are the best apples grown in the U.S.A., while in Britain the best dessert apples are 'Cox's Orange Pippin', 'Beauty of Bath', 'Gladstone', 'Blenheim' and 'James Grieve', the most acid apples. The best English varieties for cooking, on the other hand, are 'Prince Albert', 'Bramley's Seedling', 'Bismarck' and 'Lord



(121b) Crab apple (*Malus pumila*) (x0.3)

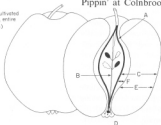


(121c) M.B. (*Malus baccata*)

Derby', while in the U.S.A. 'Spitzenberg' and 'Golden Russet' are grown for cooking. Australia, apart from 'Jonathans', 'Cox's Orange' and 'Rome Beauty', produces the well known green apples called 'Granny Smith' and 'Sturmer Pippin' which are yellow with brownish-red patches.

The large number of varieties of apples is the result of their cultivation in the eighteenth and nineteenth centuries. Only a few new varieties were produced earlier than that, and the oldest, 'Court Pendu Plat', mentioned in the sixteenth century, seems to be a variety cultivated already by the ancient Romans. Varieties known in England from the sixteenth and seventeenth centuries are 'Golden Pippin' and 'London Pippin', the latter also being known as 'Five Crown'. "Pippin" is the general name for red apples brought in the fourteenth century from France to Britain for the production of cider and it is probable that these were the ancestors of the best dessert apples of England, the 'Cox's Orange Pippin'. This variety is the product of a plant breeder, a retired brewer named Cox, who probably developed it from the 'Rabston Pippin' at Colnbrook in 1825 (near what is now

121a Cultivated apple, entire (x0.5)



121b Cultivated apple (x0.5)

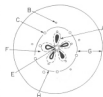
- A Cartilaginous endocarp
- B Central bundles
- C Edible part
- D Remnants of calyx (stamens and pistil)
- E Derived from receptacle
- F Derived from epi- and mesocarp

London Airport). The apple whose fall inspired Isaac Newton to propound the theory of gravity must surely have been the large green 'Flower of Kent'. In mainland Europe the most popular apples are 'Reinettes', but the French claim that they succeeded long ago in the cultivation of the best apple of all—the very old variety, bearing yellowish fruit, called 'Calville Carte Blanche'.

Apples are mainly eaten raw as a dessert fruit, but they are also often cooked in the form of a compote, apple sauce or tart fillings (e.g. Apfelstrudel). Sometimes they are baked whole and served as a sweet, but they are not usually made into preserves because they can successfully be stored fresh for many months.

The starch content of apples is small and varies from 0.2% to 0.4%. The mealy taste of many apples does not result from the presence of starch but of hydrolysed protopectin causing the cells to loosen from each other. Starch is present in comparatively larger quantities in freshly harvested apples, but during storage it is normally almost completely broken down into sugars.

Apples provide the material for the production of beverages: cider and apple brandy (Calvados); and of pectin. They can therefore also be classified as beverage plants and plants for extraction.



121b TS of cultivated apple (x0.5)

- A Carpellary bundles (broken line) connecting the dorsal and ventral carpellary bundles
- B Sepal bundles
- C Petal bundles
- D Dorsal carpellary bundles
- E Ventral carpellary bundles
- F Pericarp
- G Swollen receptacle
- H Border line between the pericarp and receptacle

## 122. Apricot

Apricots are the drupes of *Prunus armeniaca* (Rosaceae). They are borne on a small tree 6–9 m tall, and are native to China, where they have been cultivated since 2000 B.C. Apricot trees were introduced to the Mediterranean region at the beginning of the Christian era, via Armenia and Persia, and the ancient Greeks and Romans were the first European people to cultivate them. They were introduced into northern Europe much later, in the late Middle Ages, and to England not until about A.D. 1500. The name apricot is itself of Arabic and Latin origin, being a corruption of the Arabic article *al* and the Latin word *praecox* meaning precocious (referring to its blossoming).

Apricots are smaller than peaches (see 160) and their pubescence (short hairs on the epidermis) is less, and sometimes even lacking. The flesh is normally orange but there are varieties that are white-fleshed. The seeds are mainly bitter. The cultivated apricots belong to two varieties: *P. a.* var. *mad-*



122 a. Apricot (*Prunus armeniaca*) (x0.5)



122b. L.S. of the fruit  
A. Fleshy mesocarp  
B. Stone developed from endocarp  
C. Seed (cotyledon)

122. Apricot (*Prunus armeniaca*)  
(x0.5)

*schurica* and *P. a. var. siberica*, while the best known Japanese species is *Prunus mume* which has striking double flowers. Nowadays apricots are produced in all countries with a suitable climate—America, Australia, South Africa, etc., but the most important producer is the U.S.A., where 90% of the world crop is harvested. About 90% of the American crop comes from California, while the rest is mainly the product of Washington and Utah.

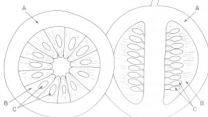
Apricots bloom early in spring, earlier than peaches or plums but later than almonds. The fruit is commercially distinguished according to whether the stone is easily separable from the flesh (free-stone) or not (clingstone). Apricots are eaten fresh, in the form of a jam, or preserved either by canning or drying. The edible part is the fleshy portion derived from the mesocarp. The seed is encased in a woody endocarp, the so-called stone; this is always removed from dried fruit which is sold in halves, and is usually also removed from canned apricots.

In the Far East apricots are often crossed with oriental plums and these hybrids are known as PLUMCOTS.

## 123. Bael

Bael, BEL, or BENGAL QUINCE is the fruit of *Aegle marmelos*, (family Rutaceae), a thorny deciduous tree native to India, where it grows wild as well as

123b. L.S. of the fruit  
A, B, and C as in 123a



123. BAEL or BENGAL QUINCE (*Aegle marmelos*) (x0.5)

123a. L.S. of the fruit  
A. Rind  
B. Mesocarp developed from endocarp  
C. Seeds

cultivated. It reaches a height of up to 12 m and bears subglobose fruit 5–10 cm in diameter. The fruit resembles a citrus fruit, a hesperidium, but its rind is 1.5–2 cm thick and hard. It consists of 10–20 carpels. The pulp filling the carpels develops from the protrusions growing out from the endocarp and is greyish-yellow and mucilaginous when fresh. When it is dried the pulp becomes reddish and hard. The fruit is aromatic, refreshing and has a pleasant taste. It may be eaten fresh, dried or a sherbet may be prepared from it. It is also used for medicinal purposes, for the treatment of diarrhoea and dysentery. As well as in India, bael is cultivated in south-east Asia.

## 124. Banana

Bananas (an African name) are the berries of the monocotyledonous genus *Musa* (family Musaceae). These berries are of a special type, in that the rind, which can easily be peeled off, does not develop from the seedbox wall but from the receptacle in which the seedbox is embedded. *Musa* spp. are native to India and Malaya and it seems that the cultivated bananas are derived from the wild species *Musa acuminata* and *M. balbisiana*. The cultivated species *M. paradisiaca* originated from *M. acuminata*, while the form derived from *M. balbisiana* retained the same specific epithet. The commonest cultivated variety is *M. paradisiaca* var. *sapientium*, which, however, is a triploid hybrid produced by the crossing of *M. acuminata* with *M. balbisiana*.

*Musa* spp. are the largest perennial herbaceous plants. They consist of a rhizome from which arise aerial shoots 3–9 m tall. The stem is in fact a false stem (pseudostem) formed from the bases of leaves tightly rolled around each other. New leaves emerge successively through the pseudostem and crown it. They develop large laminae which normally become torn by the wind into ribbons that



124a. Banana berry (x0.5)  
A. Cork layer  
B. Attachment

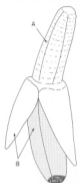


then hang down from the midrib. Only the very last leaf is smaller and protects the single inflorescence, a compound spike which emerges finally through the pseudostem. The inflorescence bears male flowers at its tip, and beneath them, separated by several sterile flowers, are female flowers which in the cultivated banana develop parthenocarpically into the fruits. For this reason cultivated bananas are seedless and the remnants of the ovules appear in the pulp as mere brown patches. The fruits are arranged in combs or hands, separated by several sterile flowers, are female flowers which in the cultivated banana develop parthenocarpically into the fruits. For this reason cultivated bananas are seedless and the remnants of the ovules appear in the pulp as mere brown patches. The fruits are arranged in combs or hands, each formed of 10-20 bananas or "fingers". A single inflorescence may produce 6-15 combs weighing 40-50 kg. The increasing weight of the developing fruits bends the stalk of the inflorescence down and the pendulous fingers (bananas) thus become erect like candles on a chandelier.

Bananas are the only commercial fruit containing a significant amount of starch (3% $\Delta$ ), and there are also even more starchy bananas that are used as vegetables. These are called plantains, belonging mainly to the variety *M. paradisiaca* var. *paradisiaca*, and as well as being eaten cooked, a flour is often prepared from them. Bananas, on the other hand, are mainly eaten raw. Only the pulp is edible, and the rind is always peeled off. Sliced raw banana pulp is used in fruit salads; or the sliced fruit may be dried and the dried slices called "figs". Bananas are sometimes cooked and may even be fried (banana fritters).

The banana was introduced from its native areas of India and Malaya into all tropical countries and became one of the most important food plants of the tropics. Bananas are easily propagated under cultivation by vegetative means, using pieces of the rhizome known as suckers, which are planted in holes almost 40 cm deep. Today the largest producers and exporters of bananas are the small "banana republics" of Central America (e.g. Honduras), 85% of the world's banana supply coming from these areas. Bananas for overseas markets are picked very immature and ripen during shipment while retaining their unripe green colour.

124. BANANA  
(*Musa paradisiaca*)



124b. Extra berry with partly peeled rind (x0.5)  
A. Edible pulp  
B. Rind



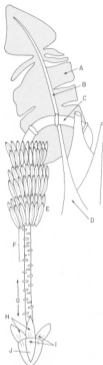
124c. TS of the berry (x0.5)  
A. Pulp (pericarp)  
B. Rind (mesocarp)  
C. Epidermis with stomata  
D. Photosynthetic layer  
Black patches in the centre of the pulp represent the abortive ovules. Otherwise the black dots are the vascular bundles and latex tubules.

Later, when they are stored in their countries of destination, they turn yellow.

As a rule, bananas only grow in tropical regions. The only species that thrives outside the tropics is *Musa cavendishii*, and this will only grow in sub-tropical zones where the night temperature never falls below 18°C. This species grows in Florida, southern Brazil, China, North Africa and, on a commercial scale, mainly in the Canary Islands. In the Canaries there are large plantations of these bananas, which are much smaller than the other types and which become dark brown before they reach the market. For this purely aesthetic reason, European housewives abstained from buying Canary bananas, and the bulk of their produce therefore goes to North Africa, where they are very popular among the Arabs. Despite the fact that the appearance of the dwarf Canary bananas is not attractive to Europeans, their taste is delicious. When and how banana plantations came to be established in the Canary Islands is unknown, but it seems probable that they were introduced there in the nineteenth century, at the same time as they were commercially exploited in the New World.

124d. Inflorescence (x0.075) with a part of the plant in the background

- A. Blade
- B. Midrib
- C. Peduncle of the compound spike
- D. Pseudostem
- E. Fruit developing in two rows
- F. Scars of neutral flowers
- G. Scars of male flowers
- H. Scales
- I. Sterile male flowers
- J. Bud of male flowers



## 125. Barbados Cherry

*Malpighia glabra* (family Malpighiaceae) is known as Barbados Cherry, ACIROLA OF WEST INDIAN CHERRY. It is native to the West Indies and Central America, and there are large plantations of acerolas in Puerto Rico. It forms a dense spreading shrub, reaching 2-5 m in height. The fruits are similar to cherries but each drupe contains three seeds. The

drupes are bright red with 1-3 vertical furrows, and are borne on short pedicels, 1-3 in number, in the axils of the leaves. The unripe fruit is the richest known source of vitamin C (ascorbic acid), containing 1000-4000 mg per 100 g, i.e. at least 20 times as much as an orange. Preserves and jellies are made from the acid fruit, and the juice is used for the enrichment of other fruit materials with vitamin C.



125. BARBADOS CHERRY (*Malpighia glabra*)  
(x 0.35)

## 126. Bilberry

Bilberries are the berries of a dwarf shrub, *Vaccinium myrtillus* (family Ericaceae). The shrub is 20-60 cm tall and has a creeping rhizome from which much-branched erect stems originate. The berries are small, about 8 mm in diameter, dark blue and with a glaucous bloom. Bilberries grow in mountainous woods and on heaths; the plant is native to northern parts of Eurasia and is also called WHORTLEBERRY or BLAEBERRY. The name bilberry is derived from the Danish *boelle-bær*, meaning "ball berry". The small fruits are used for tarts, cakes, pastries and in particular for preserves—bilberry sauce. Raw, fresh bilberries are eaten mainly with milk or cream and sugar.

The North American "bilberries" also belong to the genus *Vaccinium* but not to the species *myrtillus*. All the American species are called BLUEBERRIES and many of them are cultivated whereas the Eurasian bilberries only grow wild. Many of the blueberries are vigorous shrubs up to 4-5 m tall and the berries are up to 2-5 cm in diameter, growing in clusters. The most important cultivated types are HIGH-BUSH, LOW-BUSH and RABBITEYE blueberries. High-bush blueberries, *V. australe*, are 1.2-4.5 m tall with blue, bloomed berries; they are grown



126a. Twig with fruits (x0.5)



126b. Single berries, (x1)

126. BILBERRY  
(*Vaccinium myrtillus*)

mainly in New Jersey, North Carolina and Washington. The low-bush blueberries, *V. lamarkii*, have black berries, also with a bloom, and form the bulk of the commercially grown plants; they are 30-60 cm tall and are grown mainly in Maine, Michigan and Minnesota. Rabbit-eye blueberries, *V. ashei*, are grown from South Georgia and Alabama to North Florida; they are up to 4-5 m tall and their fruit is black with very little bloom. There are various other North American species and these include: CANADIAN blueberries, *V. myrtilloides*, which are a little smaller than *V. lamarkii* (low-bush) and bear smaller, more acid, maroon coloured fruit; EVERGREEN blueberries (*V. ovatum*), which reach a height of up to 6 m, bear black or slightly blue fruits and grow along the coast from Central California up to British Columbia; and MOUNTAINOUS blueberries (*V. membranaceum*), which are 0.9-1.8 m tall with maroon berries and grow especially in Oregon and British Columbia.

## 127. Blackberry

Blackberry or BRAMBLE is the name given mainly to the fruit of *Rubus fruticosus*, a prickly shrub belonging to the family Rosaceae. This shrub yields etaerios of black drupelets, small stony fruits aggregated on a conical receptacle. In spite of the fact that the fruits are drupelets, they are called berries, as are similar fruits of the genus *Rubus* (e.g. raspberry—168). *R. fruticosus* grows in the Eurasian part of the northern hemisphere, while in North America it is substituted by other *Rubus* spp. It is found in woods and hedgerows and its fruit is picked for the fresh fruit market or for canning and jam-making factories. On the other hand, American blackberries are mostly cultivated and belong to species other than *R. fruticosus*. The most widely cultivated species in America are the erect, woody species *R. alleghaniensis*, *R. argutus* and *R. frondosus*. They are mainly grown in Texas, Oklahoma, Arkansas, Oregon, Washington and



127a. Entire blackberry  
half size

127 BLACKBERRY  
(*Rubus fruticosus*)

Michigan. The cultivated American blackberries have also been introduced to Europe, mainly to Great Britain, but only with limited success.

Blackberries are consumed whole, with the receptacle to which its drupelets adhere, but without the calyx. They may be eaten raw, alone or with cream, or cooked in tarts, pastries and preserves. They are often also stewed with apples.

Other species of *Rubus* yield different etarries of drupelets. Apart from raspberries (168) and loganberries (147), which will be discussed separately later, some species, e.g. the Eurasian *R. caesius*, bear DEWBERRIES, consisting of fewer drupelets and having a dew-like bloom. The dewberries are actually the fruits of trailing, creeping blackberries and they are popular in America where they develop from other species and grow larger and more palatable. In the U.S.A. the best known varieties of dewberries are 'Lucretia' and 'Mayes', possibly derived from a cross between *R. bailyanus* and *R. argutus*. *Rubus chamaemorus*, a sub-arctic species spread over the whole of the northern hemisphere, has orange drupelets when ripe and the aggregate fruit is called a CLOUDBERRY. The drupelets of *R. saxatilis* (ROCK BRAMBLE) are garnet-like in colour and those of *R. arcticus*, which is distributed throughout the sub-arctic region, are dark red; both these species are plants with a herbaceous stem.

Blackberries and similar plants of the genus *Rubus* are capable of rapid vegetative reproduction by means of stolons. Some shoots develop enormously in length so that they bend over and touch the ground, and at the point where they touch the soil they develop a bud which becomes rooted. Because of this easy method of vegetative reproduction blackberries grow most often as an unwanted weed; for example, many miles of New Zealand's coastline are overgrown by blackberries which originally were imported and escaped from cultivation.



127b. L.S. of the blackberry (x 1.5)

127 BLACKBERRY (*Rubus fruticosus*)

## 128. Carambola

Carambola, or *Averrhoa carambola*, is a small tropical tree, 5-12 m tall, native to Indonesia. It was originally classified as belonging to the family Oxalidaceae, but was re-classified by Hutchinson (1959) who put it into a new family, the Averrhoaceae. It bears rose-coloured flowers, 8 mm long, in clusters and these develop into fleshy berries 8-12 cm long and 3-6 cm wide. The fruits are yellow, with five pronounced ribs, and are star-shaped in cross section. The flesh is translucent yellow, crisp and juicy and contains brown seeds about 1 cm long. Trees occur with either sweet or acid fruits which are used for fruit salads, jellies, tarts, preserves and in making drinks. Carambola has now spread throughout the tropics but it is unknown even as an imported fruit in temperate regions. In the monsoon countries of Malaysia there occurs another species of *Averrhoa*, *A. bilimbi* (known as BILIMBI), which yields acid berries similar to those of *A. carambola* but green and only slightly 5-ribbed. It is used for making pickles, curries and preserves.



128a. T.S. of the fruit

128 CARAMBOLA (*Averrhoa carambola*) (x 0.3)



128a Twig with a fruit

## 129. Carob

Carob, ST. JOHN'S BREAD, or LOCUST is exceptional in being a dry fruit but belonging to the fruit in the commercial sense. It is the fruit of *Ceratonia siliqua*, a small evergreen tree of the family Leguminosae and native to the eastern part of the

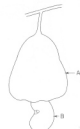
129 CAROB (*Ceratonia siliqua*)129b Part of the pod, L.S. (x10)  
A Lateral cavities  
B Seed  
C Parchment of the seed cavity

Mediterranean region. It has been cultivated in its native countries from ancient times and tradition has it that the Prodigal Son lived on its fruits. However, the association of carob with St. John the Baptist seems to be a misapprehension: St. John lived on the insects called locusts and not on the fruits of the locust tree. The carob or locust is an indehiscent legume, brown and leathery, containing a row of shiny brown seeds which, it is believed, were the original weights used by jewellers (the word "carat" is derived from the Greek *keratos*, meaning fruit of the carob tree). The seeds are embedded in a sweet juicy pulp that contains about 50% dry weight of sugar. The sweet pulp of the dried pods was a popular food in Europe until the beginning of the twentieth century; today they have completely disappeared from European markets. In the U.S.A., where the carob tree was introduced only for the seeds, carob beans are chiefly used for making dog biscuits. They are also used for preparation of a flour used as an additive with wheat flours in American bakeries, or for extraction of a gum which is used in the food industry. But if the carob is used for human consumption as a fruit, only the sweet pulp surrounding the seeds is eaten and the rest is discarded.

### 130. Cashew Apple

Cashew apple is the false, accessory fruit of the cashew tree *Anacardium occidentale* (Anacardiaceae), of which the true fruit is an achene known as the cashew nut. The cashew apple is the enlarged, swollen pedicel, which bears the nut. The "apple" is in fact pear-shaped, about 10 cm long and 8 cm wide, and red or yellow in colour. At harvest the cashew apple is separated from the nut and sold separately as a juicy fruit.

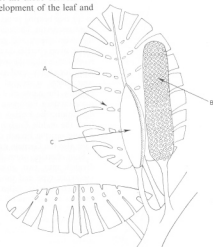
The cashew is native to tropical America but is today cultivated chiefly in other tropical countries. The biggest producers are southern India, Tanzania and Mozambique. In countries where it is

130 CASHEW  
(*Anacardium occidentale*) (x0.5)  
A. Cashew apple  
B. Cashew nut

cultivated the juicy cashew apple seems to be more highly prized than the achene.

### 131. Ceriman

Ceriman is also called MONSTER PLANT, referring to its Latin name *Monstera deliciosa*. It belongs to the family Araceae and is a liana native to monocotyledonous Mexico and Guatemala. As a robust climber, it has a stout stem which bears long-stalked ovate leaves up to 60 cm across. The laminae are deeply lobed and in addition they are perforated. This perforation is unique in the whole of the plant kingdom and develops as a result of disintegrating tissue in the young leaves: the tissue between the veins dies during the development of the leaf and

131 CERIMAN (*Monstera deliciosa*) (x0.175)  
A. Perforated leaf  
B. Spathe covered by berries  
C. Spathe protecting the spathe

thus holes appear in the mature lamina. The plant produces hanging aerial roots up to 2 m long.

The fruits are borne on a spadix 15-21 cm long, and during its development the spadix is protected by a green, hooded spathe. The spadix, covered with tiny berries, is the actual edible part of *Monstera* and has a delicious flavour somewhat like pineapple.

Although ceriman is a tropical plant it has become very popular in North America and Europe as a decorative indoor plant.

## 132. Cherry, Sour

Sour cherry is a drupe borne by *Prunus cerasus* (family Rosaceae), a small tree very closely related to the tree bearing sweet cherries; they are both of Eurasian origin. The sour cherry tree is hardier than the sweet cherry and grows even in Scandinavia where sweet cherries do not thrive. The sour cherry is self-fertile while the sweet is self-sterile. The Latin name for cherry, used as the specific epithet of the sour cherry, is derived from the Greek *kerasos*, possibly the name of a township. The names in some modern European languages have the same derivation: the English name "cherry" is derived from the middle English *cherise* by the loss of the ending *-se*; the French *CERISE* is similar, and perhaps also the German *KIRSCH*.

Sour cherries, normally dark red in colour, are divided into two groups: the clear-juiced or AMARELLE type and those with coloured juice or MORELLO cherries, called GRIOTTE in France. Sour cherries are used mainly for cooking, as a filling for tarts (*Schwarzwälderkerchentorte*), pastries, cakes and dumplings, and for preserving in alcohol, but because of their acidity they are rarely used as dessert fruit.



132. CHERRY, SOUR (*Prunus cerasus*) (x0.5)  
(Morello cherries, amarellas, or griottes)

## 133. Cherry, Sweet

Sweet cherries are much more common in Europe than sour cherries. They are the drupes from about 900 varieties derived from the wild *Prunus avium* (Rosaceae), a native of Europe and western Asia. They are heart-shaped and vary in colour from black to red and yellowish with more or less pronounced reddish shading. There are two types of sweet cherry: the firm-fleshed BIGAREAUX, for example the variety 'Napoleon'; and the soft-fleshed GUIGNES (in French) or GEANS (in English), for example the variety 'Black Tartarian'. The tree that bears sweet cherries is large by comparison with the small sour cherry tree, pyramidal in shape and incapable of self-pollination. Cherries were already known to the ancient Greeks and were mentioned by Theophrastus (ca. 372-287 B.C.). Today the largest producers of sweet cherries are Italy, Germany and Switzerland, and Europe is far ahead of any other continent where cherries have been introduced. They were introduced into North America by early migrants and are now also cultivated in South America, Australia and South Africa. Sweet cherries are chiefly eaten raw, but they are also preserved in syrup, in alcohol, or in the form of jam, as well as being used in the preparation of cakes, pastries and tarts.

Apart from sour and sweet cherries, there is also a type that has an intermediate character. These are called DUKE CHERRIES, and they are believed to have originated from a cross between the sour and sweet cherry. Duke cherries are without commercial importance but are cultivated in gardens for domestic use.

## 134. Cranberry and Cowberry

CRANBERRIES are two species of the genus *Vaccinium* (family Ericaceae). The species *V. macrocarpon* is exclusively native to America, growing in Canada



133a. Pair of cherries



133b. Cherry L.S.

133. CHERRY, SWEET  
(*Prunus avium*) cultivated (x0.5)

and the U.S.A. It is a small shrub bearing bright red berries which are pear-shaped and measure 10–20 mm in diameter. They are cultivated in Scandinavia, mainly in Sweden, and they have also been introduced into Great Britain. *Vaccinium oxycoccos* is another species of cranberry, yielding small berries and native to North America as well as to the northern parts of Eurasia. In America they are misleadingly called "European cranberries". They are borne on a dwarf shrub and the small berries are also called in German MOOSBEEREN (MOSSBERRIES), because the berries, owing to their short stems, appear as if they are produced by the moss which they in fact overgrow. They are not of any commercial value, and in America only the large berries of *V. macrocarpon* are collected or cultivated. Half of the American crop of *V. macrocarpon* is produced on plantations in Massachusetts, where their cultivation began in 1840, and the second largest producer is New Jersey with one third of the crop. Over half of the total crop in the U.S.A. is preserved in the form of cranberry sauce and canned. The cranberries are not eaten fresh because they are too acid.

In Europe, the small cranberries in some regions are substituted by the similar fruit of *V. vitis-idaea*. These are actually native to the whole of the northern hemisphere but in America only the small variety *V. vitis-idaea* var. *minus* grows, while the larger, European variety is *V. vitis-idaea* var. *vitis-idaea*. The variety *minus* has smaller berries and is without commercial importance, while the wild European variety called COWBERRY or FOXBERRY is collected; the latter is a small shrub, at most 30 cm tall. Like bilberry, it has a creeping rhizome with numerous roots and erect stem branches, but unlike bilberry it is evergreen. The fruits are bright red berries 8–10 mm in diameter. It grows in huge quantities, mainly in Alpine countries, northern Germany, Czechoslovakia and Sweden, while the small cranberry, or "mossberry", occurs in greater numbers in Estonia and Finland. Cowberries are made into a sauce which is inaccurately labelled for

134a *Vaccinium vitis-idaea*134b *Vaccinium oxycoccos*134. CRANBERRY  
(x 0.5)

export as cranberry, and they are also collected for domestic production of "cranberry" sauce which is served mainly with venison, hare, pickled beef, turkey, etc. "Mossberries" are used only for adulteration of cowberries, being mixed with them in "cranberry" sauce. The foxberries are called in German PREISELBEEREN which is a name taken over from Slavonic languages. The Russian name for foxberry is BRUSNIKA, the Poles call it BRUZNICA and the Czechs BRUSINKA.

### 135. Currant

The currants, *Ribes* spp. belong to the family Saxifragaceae. The cultivated currants are native to northern Europe and Siberia and their cultivation began before 1600, mainly in the Netherlands, Denmark and around the Baltic Sea. In the early seventeenth century the currants cultivated in Europe were taken to North America where there are other native species of *Ribes* which are, however, of little use. Currants are deciduous shrubs without spines, growing to no more than 2 m in height. The fruit is small, about 5 mm in diameter and forming a racemose infructescence. Blackcurrants are produced by the species *R. nigrum*, while the other Eurasian species, *R. rubrum*, *R. petraeum* and *R. sativum* are involved in the ancestry of red and white currants; the white type is merely a variant of *R. sativum*. In America there is another indigenous blackcurrant, *R. americanum* (syn. *floridum* or *missouriense*) but it is without commercial importance. The growing of blackcurrant as well as of the closely related gooseberry is forbidden in most of the states of the U.S.A. because they are the alternative hosts for a serious pest, the blister rust of the white pine.

The name currant has been taken over from the small seedless grapes used for the production of the special dried fruit of that name. It is a corruption of the name of the Greek port, Corinth, and it acquired its double meaning because of the similarity



135a White currant (x 0.5)



135b Red currant (x 0.5)

135c Black currant (x 0.5)  
135. CURRANT (*Ribes sativum*)

135a. Entire berry  
(xO 75)135b. T.S. of the berry (xO 75)  
A. Pedicarp  
B. Seed  
C. Sarcotesta135. CURRANT (*Ribes sativum*)

between the racemes of *Ribes* and Corinthian grapes.

The berries of currant are eaten raw or in cakes, tarts and pastries; they are used to produce a jam and frequently a drink is made from them. Blackcurrant is valued for its high vitamin C content (it contains 200 mg per 100 g of fruit). In France, blackcurrant is used for the production of a special syrup sold as *cassis*, which is a famous product of Dijon and is chiefly added to white wine.

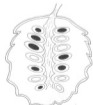
### 136. Custard Apple

Custard apple is the fruit of *Annona squamosa* (family Annonaceae), a small tree which, like all other species of *Annona*, bears edible fruits. *Annona* spp. are native to tropical America and their fruit is actually an etaerio of berries which, together with the fleshy receptacle and pistils, fuse together into a single heart-shaped structure. This has a scale-like covering and resembles a coniferous cone. The fruit of *A. squamosa*, known also as SWEETSOB or SUGAR APPLE, is 7–10 cm in diameter, yellowish-green and covered with fleshy tubercles representing the loosely adhering carpels. When ripe the fruit has a whitish or bluish bloom. The edible, custard-like, granular pulp is white and the seeds are embedded in it. Each berry is uniloculate and single-seeded. The aggregate berries in *A. squamosa* retain their individuality in the fruit and in this way the fruit differs from that of all other species of *Annona*. The pulp contains 16–18% sugars. Custard apples are usually eaten raw as a dessert fruit; they are very perishable and for this reason they are an almost unknown fruit in temperate regions.

The name custard apple is also given to a very similar fruit, *Annona reticulata*, otherwise known as BULLOCK'S HEART.



136a. Entire fruit (etaerio of berries)



136b. L.S. of the fruit

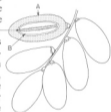
136. CUSTARD APPLE (*Annona reticulata*)  
(xO 5)

### 137. Date

Dates are the single-seeded berries of *Phoenix dactylifera*, of the monocotyledonous family Palmae. The date palm is a tall tree reaching a height of up to 30 m and its stem, typically unbranched, is covered with the remains of the leaf petioles. The pinnate leaves form a crown. The adventitious roots are enormously long and grow mainly in the upper layer of the soil; in Egypt they usually grow in association with a mycorrhiza. The date palm is dioecious and produces in the leaf axis male or female inflorescences which are much-branched panicles. Initially, the inflorescences are completely covered by a fibrous spathe from which they later emerge. Under cultivation, the female flowers are artificially pollinated from the male inflorescence which is detached for this purpose and hung up over the female inflorescence.

Dates were already cultivated by the Babylonians and thus they were actually the first people to recognize the significance of sexual reproduction in plants. The origin of the date palm is unknown, but it appears to be native to India rather than to the Arab countries, in spite of the fact that the latter have, for many thousands of years up until the present day, been the most important date-growing regions. The Arabs introduced the date palm to North Africa and even to Spain, but Malaga is the only place in Europe where date palms yield fruit. Today date palms are also cultivated in California, Arizona and Mexico.

The date palm requires a high temperature and dry air, and they therefore form the typical vegetation of the deserts of the Middle East and Sahara. Their berries, often wrongly called drupes, are elongated structures with a single hard seed easily mistaken for a "stone"; the hardness of the seed is due to the sclerenchymatous endosperm, and its heavily thickened cell walls contain food reserves for the seedling in the form of hemicellulose. The hard, cylindrical endospermous seed is covered by a brown papery testa and it has a deep longitudinal

137a. One of the dates shown in L. 5.  
A. Fleshy pericarp  
B. Seed of the berry  
C. Deep furrow of the seed137. DATE (*Phoenix dactylifera*)  
Fruit (xO 5)

groove on one side. A circular patch on one end of the seed marks the position of the embryo. The fleshy, edible pericarp, when dried, contains 65–70% sugars, mainly sucrose. A lower sugar content occurs in the types of dates called soft and semisoft; they have firmer flesh which does not dry as easily as that of the normal "dry" dates. However, the sugar in soft and semisoft dates occurs in sufficiently high concentrations to prevent decay and they can be stored successfully. Dry dates can be softened again by soaking in water. Dates are eaten either fresh or dried as a table fruit, and they are often used in confectionery and in the preparation of pastries. In the Arab world they are sometimes still used as a substitute for money.

All the parts of the date palm are used by the Arabs for some useful purpose, and it is said that there are about 800 different uses, largely because it is almost the only plant available to the inhabitants of the desert in hot countries. Cultivated date palms are propagated vegetatively because otherwise they would lose their required qualities. The single-stemmed date palms are also the result of human labour: many additional stems arise from shoots at the base of the primary stem, and if these are not cut off the date palm becomes many-stemmed like a candelabra.

The name date is derived from the Greek word *dactylos*, meaning finger, referring to the oblong berries borne in clusters. The specific epithet *dactylifera* has the same derivation.

### 138. Durian

Durian, *Durio zibethicus*, is a tropical tree native to Malaysia, belonging to the family Bombaceae. It reaches 30 m in height and has a spiny fruit weighing up to 4 kg. The fruit is an ovoid capsule, taking three months to develop, and it opens by means of 5 valves. When it is ripe, it drops from the tree and turns rancid if it is not eaten within a short time. The edible part is the aril which is cream-



(137b) Seed, side with the deep furrow  
(137c) Seed, opposite side marking the embryo by a small patch  
(137d) Seed, T.S. showing the embryo

(137) DATE (*Phoenix dactylifera*)  
Fruit (x0.5)

coloured and associated with the large seed. The fruit, when ripe, gives out an abominable stench reminiscent of rotten vegetables or bad drains, and only people who are able to endure the odour can enjoy the quality of the fruit. Wallace, co-author of the Darwinian theory of evolution, was evidently one such person, and wrote of the durian: "It was worth a journey to the East, if only to taste of its fruit".

### 139. Fig

Edible figs are the multiple or compound fruits of *Ficus carica*, a member of the family Moraceae. The plant is a tree or shrub native to Asia Minor, from where it spread into the Mediterranean region. It was known to the ancient Egyptians in 4000 B.C. and later Herodotus (ca. 485–425 B.C.) wrote about its cultivation.

The best known cultivated varieties are the common or Adriatic fig and the Smyrna fig. The common fig produces seedless fruit by parthenocarpy, while the Smyrna fig must be pollinated, in spite of the fact that it does not develop any male flowers. The figs are pear-shaped structures formed from the rolled up discs of the capitula, so that the florets of the capitulum occur inside the structure and are not visible from the outside. The capitulum communicates with the outside by a small aperture at the top of the fig. The female florets develop into the actual fruits, tiny achenes, which are mistaken by the layman for seeds. The achenes inside the fig represent the infructescence and the edible part is the swollen, fleshy disc of the capitulum forming the wall of the fig. The fig is thus a multiple fruit developing from a whole inflorescence and is defined as a syconium (*sycon* in Greek means fig).

In the case of the Smyrna fig, which lacks staminate flowers and which is unable to produce fruit by parthenocarpy, pollen must be transferred from the wild "caprifig" which develops flowers of both sexes. This transfer of pollen is carried out by



(138) DURIAN (*Durio zibethicus*) (x0.3)  
Fruit (capsule)



138a. Entire inflorescence ( $\times 0.5$ )

A. Pore  
B. Florets  
C. Fleecy receptacle  
D. Bracts

139. FIG (*Ficus carica*)

a wasp, *Blastophaga psenes*, which lays its eggs in the ovaries of the caprifig. If the wasp happens to enter a Smyrna fig, it is unable to lay its eggs in the ovaries, but it transfers pollen from the caprifig to the stigmata of the Smyrna fig and fertilization, i.e. the production of fruit, takes place. The wasp is lured into the Smyrna figs by the attachment of branches of the caprifig to the Smyrna fig tree, a method called caprifigation. If the Smyrna fig is introduced into a new country, the caprifig and also the wasp *Blastophaga psenes* must be introduced with it.

There is another type of fig, called the San Pedro type, which is grown in California and which produces its first crop without pollination but requires caprifigation to produce the second. All types of fig yield a crop at least twice yearly, and the caprifig gives three crops, each of them after pollination.

Figs are grown in the Mediterranean regions of Syria, Egypt, Algeria, Turkey, Morocco and Europe. In Europe the main producer is Spain, chiefly in the provinces of Huelva, Malaga, Murcia, Huesca and Majorca, the largest island of the Balearics. The figs cultivated in Spain are mostly common figs except for the *uron* figs, a kind of Smyrna fig cultivated in the south of Granada. In Italy the largest centre is near Naples and the most popular kind is a type called *DOTTATO*. In Greece the centre of the fig industry is the port Kalamai on the southern shores of the Peloponnese in the gulf of Messina. Turkey is the home of the Smyrna figs which are cultivated in the Meander valley for preservation by partial drying, while those that are grown for fresh consumption are known as *BARDAJIC* figs. Portugal is the European country producing the least figs, and here they are cultivated only on the southern coast of the province Algarve with the centre Faro in the Gulf of Cadiz.

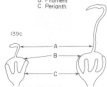
Figs were introduced from Europe to North America as early as 1600 but commercial cultivation did not start until about 1900. The names have been altered—so that Smyrna fig is known in the U.S.A. as *KALIMYRNA*, and the Italian *dottato* as

KADOTA; *SAN PEDRO* originated from the Italian *SAN PIETRO*, etc. The largest centre of cultivation in America is in California. Figs thrive only in the hotter parts of the moderate zones while in tropical countries they can be cultivated only at higher altitudes.

Figs are consumed either fresh or dried. The ordinary, dried figs are compressed and threaded together on a string passed through the centre of each to form a ring; these are called string figs. Luxury figs are not compressed and only partially dried, thus preserving their natural shape.

In Roman times, according to Pliny, figs formed an important part of the diet for slaves, while the better kinds (e.g. those from Ebusus—today Ibiza) were eaten only by epicures. The situation has not changed much and figs are still the "poor man's food".

Figs are used as a coffee substitute and also as a laxative; their leaves are smoked with opium. The large, 3–5-lobed leaves have a structure somewhat similar to the human hand, and for this reason they were frequently depicted in early Christian paintings and sculpture, hiding the external genital organs.

139. FIG (*Ficus carica*)139a. Male flower  
A. Anther  
B. Filament  
C. Perianth139c. Short styled flower  
A. Style  
B. Ovary  
C. Perianth

139d. Long styled flower

139. b, c, and d. Three types of flowers (highly magnified)

## 140. Gooseberry

Cultivated gooseberries are derived from *Ribes uva-crispa* or *R. grossularia*, a spiny shrub closely related to currants. However, in modern nomenclature the generic name has been altered and the gooseberry is called *Grossularia reclinata*. Gooseberries belong to the family Saxifragaceae and they are native to northern Europe and Siberia. They bear berries embedded in the torus and varying according to the variety; they may be smooth or hairy, and green, yellow, pale red or dark red. They have a good flavour when properly ripe, but their commercial importance is declining. Gooseberries were firmly established in English gardens before 1600 and in 1672 an anatomical drawing of the

140a. Glabrous berry ( $\times 0.5$ )140b. Hairy berry ( $\times 0.5$ )140. GOOSEBERRY  
(*Ribes uva-crispa*)

plant was published by the founder of plant anatomy, Nehemiah Grew, in his book "The Anatomy of Vegetables Begun". Thus the gooseberry was one of the first fruits to be studied microscopically.

Gooseberries were introduced into North America, but without much success. The climate does not permit the cultivation of European gooseberries while the American species, *R. hirtellum* and *R. missouriense*, are not good enough for consumption. However, crosses were produced in America between indigenous species and European varieties, but these cannot be eaten fresh and are always used for jellies, jams and pie fillings. Probably the only exception is the type 'Poorman' which is edible in the fresh state like European gooseberries. Another obstacle to the cultivation of gooseberries in America is the fact that they are the alternative host of the blister rust parasite of white pine (this has already been mentioned in connection with another *Ribes* sp., the currant—135).

The failure in cultivation of the gooseberry in America deprived the American people of a cheap fruit which was greatly improved in England in the nineteenth century. In continental Europe gooseberries are much less popular than in England and nowadays they tend to be superseded by more luxury fruits, mainly imported from overseas.

The edible part of the gooseberry is not only the pericarp but also the sarcotesta, the gelatinous covering of the seeds which is derived from the outer integument. The name gooseberry is a corruption of *Krausbeere*, a German name meaning "curly berry".

## 141. Grape

The grape is a true berry borne by a vine of the genus *Vitis* (family Vitaceae). There are about 60 species and varieties of grapevine and all grapes cultivated before 1880 (when the French vineyards were completely devastated by the insect pest *Phylloxera*) were derived from the wild variety,



140c. T.S. of the berry (x1)  
A. Pericarp  
B. Placenta  
C. Seed with sarcotesta



140d. Seed (highly magnified)  
A. Seed  
B. Sarcotesta

140. GOOSEBERRY  
(*Ribes uva-crispa*)

*Vitis vinifera* var. *sylvestris*. This plant grows in the Mediterranean region and is found even in the valley of the Danube and Rhine; however, it seems that it was native to the Caspian Sea region, from which it was introduced into the Mediterranean in very ancient times. The Egyptians cultivated the vine 6000 years ago and great success in the production of new varieties was achieved by the ancient Greeks and also by the Romans, who introduced the grapevine to the colder parts of Europe.

Since the infestation by *Phylloxera*, all European grapevines have been grafted on to American stock, because it was discovered that the American species of grape, *Vitis labrusca*, *V. aestivalum*, *V. vulpina*, etc. resist this parasite. Thus, almost all vineyards throughout the world consist of vines whose rooted part is of American origin while the leafy and flowering part is developed from European scions.

Grapes, which grow in bunches (panicles) may either be eaten fresh or their juice used for the production of wine. In general the grapes used as table fruit are of a different kind from those cultivated for wine-making. An exception is the variety 'Petit Gamay', the source of Beaujolais wine as well as of a delicious black table grape. Other grapes, used solely as dessert fruit and originating in France, include the black 'Alicante', white 'Golden Chasselas of Fontainebleu', 'Napoleon', 'Bicane Chasselas' and 'Rose Chasselas' and also the very popular white French dessert grapes, 'Vibert Chasselas' and 'Royal Madelaine'. In Spain the white ovoid grapes, 'Almeria' are cultivated as a table fruit and from Italy come the elongated, date-shaped 'Regina' grapes; 'Rozaki' grapes from Greece and 'Bolgar' grapes from Bulgaria are very similar to the Italian 'Regina'. Popular dessert varieties in the U.S.A. include 'Flame Tokay', 'Emperor', 'Thompson Seedless', 'Ribier', 'Malagas' of California, etc. During the first half of the year the markets of the northern hemisphere are supplied by grapes from South Africa, Australia and South America (Chile, Uruguay and Argen-



141a. A panicle of grapes (x0.5)

141. GRAPE  
(*Vitis vinifera*)

tina) and then towards the end of the summer from Algeria, Egypt and Israel, while Belgium and the Netherlands supply excellent white and black grapes from their glasshouses the whole year round.

Another form in which grapes are consumed is in the dried form known as RAISINS. Raisins are produced from special grapes growing in warmer countries and containing larger quantities of sugar which makes them unsuitable for wine-making. These grapes, which can obviously also be eaten fresh, have been used for the production of raisins from the most ancient times and were mentioned in the Bible. The best varieties of raisin are 'sultanas', produced from 'Thompson Seedless' grapes which are quite large and pale yellow, and 'currants', small, blackish, seedless raisins of which the name is a corruption of Corinth, the Greek port from which currants are shipped. This variety has been produced in Greece from the first century A.D. Other varieties are the white, oval 'Kishmish' and the smaller, black 'Muscat' which are used as dessert raisins. Raisins originally came to Europe from Greece and the Levant, and the biggest producers were Turkey and Greece, but today the U.S.A. has become the largest producer. Raisins are mainly used as flavouring materials, added to bakery and patisserie products and in confectionery. They are also often used as a beverage material in wine-making instead of fresh grapes.

Another way in which grapes are commonly used is in the form of grape juice or grape must. Grape must is produced in all wine-growing countries as an alcohol-free or only very slightly alcoholic drink.

Besides the grapes, the leaves of the vine are sometimes used for human consumption. For example, in Greece and Turkey vine leaves are stuffed with rice, minced lamb and seasoning, in which form they are known as *dolmas*.



141b. Berry of grape vine, L.S. (x1)  
A. Skin  
B. Seed  
C. Central bundles



141c. T.S. of the berry (x1)  
A. Peripheral vascular bundles  
B. Seeds  
C. Two central vascular bundles

141. GRAPE  
(*Vitis vinifera*)

## 142. Grapefruit

Grapefruit is borne by *Citrus paradisi*, a tree 10–20 m tall belonging to the family Rutaceae. The grapefruit itself is a berry-like fruit classified, as are all other citrus fruit, as a hesperidium. The hesperidium has a separable rind which is easy to peel off (unlike the rind of a pepo, e.g. cucumber), and which develops from the epicarp and mesocarp. The pigmented part of the rind is called the *flavedo* and consists of the epidermis and several layers of tissue beneath it. It originates from the epicarp and contains many essential oil glands which also appear, though less frequently, in the *albedo*—the whitish part of the rind derived from the mesocarp. The juicy part of a hesperidium consists of segments filled with juice sacs developing from the endocarp. The juice sacs originate as multicellular hairs arising from the inner surface of the membranous endocarp limiting the segments; later they become filled with juice and obliterate the loculi of the seedbox. Grapefruits are globose and large (8–15 cm in diameter), and are normally yellow in colour when ripe; in some varieties the rind is thin, in others it is thick.

The origin of the grapefruit is uncertain, but it seems probable that it was developed in the West Indies from a cross between the sweet orange (*Citrus sinensis*) and *Citrus grandis*, known as SHADDOCK or PUMPELO (POMELO). This is a native of Thailand and Malaysia and it was introduced to the New World in the seventeenth century. It was named after a captain in the East India Company called Shaddock who brought it to Barbados. Shaddock is a globose or pear-shaped hesperidium measuring 10–30 cm in diameter. The name grapefruit first appears in records of 1814 from Jamaica. The chief surgeon of the Napoleonic army introduced grapefruits into Florida in the nineteenth century but no other records of the fruit have survived until 1880, when they began to be commercially exploited, and in Europe grapefruit became a common imported fruit between the two World

142a. Entire



142b. T.S. of the fruit

142. GRAPEFRUIT  
(*Citrus paradisi*) (x0.5)

Wars. Its varieties include the seedless grapefruit, 'Marsh' or 'Marsh Seedless', containing no seeds or only a few (up to 8), and 'Pink Marsh', a variety with pink flesh.

Grapefruits are usually eaten raw and very often for breakfast. They may be canned, either as segments or as expressed juice.

### 143. Guava

Guavas are juicy berries produced by *Psidium guajava*, a small tree or shrub of the family Myrtaceae. The plant is native to tropical America and was cultivated by the Incas long before America was discovered by the white man.

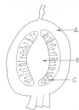
The berry is ovoid or pear-shaped, 4–12 cm long, and the colour of the epicarp varies from pale green to pink. The flesh, derived from the mesocarp, endocarp and fleshy placenta, is white, yellow, pink or red. The ovary is inferior so that the persistent calyx appears on the top of the fruit and forms a conspicuous structure typical of guavas. The fruit is 4–5-locular and the numerous seeds, embedded in the flesh, are small and reniform, each measuring 3–5 mm in length. The fruit is one of the richest in vitamin C, containing 242 mg per 100 g, and some varieties are also rich in vitamin A. The Allied armies in the Second World War were supplied with guava juice as a source of vitamin C.

Guavas are eaten raw or preserved. For canning, they are first peeled and cut into halves, and the seeds may be removed. They are also preserved in the form of jellies, jams or even paste, and the best jelly is made from sour wild guavas. Sometimes they are stewed and used as pie fillings.

The commonly cultivated and best known guava is the variety *Psidium guajava* var. *pyrifolium*, but other varieties and species are also cultivated. These include *P. guajava* var. *pomiferum*, red guavas with apple-shaped fruits, and *P. cattleianum* or *P. littorale*, the purple guava native to Brazil, with small, round, purple fruits, 3 cm in diameter.



143a Entire fruit (berry)



143b L.S. of the fruit  
A. Pericarp and torus  
B. Placenta  
C. Seeds embedded in pulp derived from endocarp and fleshy placenta

143. GUAVA (*Psidium guajava*) (x0.5)

Guavas were introduced to the palaetropics at an early date; by Spaniards across the Pacific to the Philippines and by the Portuguese across the Atlantic to India. From these regions they spread through all tropical and subtropical countries (Malaya, Indonesia, Burma, etc.).

### 144. Huckleberry

Huckleberries are the fruit of *Gaylussacia baccata*, the black huckleberry of the family Ericaceae. The plant and its fruit are similar to the blueberry (the American bilberry). It is a shrub about 1 m tall, growing wild in North America. It is not cultivated and is not collected for commercial exploitation. The red flowers, and later the black fruits, appear in short, dense, drooping clusters or racemes. The fruit, despite its external similarity to blueberries, is not a berry but a drupe containing 10 stones. The common name huckleberry is a corruption of "hurtleberry", a synonym for whortleberry (bilberry), derived from the French *hurtle*. It received its generic name in honour of the French chemist and physicist, Louis Joseph Gay-Lussac.



144a

144a. Entire fruit (drupe) (x0.5)  
pointed calyx



144b

144b T.S. of the fruit (x4). A. Stones



144c

144c. Seed, L.S. (Highly magnified)  
A. Endocarp  
B. Testa  
C. Endosperm  
D. Embryo

144. HUCKLEBERRY (*Gaylussacia baccata*)

### 145. Kumquat

If they were still considered as belonging to the genus *Citrus*, kumquats would be the smallest of the citrus fruits. However, they have now been reclassified and placed in the genus *Fortunella* (Rutaceae), differing from the genus *Citrus* in having 3–5-locular fruits with two ovules per loculus, as well as dwarf fruits measuring only about 2.5 cm in diameter. The flesh of *Fortunella* is acid but the rind is sweet and the whole hesperidium can be eaten together, either fresh or preserved in syrup. The best known species are *F. japonica* and *F. margarita*, cultivated in China and Japan and native to China. Fortunellas are often cultivated for decorative purposes as ornamental plants.



145. KUMQUAT (*Fortunella* spp.)  
Twig with a fruit (x0.3)

146a Entire fruit

146b L.S. of the fruit  
A: Shell (Pericarp)  
B: Aril  
C: Seed**146. Litchi**

Litchis are true nuts borne by the tree *Litchi chinensis* or *Nephelium litchi* (family Sapindaceae), a native of southern China but grown chiefly in Bengal. The spherical nuts, measuring over 2.5 cm in diameter, are borne in clusters (panicles) and have a brittle red pericarp covered with tubercles. The edible part of the nut is not the seed but the aril which surrounds it. The aril consists of a juicy, translucent material covering the large single seed, which is shiny and dark brown and without any use. The arils are usually eaten raw and fresh, but they are sometimes dried; the term "litchi nut" is commonly used only for the nuts with the dried aril inside. The arils can also be obtained canned, but the nuts stand up to transport very well and nowadays they are frequently available in European markets.

146. LITCHI (*Nephelium litchi*) (x0.5)147 LOGANBERRY  
(*Rubus loganobaccus*)  
(x0.5)**147. Loganberry**

Loganberries are etaerios of drupelets like blackberries and raspberries. They are the fruits of *Rubus loganobaccus* (Rosaceae), a shrub that originated in the U.S.A., in the garden of a Judge Logan at Santa Cruz in California in 1881. According to research carried out in England, loganberries are derived from a cross between an American variety of blackberry, 'Aughinbaugh', and a raspberry. Some botanists hold the opinion that the loganberry is a variety of *Rubus ursinus*, but this view is probably without foundation. Loganberries, considered outside the English-speaking countries as being rather poor in flavour, are eaten raw or in the form of jams and other preserves.

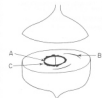
**148. Loquat**

Loquat, *Eriobotrya japonica*, is an evergreen tree 5-10 m tall, belonging to the family Rosaceae. It is

native to China, Japan and northern India but today it is cultivated in many other parts of the world, e.g. in the Mediterranean region, Florida and California. The fruits of *E. japonica* are small (3-8 cm long), pear-shaped, yellow, downy pomes with a persistent 5-lobed calyx and 2-4 black, stony seeds. The pomes are eaten either fresh or in the form of jams, jellies or sauces, and in Bermuda an alcoholic drink is prepared from them. The largest producer of loquats is Japan, where the fruit is very popular, and for this reason it is often called JAPANESE MEDLAR. The stony seeds have a pleasant flavour and are used in cooking (see Medlar, 153).

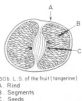
148a L.S. of the pome 148b T.S. of the pome  
A: Pericarp and torus  
B: Seed**149. Mamey**

Mamey or MAMMEY APPLE is known botanically as *Mammea americana*. It is an evergreen tree of the family Guttiferae, native to tropical Central America and the West Indies, growing up to 15 m in height. The fruit is little known outside its native region; it is commercially exploited mainly in Cuba, where a preserve is manufactured from it. It is a drupe about the shape and size of an orange with a russet surface covered with small spots. The rind is tough and is about 4 mm in thickness. Beneath the rind is a yellow, edible flesh and the brown endocarp, 2-5 mm thick, is fused with the testa. The seed develops in only one loculus out of the three, while in the remaining two loculi the seed degenerates but the endocarp develops.

149. MAMEY (*Mammea americana*)  
T.S. (x0.5)A: Developed seed  
B: Degenerated seeds (only endocarp developed)  
C: Stone**150. Mandarin, Tangerine, etc.**

Mandarins and similar fruits are hesperidia of a small tree, *Citrus reticulata* (or *nobilis*), of the family Rutaceae, which seems to be native to the southern part of the former Indochina (Cochin-China). It has been cultivated for a very long time in China and Japan, but was introduced very late into Europe—not until the beginning of the nineteenth

150a. TANGERINE, etc. hesperidium  
150b MANDARIN, TANGERINE, etc.  
(*Citrus reticulata*) (x0.5)



150b. L.S. of the fruit (tangerine)  
A. Rind  
B. Segments  
C. Seeds



150c. UGLI L.S. a cross between *Citrus reticulata* and grapefruit (x40-5)  
150. MANDARIN, TANGERINE, etc.  
(*Citrus reticulata*) (x10-5)

century. There are many varieties of *C. reticulata* which may be divided into three groups: MANDARINS, TANGERINES and SATSUMAS. Satsumas are the commonest variety cultivated in Japan and are also the hardiest variety; they are also sold on European markets, but tangerines are more popular. The group of tangerines includes, among others, the variety CLEMENTINE which originated in Algeria. Tangerines have a deep orange-red flavoured, while that of mandarins is yellow or pale orange. The fruit of tangerines is much smaller than that of the orange (157) and is popular for its easily separable rind. Mandarins, tangerines, etc. are mainly eaten fresh and have a flavour similar to oranges.

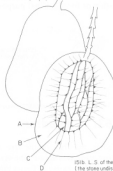
A fruit called UGLI has been produced from a cross between *Citrus reticulata* and *C. paradisi*, the grapefruit, and is cultivated in Jamaica.

## 151. Mango

Mango is the fruit of *Mangifera indica* (Anacardiaceae), a tree about 25 m tall, cultivated chiefly in India but probably native to the more eastern parts of Asia. The mango tree is venerated in the Hindu religion and its drupes are as popular in India as apples are in Europe. The fruit develops in highly branched terminal panicles and is a drupe, ovoid-oblong in shape and usually beaked. If the beak does not develop, the apex can be recognized by the scar of the style. The size of the fruit varies from 3 to 38 cm along the long axis. The colour of the ripe fruit is a mixture of green, yellow and red patches. The edible part is the fleshy mesocarp, while the thick epicarp and the woody endocarp, enclosing the exalbuminous monoembryonic or polyembryonic seed, are the inedible parts. Mango is used as a dessert fruit as well as in the form of a juice, jam, jelly or preserve. The unripe fruit is used as an ingredient in chutneys and pickles. Mango has been cultivated in India for more than 4000 years and had been introduced into East Africa by

the Persians by the tenth century A.D.; in recent times it has been introduced into tropical America and West Africa.

151a. Entire fruit (drupe)



151b. L.S. of the fruit (the stone undissected)  
A. Epicarp  
B. Mesocarp  
C. Endocarp  
D. Mass of fibres extending from the endocarp into flesh

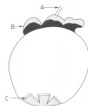
151. MANGO (*Mangifera indica*) (x10-5)



151c. Stone, L.S.  
A. Stone  
B. Testa  
C. Exalbuminous embryo  
D. Origin of fibres

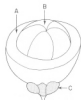
## 152. Mangosteen

Mangosteen is the berry of *Garcinia mangostana* (Guttiferae), a small tropical tree growing up to 10 m tall and native to Malaysia. It is found frequently in Java and Sumatra but grows also in the neighbouring countries—the Philippines, Ceylon, etc. Attempts to introduce it into other tropical countries have failed and neither is it exported, despite the fact that people who eat it say that it is one of the tastiest tropical fruits. The pericarp is not edible and is marked with flattened sessile stigmas. The berry is of the size of a small apple (q.v.) and has a reddish-purple colour. Its pulp consists of the aril of the seeds, forming segments similar to the segments of the citrus fruits. These segments, the edible portion of the fruit, vary in number between five and eight. The inedible pericarp is hard and



152a. Entire berry  
A. Peduncle  
B. Fleshy calyx  
C. Flattened stigmas

152. MANGOSTEEN  
(*Garcinia mangostana*) (x10-5)



152c. T.S. of the fruit  
A. Pericarp  
B. Fleshy segments  
(5-8) of aril  
C. Fleshy calyx

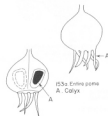


152b. Entire berry  
A. Flattened stigmas

152. MANGOSTEEN [*Garcinia mangostana*] (x0.5)

### 153. Medlar

Medlar, the fruit of the tree *Mespilus germanica* (Rosaceae), was at one time very popular in central Europe. It is native to Persia but was already grown in Europe in Roman times. The fruit is a pome but its seeds are stone-like because of the hardening of the endocarp. The pomes ripen very late; they should be picked late in November and then stored for 2 or 3 weeks before they can be eaten. The fleshy part of the medlar is not especially palatable, and if they are heard of at all nowadays, it is as jam that is prepared from them.



153a. Entire pome  
A. Calyx

153b. L.S. of the pome  
A. "Stone" (pyrene)

153. MEDLAR  
(*Mespilus germanica*) (x0.5)

### 154. Melon

Melons are the fruits of many varieties derived from the vine species, *Cucumis melo* (Cucurbitaceae). Today melons are cultivated all over the world, but their origin is uncertain. It seems that they were unknown to the ancient nations of the Mediterranean area, and possibly originated in Africa, where wild melons still grow. Some authors believe that melons were already cultivated by the ancient Egyptians and that they were introduced to Europe from India. However, it seems more probable that they originated in Africa and were

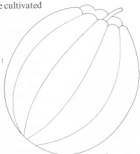
#### IV. FRUIT

introduced much later from Europe to Asia. In any case, it is at least certain that melons were cultivated by the Moors in Spain.

154b. CANTALOUPE (x0.5)



154a. OREN (x0.5)



The melon is a berry-like fruit called a pepo and its rind, developed from the receptacle, is inseparable from the fruit. Its different varieties can be classified into four groups. (1) CANTALOUPEs are cultivated in Europe and have a thick, warty rind, which is yellow, while the flesh is brownish. The name cantaloupe is derived from the township Cantalupo, near Rome, where this variety originated. (2) MUSK-MELONS are cultivated chiefly in America. They are smaller than cantaloupes and their rind is finely netted to nearly smooth. (3) The CASABA MELONS have large fruits and smooth, splashed or striped yellow rind. This group includes the HONEYDEW melons with their ivory rind and pale green flesh. (4) The fourth group includes melons grown in India, China and Japan. These are the types used as vegetables, and they are elongated, resembling the cucumber.

Melons contain many small seeds, 5-15 mm long, and they are propagated by planting the seeds about 4 cm below the soil surface.



154c. NETTED MELON, entire  
Variety of musk melon (x0.25)



154d. Netted melon, L.S. (x0.25)

154. MELON (*Cucumis melo*)