

## X. FERMENTATIVE MICRO-ORGANISMS

Micro-organisms (bacteria and fungi) are used in bakeries, breweries, distilleries and in wine-making as well as in the production of cheeses and other dairy products. Broadly speaking, they are plants, but rather than being actually consumed by man, they are mainly used in industrial processes. Nevertheless, it is essential to consider them here because they are of enormous importance in the preparation of organic matter for human consumption.

The micro-organisms metabolize organic matter and break it down into other useful compounds. These changes in organic materials are mostly classified as fermentation and different types of fermentation may be specified according to the resulting compounds. The most important is alcoholic fermentation, in which glucose is broken down into ethyl alcohol and carbon dioxide; by this method all alcoholic beverages, and also leavened bread, are prepared. Alcoholic fermentation is carried out by yeasts and is sometimes assisted by saccharifying moulds. Another type is acetic acid fermentation, by which wine vinegar is obtained, due to the action of the bacterium *Acetobacter*; and lactic acid fermentation, whereby *Lactobacillus* spp., *Leuconostoc* spp., *Streptococcus* spp., etc. cause the souring of milk, fermentation of cabbage (sauerkraut), etc.

Micro-organisms that ferment animal or plant products for consumption not only convert carbohydrates into alcohol and carbon dioxide or into lactic acid, alcohol into acetic acid, etc., but they also add a more or less distinctive odour and taste, imparting a specific flavour to the converted material. This flavour results both from their metabolic activity and from their presence. Micro-organisms are sometimes removed from converted substances, such as wines or beers, but for sour milk or cheeses they are, on the contrary, left in the processed material and 1 cc of sour milk, for example, normally contains 500 million streptococci. In such cases some bacteria and fungi used in food processing may be classified as flavouring plants or, exceptionally, even as food plants (e.g. food yeast).

Fermentation especially for flavouring purposes is used on many vegetables, spices, beverage materials, etc. Such fermentation may be of two kinds: either the materials are fermented by their own enzymes which are liberated by breakage of the cells, as in the case of tea; or fermentation may be caused by bacteria or moulds (e.g. processing of cocoa seeds, soya beans and vanilla capsules).

Not all the micro-organisms used to improve our foods are fermentative microbes. Acetic acid fermentation is, strictly speaking, not a fermentative process at all, because it takes place not by anaerobic, but aerobic respiration. There are many food microbes which can under no circumstances be called fermentative and which in this chapter are put together with fermentative micro-organisms only for convenience. These are the bacteria and fungi that cause the ripening of cheeses (301), saccharifying micro-organisms (302) and the grey mould responsible for the excellent taste of some sweet wines (304).

### ACETIC ACID FERMENTATION

#### 299. *Acetobacter*

Acetic acid fermentation results from the aerobic respiration of some bacteria that oxidize alcohol to acetic acid and water. Acetic acid is the main organic compound in vinegar and thus every vegetable material that is able to undergo alcoholic fermentation may be further converted into vinegar. In grape-growing countries vinegar is derived from wine, in Great Britain from fermented malt and in the U.S.A. the commonest alcoholic base is cider. The name vinegar itself is of French origin and means "sour wine". The organisms causing acetic acid fermentation are bacteria belonging to the genus *Acetobacter*, and they may be divided into two groups according to their ability to break acetic acid down further into carbon dioxide and water. The species that possess this ability are *Acetobacter aceti*, *A. xylinum*, *A. pasteurianum*, *A. keuzingianum* and *A. rancens*. In contrast, the species *A. melanogenum*, *A. suboxydans*, *A. roseum* and *A. oxydans* are not capable of further metabolism of acetic acid, and have been reclassified as *Acetomonas*.

Vinegar is produced either by the quick or by the slow method of fermentation. The quick method is performed by *Acetobacter acetogenum* and by the acetic acid bacterium *Bacterium schuetzenbachii*, while those used for the slow method are *A. aceti*, *A. rancens* and *A. xylinum*.

### LACTIC ACID FERMENTATION

#### 300. *Lactobacillus*, *Leuconostoc* and *Streptococcus*

Lactic acid fermentation is used chiefly in the processing of various dairy products. It is a process in which sugar (glucose) is broken down into two molecules of lactic acid by the anaerobic respiration of various bacteria. Cultured sour milk and sour cream are produced by the inoculation of milk with *Streptococcus lactis* or *S. cremoris*; these bacteria produce the acidity

while bacteria of the genus *Leuconostoc* (*L. citrovorum* and *L. dextranicum*) are added simultaneously for flavouring purposes. Souring of milk may also be brought about by lactobacilli: e.g. *L. acidophilus* ferments milk to produce acidophilic milk, or so-called biogurth. A special *Lactobacillus* is also required for the production of yogurt; it is fermented by *L. bulgaricus* together with *Streptococcus thermophilus* in the ratio of 1:1 at a temperature of 37°C, while the ordinary souring of milk takes place at normal room temperature (20°C). When milk is inoculated with only *S. thermophilus* at 37°C, Bulgarian buttermilk is obtained. Kefir, produced from cows', goats' or sheep's milk, and koumiss, usually derived from mares' milk, require fermentation with various species of *Streptococcus*, *Lactobacillus* and *Saccharomyces* spp., lactose-fermenting yeasts. Their alcohol content is very low (0.5–1.0%<sub>v/v</sub>).

Lactic acid fermentation is also employed in the pickling of cucumbers, cabbage (sauerkraut) and other vegetable materials; the bacteria responsible for the fermentation of pickles are mainly *Lactobacillus plantarum*, *Lactobacillus brevis* and *Leuconostoc mesenteroides*. The sour taste of rye bread is also due to lactic acid bacteria: lactic fermentation in older methods of preparing rye bread was dependent on bacteria naturally present in the dough, but in more modern methods the dough is artificially inoculated with a culture of lactic acid bacteria.

*Lactobacillus lactis*, *L. casei* and *L. brevis* are normally used at low temperatures, while *L. bulgaricus* and *L. thermophilus* are recommended for high temperature fermentation. But the peculiar drink *dahi*, a kind of Indian yogurt, requires a complex mixture of lactic acid microbes: apart from *Lactobacillus bulgaricus* and *L. plantarum*, some *Streptococci* and also *Lactobacillus casei* and *L. brevis* have been isolated from it.

## RIPENING OF CHEESES

### 301. *Brevibacterium*, *Penicillium*, etc.

When cheeses are made from natural milk, it must first be soured by the addition of a starter. If the milk is being processed at higher temperatures the starter consists of *Streptococcus thermophilus* combined with a *Lactobacillus* (e.g. *L. lactis*), while if processing occurs at lower temperatures the starter is *Streptococcus lactis* or *S. cremoris*. The milk, after it reaches the required acidity, is then curdled by the addition of rennet (i.e. the enzyme rennin in impure form) which converts a soluble protein, caseinogen, into insoluble casein. In this way the sour milk is separated into curds and whey. Some cheeses are further ripened with propionic acid bacteria, e.g. *Propionibacterium shermanii*, which is responsible for the formation of "eyes" in

Emmenthaler and other cheeses. In this type of action propionic acid, acetic acid and small quantities of succinic acid and carbon dioxide are formed from glucose.

Many cheeses are ripened after they have already been shaped. This may be done by smears applied to the surface of the young rind so that the microbe then penetrates through the rind into the entire cheese. In this way the characteristic flavours of many cheeses are obtained. Limburg cheese is smeared with *Brevibacterium linens* and *B. erythrogenes*—short, reddish rod-like bacteria responsible for the taste and orange colour of the cheese. Camembert and Brie cheese are smeared with the mould *Penicillium camemberti* or *P. caseicola*, but the blue-veined Stilton, Gorgonzola and Roquefort cheeses are produced by the addition of *Penicillium roqueforti* to the curd (see *Penicillium* (218)).

### 302. Saccharifying Micro-organisms

In the Far East, starters, containing some moulds as well as yeasts, are used for the fermentation of alcoholic rice beverages (sake) or some distillates such as those produced in China from *Andropogon sorghum*. These starters are called *kyoku-shi* in China and *koji* in Japan. Apart from yeasts, *kyoku-shi* contains several phycomyces (*Rhizopus*, *Mucor* and *Absidia*, all members of the Mucorales) and several Fungi Imperfecti (*Aspergillus*, *Penicillium* and *Monascus*). The Japanese sake, on the other hand, is fermented by yeast with a pure culture of *Aspergillus oryzae* forming the starter called *koji*. The function of these starters is to aid alcoholic fermentation by hydrolysing starch into sugar.

### 303. Grey Mould

Sometimes the alcoholic fermentation of wine is accompanied by the activity of a mould called grey mould or *Botrytis cinerea*. This is a fungus that attacks the grapevine but under certain circumstances the parasitic organism may be beneficial. Whether or not it becomes beneficial depends on the time of the attack and on the subsequent weather: if the grapes are ripe when infection takes place, *B. cinerea* will penetrate the skin by means of a greyish mycelial thread, and if dry and warm weather follows the attack the botry-

tized grape will lose some water and its sugar content will be concentrated. In addition, *B. cinerea* metabolizes sugar into glycerol instead of into alcohol, so that only a proportion of the sugar is undergoing alcoholic fermentation. It also decreases the levels of malic and tartaric acid by its metabolic processes, and all these changes help to produce excellent, sweet wines with a distinctive taste, particularly in the Sauternes and Barsac regions of France and in many other countries. In Germany the wines produced from botrytized grapes are called *Beerenauslese* and *Trockenbeerenauslese*; and the best Hungarian wine, Tokay, is fundamentally the work of *Botrytis* rather than of a special type of vine or environmental conditions. For this reason grey mould that contributes to fermentation by yeasts is called "pourriture noble", meaning "noble mould" or "noble decay".

Botrytized grapes cannot be left on the vine too long because they become rotten, and the infected grapes are therefore cut from the bunches before this can happen. The remaining grapes may then be successively harvested as they also become infected. However, if after the fungal attack the weather is humid and cold, *B. cinerea* can only spoil the crop.

*Botrytis* is a member of the Fungi Imperfecti and belongs to the order Moniliales (formerly Hyphomycetae).

## ALCOHOLIC FERMENTATION

### 304. Yeast (True and False)

Alcoholic fermentation is the result of anaerobic respiration by yeast, and yeast used for the preparation of products for consumption is chiefly of the genus *Saccharomyces* (family Saccharomycetaceae; Ascomycetes). They are unicellular organisms belonging to the subgroup Protoascomycetes, while "typical" ascomycetes are multicellular organisms producing mycelia in which the diploid hyphae develop terminal asci, each with eight ascospores. In *Saccharomyces* the whole organism is considered as an ascus when four spores develop within it. Alcoholic fermentation was known from prehistoric times but yeast was first discovered in the seventeenth century and it was a further 200 years before it was recognized as the cause of alcoholic fermentation. This important fact was discovered by Louis Pasteur, the founder of bacteriology and microbiology.

Brewer's yeast used for brewing beer is either *S. cerevisiae* or *S. carlsbergensis*. The latter causes bottom fermentation, settling at the bottom of the fermented malt, while the former is responsible for top fermentation, floating clumped together at the surface. Beers, stouts and porters are brewed by top fermentation and bottom fermentation is used for lager beers: *S. carlsbergensis* is named after the famous Danish lager brewery Carlsberg.

A wild variety of *S. cerevisiae*, *S. c. var. ellipsoideus*, often considered as a separate species, *S. ellipsoideus*, is the yeast adhering to the epidermis of naturally fermented by a whole group of yeasts but its specific taste is contributed by the apiculate, lemon-shaped yeast, *Kloeckeraspora* spp. The characteristic bouquet of cider from Normandy is due mainly to *K. apiculata*. Different types of yeast (*S. cerevisiae* var. *sake*) are also added to rice in the production of a beer in Japan and China, but in this case the mash is inoculated simultaneously with saccharifying moulds. A special yeast is also required for the fermentation of sherry. Some authors call it *Saccharomyces beticus*, while others use the name *S. fermentati*; however, there are also workers who recognize both species of sherry yeast. Lastly should be mentioned a special yeast for the production of naturally sparkling wine: for the second fermentation the yeasts mainly used are *S. bayanus*, *S. oviformis* and *S. fructum*.

Yeast is sometimes also used for the fermentation of animal products: yeasts of various kinds, together with micro-organisms, are used to cause lactic acid fermentation of milk for the production of kefir or koumiss. In this way milk is converted into a sour and mildly alcoholic beverage. Kefir is mainly produced in the Caucasus, while koumiss is a drink of the Tartars and is normally made from mare's milk.

But it must not be overlooked that yeast is also used for reasons other than to obtain alcohol. Alcoholic fermentation of dough is used for leavening bread, the required metabolic product in this case being a gas, carbon dioxide, and not alcohol which evaporates and is lost. Baker's yeast includes various types of *S. cerevisiae*.

Other useful species of yeast include *Zygosaccharomyces soyae* and *Hansenula* spp. which are used for the fermentation of soya beans in the manufacture of soy sauce. Alcoholic fermentation also takes place in the processing of cocoa seeds and is caused not only by *S. c. var. ellipsoideus* and *K. apiculata*, which have already been mentioned, but also by *S. anomahus* and *Schizosaccharomyces bussei*.

All the yeasts listed so far are true yeasts belonging to the Ascomycetes (subgroup Protoascomycetes), but there are also false yeasts, belonging to the Fungi Imperfecti. Among these micro-organisms is Torula yeast (*Torulopsis* or *Candida utilis*) which was manufactured in Jamaica on a large scale after the Second World War as a food yeast. Food yeast is consumed for its rich vitamin content as well as being a source of proteins which are especially valuable in the tropics. After production, food yeast is often dried and made more palatable by mixing it with chocolate or spices. Another false yeast which has industrial importance is *Brettanomyces*; species of this are used in the alcoholic after-fermentation of English beers in storage as well as in the production of some Belgian beers. Furthermore, useful false yeasts of the genus *Candida* include *C. krusei*, which is added to dairy starters to promote

the activity of lactic acid bacteria, and *C. utilis*, *C. lipolytica* and *C. tropicalis* which are often used for the production of food yeast.



299 YEAST (*Saccharomyces* spp.)  
Budding yeast (highly magnified)

The chemical constitution of yeasts per 100 g (or per 100 mg in the case of vitamins) is as follows:

Type of yeast	Water	Pro-	Fats	Carbo-	Vitamins				
	%	teins	%	hydrates	A	Thi-	Ribo-	Niacin	Ascorbic
		%	%	%		amine	flavin		acid
Baker's yeast (dry)	5	36.9	1.6	38.9	trace	2.33	5.41	36.7	trace
Brewer's yeast (dry)	5	38.8	1.0	38.4	trace	15.61	4.28	37.9	trace
Formula yeast (dry)	6	38.6	1.0	37.6	trace	14.01	5.06	44.4	trace

### Fermentative and Other Micro-organisms Used in the Processing of Vegetable and Animal Materials Consumed by Man (FER)

#### BACTERIA

##### 299. Bacteria causing acetic acid fermentation

*Acetobacter aceti*  
*A. acetogenum*  
*A. curcum*  
*A. kuetzingianum*

*A. melanogenum* (*Am*)  
reclassified as *Acetomonas*)  
*A. oxydans* (*Am*)  
*A. ranceus*  
*A. roseum* (*Am*)  
*A. schuetzenbachii*  
*A. suboxydans* (*Am*)  
*A. xylinum*

#### BACTERIA (contd.)

##### 300. Bacteria causing lactic acid fermentation

*Lactobacillus acidophilus*  
*Lac. brevis*  
*Lac. bulgaricus*  
*Lac. casei*  
*Lac. lactis*  
*Lac. plantarum*  
*Leuconostoc citrovorum*  
*Leu. dextranicum*  
*Leu. mesenteroides*  
*Streptococcus cremoris*  
*Strep. cremoris*  
*Strep. lactis*  
*Strep. thermophilus*

##### 301. Bacteria causing ripening of cheeses

*Propionibacter shermanii*  
*Brevibacterium linens*  
*erythrogenes*

#### FUNGI

##### Phycomycetes

##### 302. Saccharifying moulds

*Absidia* spp.  
*Mucor* spp.  
*Rhizopus* spp.

##### Ascomycetes

##### 304. True Yeasts—Alcoholic fermentation

*Hansenula* spp.  
*Klosterospora apiculata*  
*Saccharomyces carlsbergensis*  
*S. cerevisiae*  
*S. cerevisiae* var. *anomalous*  
*S. c. var. ellipsoideus*  
*S. c. var. sake*  
*Schizosaccharomyces hussei*  
*Zygosaccharomyces soyae*

##### Fungi Imperfecti

##### 303. Grey mould (*Botrytis cinerea*)

##### 303. False yeasts—Alcoholic fermentation

*Candida arborea*  
*C. krusei*

*Torulopsis utilis*

##### 302. Saccharifying fungi

*Aspergillus* spp.  
*Monascus* spp.  
*Penicillium* spp.

##### 301. Fungi causing the ripening of cheeses

*Penicillium camemberti* or *caseicola*  
*P. expansum*  
*P. roqueforti*

## APPENDICES

# MORPHOLOGICAL SURVEY

## OF THE COMMONEST PLANTS CONSUMED BY MAN

The plants consumed by man belong, as do all other plants, to various taxonomic groups but only the largest and most fundamental are mentioned here. The plant kingdom is primarily divided into Bacteria (Bacteriophyta), Cyanophyta, Algae (Phycophyta), Fungi (Mycophyta), Pteridophyta and Spermatophyta (consisting of Gymnospermae and Angiospermae).

The second fundamental division of plants consumed by man concerns their specific structure, by which they may be arranged into appropriate morphological groups. Taking as an example the carrot, it is an angiospermous plant used for its thickened, swollen primary root and for this reason it belongs to a special morphological group, together with other angiosperms that develop a taproot such as chicory, parsnip, salsify etc. There are many such morphological groups, occurring mainly among the angiosperms, and it is therefore useful to present them in the form of a list:

### Thallophyta

- Bacteria (Bacteriophyta)

- Cyanophyta

- Algae (Phycophyta)

  - Leaf-like or stem-like thallus

  - "Midrib"

  - "Sporophyll"

  - Stipe

  - Mucilage

- Fungi (Mycophyta)

  - Entire thallus

  - Fungal macrofructification

- Algae and Fungi (Lichens)

### Cormophyta

- Pteridophyta

  - Developing fronds

- Gymnospermae

  - Stem

  - Rhizome

- Wood
- Seed
- Cupule of the seed
- Resin
- Angiospermae
- Root
  - Swollen taproot
  - Fleshy adventitious root
  - Root tuber
  - Bark of the root
- Stem
  - Stem
  - Swollen hypocotyl
  - Swollen hypocotyl with the swollen taproot and epicotyl
  - Hypocotyl with the cotyledons
  - Swollen epicotyl
  - Stem sprout
  - Stem tuber
  - Stolon
  - Rhizome
  - Corm
  - Pith
  - Bark of the stem
  - Wood
- Leaf
  - Whole leaf
  - Midrib
  - Swollen base of the leaf
  - Petiole
  - Swollen base of the petiole
  - Main bud
  - Axillary bud
  - Bulb
  - Leafy shoot
  - Leaves and flowering tops (or flowering shoots)
- Flower
  - Flower (single) or inflorescence
  - Calyx
  - Stigma and the tip of the style
  - Flower bud
  - Swollen inflorescence
- Fruit
  - I. Simple

- Dry
  - (a) Achenial
    - Achene
    - Caryopsis
    - Nut
  - (b) Capsular
    - Capsule
    - Legume
    - Follicle
  - (c) Schizocarpic
    - Lomentum
    - Creomocarp
    - Mericarp
    - Carcerulus
- Fleshy
  - Berry
  - Hesperidium
  - Hesperidium-like
  - Pepo
  - Pome
  - Drupe
  - Accessory fleshy fruit
- II. Aggregate
  - Dry
    - Etaerio of achenes
    - Etaerio of follicles
  - Fleshy
    - Etaerio of berries
    - Etaerio of drupes
- III. Multiple (Compound)
  - Dry
    - Strobilus
  - Fleshy
    - Sorosis
    - Syconium
- Seed
  - Seed of an achene
  - Seed of a legume
  - Seed of a capsule
  - Seed of a lomentum
  - Seed of a siliqua
  - Seed of a berry
  - Seed of a drupe

Seed of a pepo  
 Seed with a seedling  
 Embryo of an albuminous seed  
 Aril  
 Sap  
 Latex  
 Resin  
 Gum  
 Nectar

The plants are listed under each morphological group in alphabetical order according to their common name. The common name is preceded by a number from 1 to 304 indicating the location of the particular plant in the present book. Numbers in brackets mean that the numbered item reappears in another chapter or chapters (e.g. under the number 263 there is a description of the poppy plant as a flavouring (poppy seed), while the bracketed number [263] introduces the poppy plant as a source of opium developed from the latex and the description occurs in the chapter on masticatories and fumitories). Repeated numbers without brackets refer to the same section which discusses or at least mentions more than one plant. For example, under number 219 there is a discussion of the truffle as well as other underground mushrooms: *Terfaria*, *Tirmania* and *Choitomyces*. Thus, in this survey the same number is used four times. Sometimes, but exceptionally, a plant appears under more than one number; this happens when the same plant is mentioned in two or more sections for some unavoidable technical reason (see *Penicillium*, numbers 218, 301 and 302). Lastly, plants without numbers but marked with an asterisk occur in the text independently of the numbered items. They are classified morphologically only in this survey.

The common name is followed by the scientific name and by the name of the family to which the plant belongs. This rule is broken only in the case of bacteria and microscopic fungi owing to basic differences in their classification. Plants other than dicotyledons are also accompanied by the name of a higher botanical group than the family; this name appears after the family in parentheses (most of the plants discussed belong to the dicotyledons, in which case the name is omitted to avoid unnecessary repetition).

The botanical classification of plants consumed by man is followed by their mode of use, expressed as the following abbreviations:

ALC Alcoholic beverages  
 ALK Alkaloidal beverages  
 CER Cereals  
 COFSUB Coffee substitutes  
 DYE Food dye plants

## MORPHOLOGICAL SURVEY

FER Fermentative micro-organisms  
 FLA Flavourings  
 FRU Fruits  
 FUM Fumitories  
 GUM Gum plants  
 MAST Masticatories  
 NUT Nuts  
 OIL Oil plants  
 PCER Pseudo-cereals  
 SMO Plants used for smoking food  
 STA Starch plants  
 SUG Sugar plants  
 TESUB Tea substitutes  
 VEG Vegetables  
 VIN Vinegar

## THALLOPHYTA

## BACTERIA

## 299. Acetic acid bacteria

(FER)

*Acetobacter aceti*  
*A. acetogenum*  
*A. curvum*  
*A. kuetzingianum*  
*A. melanogenum*  
 (Reclassified as  
*Acetomonas*  
*melanogenum*—  
 Am)  
*A. oxydans* (Am)  
*A. pasteurianum*  
*A. rancens*  
*A. roseum* (Am)  
*A. schuetzenbachii*  
*A. suboxydans*  
*A. xylinum*

## 300. Bacteria causing lactic acid fermentation (FER)

*Lactobacillus acidophilus*  
*L. brevis*  
*L. bulgaricus*  
*L. casei*  
*L. lactis*  
*L. plantarum*  
*L. vermiformis*  
*Leuconostoc citrivorum*  
*L. dextranicum*  
*L. mesenteroides*  
*Streptococcus cremoris* or *lactis*  
*S. thermophilus*  
 301. Ripening of cheeses by bacteria (FER)  
*Brevibacterium erythrogenes*  
*B. linens*  
*Propionibacter shermanii*



## CYANOPHYTA

18. *Nostoc* spp., Nostaceae (Hormogonales) (VEG)  
*N. commune* (*N. edule*)  
*N. commune* var. *flagelliforme*  
*N. ellipsoidosporum*

## ALGAE

## Leaf-like or stem-like thallus

- G. pulchellum*  
 Substitutes  
*Ahnfeldia plicata*  
*Gigartina stellata*  
*Furcellaria fastigiata*  
*Phyllophora nervosa*
19. Dulse or *Rhodomenia palmata*, Rhodomeniaceae (Rhodophyta) (VEG, MAST)
20. Kōbu or Kombu, the Japanese *Laminaria* sp., Laminariaceae (Phaeophyta) (VEG, FLA)  
*L. cichorioides*  
*L. japonica*  
*L. religiosa*
21. Laver or *Porphyra umbilicalis*, Bangiaceae (Rhodophyta) (VEG)  
*P. laciniata* = *P. umbilicalis* var. *laciniata*
23. Nori or Japanese *Porphyra* spp., Bangiaceae, (Rhodophyta) (VEG, FLA)

- e.g. *Porphyra tenera*
24. Sea lettuce or *Ulva lactuca*, Ulvaceae (Chlorophyta) (VEG, FLA)  
 Japanese sp. *U. pertusa*

## "Midrib"

22. Murlins or *Alaria esculenta*, Laminariaceae (Phaeophyta) (VEG)

## "Sporophyll"

22. Murlins or *Alaria esculenta* and *fastuosa*, Laminariaceae (Phaeophyta) (VEG)

## Stipe

25. Sugar wrack or *Laminaria saccharina*, Laminariaceae (Phaeophyta) (VEG)

## Gum

205. Agar—agar derived from *Gelidium* spp., Gelidiaceae (Rhodophyta)  
*G. arborescens*  
*G. amansii*  
*G. cartilagineum*  
*G. latifolium*  
*G. nudifrons*
206. Algin derived from Knotted wrack (*Ascophyllum nodosum*) and Oarweed (*Laminaria* spp.), Laminariaceae (Phaeophyta)  
*L. hyperborea*, *L. digitata* and also *Macrocystis pyriformis*

## Gum (contd.)

207. Carrageenan derived from Irish moss or *Chondrus crispus* and *Gigartina mamillata*, Gigartinaeae (Rhodophyta)
208. Furcellaran produced of *Furcellaria fastigiata*, Furcellariaceae (Rhodophyta)

## FUNGI

## Entire thallus

- Phycomycetes  
 302. Saccharifying moulds (FER)  
*Absidia* spp.  
*Mucor* spp.  
*Rhizopus* spp.
- Ascomycetes (Protoascomycetes)  
 304. Yeast—Alcoholic fermentation (FER)  
*Hansenula* spp.  
*Kloeckerospora apiculata*  
*Saccharomyces bayanus*  
*S. beticus*  
*S. carlsbergensis*  
*S. cerevisiae*  
*S. c. var. anomalus*  
*S. c. var. ellipsoides*  
*S. c. var. sake*  
*S. fermentati*  
*S. fructum*  
*S. pyriformis*  
*Schizosaccharomyces bussei*  
*Zygosaccharomyces soyae*
- 218, 301, 302. *Penicillium* in ripening of cheeses and in starters (FER)  
*Penicillium camemberti* or *caseicola*  
*Penicillium expansum*  
*Penicillium roqueforti*  
*Penicillium* spp. in sake starters
- Fungal macrofructification**  
 Ascomycetes and Basidiomycetes  
 219. Black fellow's bread or *Polyporus mylittae* (or *Mylitta australis*)  
 Polyporaceae (Holobasidiomycetes) (VEG)  
 26. *Boletus* spp., *Boletaceae* (Holobasidiomycetes) (VEG, FLA)  
*B. edulis*  
*B. luteus*  
*B. scaber*  
*B. versipellis* or *testascaber*

## Entire thallus (contd.)

- Fungi Imperfecti  
 304. False yeast (FER)  
*Candida krusei*  
*C. lipolytica*  
*C. tropicalis*  
*C. utilis* (*Torulopsis*)
303. Grey mould or *Botrytis cinerea* (FER)
302. Saccharifying Fungi Imperfecti (FER)  
*Aspergillus* spp.  
*Monascus* spp.  
*Penicillium* spp.

## Entire thallus (contd.)

## Fungal macrofructification (contd.)

27. Chanterelle or *Cantharellus cibarius*, Cantharellaceae (Holobasidiomycetes) (VEG, FLA)
28. Club and Coral fungi or *Clavaria* and *Ramaria* spp., Clavariaceae (Holobasidiomycetes) (VEG, FLA)  
*C. fistulosa*  
*C. pistillaria*  
*R. botrytis*
28. Coral fungus, see Club and Coral fungus
292. Fly agaric or *Amanita muscaria*, Agaricaceae (Holobasidiomycetes) (MAST)
29. Jew's ear or *Auricularia auricula-judae*, Auriculariaceae (Phragmobasidiomycetes) (VEG, FLA)
30. Morel or *Morchella esculenta*, Helveliaceae (Euascomycetes) (VEG, FLA)
31. Mushroom, White or *Psalliota bispora* var. *albida*, Agaricaceae (Holobasidiomycetes) (VEG, FLA)  
*P. bispora*  
*P. bispora* var. *albida*  
*P. campestris*
32. Orange agaric or *Lactarius deliciosus* (Holobasidiomycetes) (VEG, FLA)

## Entire thallus (contd.)

## Fungal macrofructification (contd.)

33. Ox tongue (in French langue de boeuf) or *Fistulina hepatica*, Polyporaceae (Holobasidiomycetes) (VEG, FLA)
34. Padi straw mushroom or *Volvarellia* spp., Agaricaceae (Holobasidiomycetes) (VEG, FLA)  
*V. bresadolae*  
*V. volvaceae* var. *heimii*
293. *Psilocybe* and *Stropharia* spp., Agaricaceae (Holobasidiomycetes) (MAST)  
*P. aztecum*  
*P. mexicanum*  
*P. zapotecum*  
*S. cubensis*
35. Puff ball or *Lycoperdon* spp., Lycoperdiaceae (Holobasidiomycetes) (VEG, FLA)  
e.g. *L. giganteum*
36. *Russula* spp., Agaricaceae (Holobasidiomycetes) (VEG, FLA)  
*R. vesca*  
*R. cyanoxantha*  
*R. violeipes*  
*R. virescens*  
*R. xerampelina*
37. Shitake mushroom or *Lentinus edodes*, Agaricaceae (Holobasidiomycetes) (VEG, FLA)

## Entire thallus (contd.)

## Fungal macrofructification (contd.)

293. *Stropharia*, see *Psilocybe* and *Stropharia*
219. *Terfezia* and *Tirmania*, Terfeziaceae, Tuberales (Euascomycetes) (VEG, FLA)
219. *Tirmania*, see *Terfezia* and *Tirmania*
219. Truffle or *Tuber* spp., Tuberales, Tuberales (Euascomycetes) (FLA)  
*T. aestivum*  
*T. magnatum*  
*T. melanosporum*  
*T. nitidum*
219. White truffle or *Choiromyces* spp., Tuberales, (Euascomycetes) (VEG, FLA)

## ALGAE &amp; FUNGI (LICHENS)

216. Archil (Orseille) or *Rocella tinctoria*, Lichen (DYE)
- \* *Lecanora* spp., Lichen spp. (Sugar plants, p. 100) (SUG)  
*L. affinis*  
*E. esculenta*  
*L. fructiculosa*  
*L. tartarea*

## CORMOPHYTA

## PTERIDOPHYTA—FILICALES

38. Fiddlehead fern or *Filices* spp. (VEG)  
Bracken fern or *Pteridium aquilinum*, Polypodiaceae (VEG)

## PTERIDOPHYTA—FILICALES (contd.)

- Cinnamon fern or *Osmunda cinnamomum*, Osmundaceae (VEG)
- Male fern or *Dryopteris filix-mas*, Polypodiaceae (VEG)

## GYMNOSPERMAE

## Cycadales

## Pith of the stem

189. *Cycas* spp., Cycadaceae (STA)

## Pith of the rhizome

189. Arrowroot, Florida or *Zamia floridana*, Cycadaceae (STA)

## Seed

190. *Dioon edule*, Cycadaceae (STA)
190. *Encephalartos caffer*, Cycadaceae (STA)

## Coniferales

## Gum (derived from wood)

209. Larch, Western or *Larix occidentalis*, Pinaceae (GUM)
210. CMC—Sodium carboxymethylcellulose, mainly conifers used (GUM)

## Seed

173. Monkey puzzle or *Araucaria araucana*, Araucariaceae (NUT)

## Coniferales (contd.)

## Seed (contd.)

173. Pine nut or *Pinus* spp.,  
Pinaceae (NUT)  
*P. cembra*  
*P. cembroides* var.  
*edulis*  
*P. cembroides* var.  
*monophylla*  
*P. korianensis*  
*P. pinea*

## Cupule

220. Juniper or *Juniperus*  
*communis*, Cupres-  
saceae (FLA)

## Resin

220. Pine tree or *Pinus* spp.,  
Pinaceae (FLA)

## ANGIOSPERMAE

## Root

## Swollen taproot

68. Carrot or *Daucus*  
*carota*, Umbelliferae  
(VEG, FLA)
75. Chervil, Turnip rooted  
or *Chaerophyllum*  
*cerefolium*, Umbel-  
liferae (VEG)
80. Dandelion or *Taraxa-*  
*cum officinale*, Com-  
positae (COESUB)
282. Chicory or *Cichorium*  
*intybus*, Compositae  
(COESUB)
95. Parsley or *Petroselinum*  
*crispum* var. *tuberosum*, Umbelliferae  
(VEG, FLA)
96. Parsnip or *Pastinaca*  
*sativa*, Umbelliferae  
(VEG, FLA)

## Root (contd.)

## Swollen taproot (contd.)

105. Radish or *Raphanus*  
*sativus* (syn. *Ra-*  
*phanus raphanistrum*)  
var. *radicula*  
var. *esculentus*  
var. *longipinnatus*  
Cruciferae (VEG, FLA)
108. Salsify (Oyster plant)  
or *Tragopogon porri-*  
*folius*, Compositae  
(VEG, FLA)
110. Scolymus (Spanish  
salsify) or *Scolymus*  
*hispanicus*, Compo-  
sitae (VEG, FLA)
111. Scorzonera (Black  
salsify) or *Scorzonera*  
*hispanica*, Compo-  
sitae (VEG, FLA)
200. Sugar beet or *Beta*  
*vulgaris* var. *altis-*  
*sima*, Chenopodia-  
ceae (SUG)
216. Sugar beet or *Beta*  
*vulgaris* var. *altis-*  
*sima*, Chenopodia-  
ceae—Caramel (DYE)
282. Sugar beet etc.  
(COFSUB)

## Fleshy adventitious root

290. Gentian or *Gentiana*  
spp., Gentianaceae  
(ALC, FLA)  
*G. cruciata*  
*G. lutea*  
*G. pannonica*  
*G. punctata*  
*G. purpurea*
251. Horseradish or *Armo-*  
*racia rusticana*,  
Cruciferae (FLA)

## Root (contd.)

## Fleshy adventitious root (contd.)

251. Horseradish tree or  
*Moringa oleifera*,  
Moringaceae (FLA)
254. Liquorice or *Glycy-*  
*rhiza glabra*, Legu-  
minosae (FLA)  
*G. g.* var. *glanduli-*  
*fera*  
*G. g.* var. *violacea*
216. Liquorice or *Glycy-*  
*rhiza* spp., Legu-  
minosae (DYE)
267. Sarsaparilla or *Smilax*  
spp., Liliaceae  
(Monocotyledoneae)  
(FLA)

## Root tuber

59. Bean, Yam or *Pachyr-*  
*hizus erosus* and  
*tuberosus*, legu-  
minosae (FLA)
69. Cassava or *Manihot*  
*esculenta* or *utilis-*  
*sima*, Euphorbia-  
ceae (STA, VEG, ALC)
- [69.] Cassava or *Manihot*  
*esculenta*, Euphor-  
biaceae (STA)
- [69.] Cassava or *Manihot*  
*esculenta*, Euphor-  
biaceae (ALC)
74. Chayote or *Sechium*  
*edule*, Cucurbitaceae  
(VEG)
103. Potato, Sweet or  
*Ipomoea batatas*,  
Convolvulaceae (VEG,  
ALC)
- [103.] Potato, Sweet or  
*Ipomoea batatas*,  
Convolvulaceae (STA)

## Root (contd.)

## Root tuber (contd.)

- [103.] Potato, Sweet or  
*Ipomoea batatas*,  
Convolvulaceae  
(ALC)
119. Yam or *Dioscorea*  
spp., Dioscoreaceae  
(Monocotyledoneae)  
(VEG)  
*D. alata*  
*D. bulbifera*  
*D. cayennensis*  
*D. esculenta*  
*D. rotunda*  
*D. trifida*

## Bark of the root

268. Sassafras or *Sassafras*  
*albidum*, Lauraceae  
(FLA)

## Stem

## Stem, entire

222. Angelica or *Angelica*  
*archangelica* (*A.*  
*officinialis*), Umbel-  
liferae (FLA)
90. Lettuce = *Lactuca*  
*sativa* var. *asparagina*,  
Compositae (VEG)
297. Peyote or *Lophophora*  
*williamsii*, Cactaceae  
(MAST, ALK)
- [11.] *Sorghum* spp., Grami-  
neae (Monocoty-  
ledoneae) (SUG)
201. Sugar cane or *Sac-*  
*charum officinarum*,  
Gramineae (Mono-  
cotyledoneae)  
(SUG)

## Stem (contd.)

## Stem, entire (contd.)

216. Sugar cane or *Saccharum officinarum*, Gramineae (Monocotyledoneae) Caramel (DYE)

## Swollen hypocotyl

60. Beetroot or *Beta vulgaris* var. *rapacea* f. *alba* or *rubra*, Chenopodiaceae (VEG)
105. Radish or *Raphanus sativus* (syn. *raphanistrum*) var. *radicula*, Cruciferae (VEG, FLA)

## Swollen hypocotyl with swollen taproot and epicotyl

71. Celeriac or *Apium graveolens* var. *rapaceum*, Umbelliferae (VEG, FLA)
113. Swede or *Brassica napobrassica* (*Brassica napus* var. *napobrassica*), Cruciferae (VEG)
116. Turnip or *Brassica rapa* (*B. rapa* var. *rapa*) Cruciferae (VEG)

## Hypocotyl with cotyledones

77. Cress, Garden or *Lepidium sativum*, Cruciferae (VEG, FLA)
118. White mustard or *Brassica alba* (*Sinapis alba* or *hirta*), Cruciferae (VEG, FLA)

## Stem (contd.)

## Swollen epicotyl

87. Kohl-rabi or *Brassica oleracea* var. *gongyolodes* or *caulorapa*, Cruciferae (VEG)

## Stem sprout

42. Asparagus or *Asparagus officinalis* var. *altilis*, Liliaceae (Monocotyledoneae) (VEG)
45. Bamboo or *Bambusa vulgaris*, Gramineae (Monocotyledoneae) (VEG)
42. Cape asparagus or *Aponogeton dystachyon*, Aponogetonaceae (Monocotyledoneae) (VEG)
45. *Phyllostachys pubescens*, Gramineae (Monocotyledoneae) (VEG)

## Stem tuber

39. Artichoke, Chinese or *Stachys tuberosa*, Labiatae (VEG)
41. Artichoke, Jerusalem or *Helianthus tuberosus*, Compositae (VEG)
102. Potato or *Solanum tuberosum*, Solanaceae (VEG)
- [102.] Potato or *Solanum tuberosum*, Solanaceae (STA)
- [102.] Potato or *Solanum tuberosum*, Solanaceae (ALC)

## Stem (contd.)

## Stolon

254. Liquorice or *Glycyrrhiza glabra*, Leguminosae (FLA)
216. Liquorice or *Glycyrrhiza* etc. (DYE)

## Rhizome

189. Arrowroot  
Arrowroot, Brazilian or *Manihot esculenta*, Euphorbiaceae (STA)
- Arrowroot, East Indian or *Curcuma augustifolia*, Zingiberaceae and *Tacca leontodioides* and *Tacca pinna-fida*, Taccaceae (Monocotyledoneae) (STA)
- Arrowroot, Queensland or *Canna edulis*, Cannaceae (Monocotyledoneae) (STA, VEG)
- Arrowroot, West Indian or *Maranta arundinacea*, Marantaceae (Monocotyledoneae) (STA)
232. Calamus or *Acorus calamus*, Araceae (Monocotyledoneae) (FLA)
246. Galangal or *Alpinia officinarum*, Zingiberaceae (Monocotyledoneae) (FLA)

## Stem (contd.)

## Rhizome (contd.)

290. Gentian or *Gentiana lutea*, Gentianaceae (FLA, ALC)
- G. cruciata*
- G. pannonica*
- G. punctata*
- G. purpurea*
248. Ginger or *Zingiber officinalis*, Zingiberaceae (Monocotyledoneae) (FLA)
91. Lotus, Sacred or *Nelumbium nuciferum* (*Nelumbo nucifera*), Nymphaeaceae (Monocotyledoneae) (VEG, CER)
- Other lotuses:  
*Nymphaea lotus*
- Nymphaea stellata*
255. Lovage or *Levisticum officinale*, Umbelliferae (FLA)
276. Turmeric or *Curcuma longa*, Zingiberaceae (Monocotyledoneae) (FLA)
216. Turmeric or *Curcuma longa*, Zingiberaceae (Monocotyledoneae) (DYE)

## Corm

114. Taro (syn. Eddo or Cocoyam) or *Colocasia antiquorum*, Araceae (Monocotyledoneae) (VEG)

## Stem (contd.)

## Corm (contd.)

117. Water chestnut, Chinese or *Eleocharis tuberosus*, Cyperaceae (Monocotyledoneae) (VEG)

## Pith

190. Sago palm or *Metroxylon sagu*, Palmaceae (Monocotyledoneae) (STA)

## Bark

223. Angostura or *Cusparia febrifuga*, Rutaceae (FLA)
239. Cinnamon or *Cinnamomum* spp., Lauraceae (FLA)  
*C. burmanii*  
*C. cassia*  
*C. loureirii*  
*C. zeylanicum*
289. Yoco or *Paullinia yoco*, Sapindaceae (ALK)

## Wood

217. Smoke of wood for smoking food (SMO)

## Leaf

## Leaf, entire

112. Amaranth or *Amaranthus* spp., Chenopodiaceae (VEG)
226. Balm, or *Melisa officinalis*, Labiatae (FLA)
112. *Basella alba*, Basellaceae (VEG)
228. Bay, Sweet or *Laurel nobilis*, Lauraceae (FLA)
294. Betel or *Piper betle*, Piperaceae (MAST)

## Leaf (contd.)

## Leaf, entire (contd.)

- [16.] *Bignonia chica*, Bignoniaceae (VEG)
230. Borage or *Borago officinalis*, Boraginaceae (FLA)
231. Borage, Indian or *Coleus amboinicus* or *aromaticus* (FLA)
65. Cabbage, Chinese (PAK-CHOI) or *Brassica chinensis* and PE-TSAI or *Brassica pekinensis*, Cruciferae (VEG)
280. Cassia or *Ilex tomitoria*, Aquifoliaceae (ALK)
73. Chard, Swiss (Seakale beet) or *Beta vulgaris* var. *sicla*, Chenopodiaceae (VEG)
237. Chervil or *Anthriscum cerefolium*, Umbelliferae (FLA)
76. Chicory or *Cichorium intybus*, Compositae (VEG)
238. Chive or *Allium schoenoprasum*, Liliaceae (Monocotyledoneae) (FLA)
239. Cinnamon or *Cinnamomum tamala*, Lauraceae (FLA)
295. Coca or *Erythroxylum coca* and *novogranatense*, Erythroxylaceae (MAST)
80. Dandelion or *Taraxacum officinale*, Compositae (VEG, FLA)

## Leaf (contd.)

## Leaf, entire (contd.)

244. Dill or *Anethum graveolens*, Umbelliferae (FLA)
83. Endive or *Cichorium endivia*, Compositae (VEG)
141. Grape or *Vitis* spp., Vitaceae (VEG)
216. Indigo or *Indigofera tinctoria*, Leguminosae (VEG)
86. Kale or *Brassica oleracea* var. *acephala*, Cruciferae (VEG)
285. Khat or *Catha edulis*, Celastraceae (ALK, MAST)
90. Lettuce or *Lactuca sativa*, Compositae (VEG)  
 Varieties:  
*L. s.* var. *crispa*  
*L. s.* var. *secalina*
90. Lettuce, Corn, or *Valerianella olitoria* (syn. *V. locusta*) Valerianaceae (VEG)
255. Lovage or *Levisticum officinale*, Umbelliferae (FLA)
286. Maté or *Ilex paraguayanensis*, Aquifoliaceae (ALK)
216. Nettle or *Urtica* spp., Urticaceae (DYE)
- [95.] Parsley or *Petroselinum crispum* or *hortensis*, Umbelliferae (FLA)

## Leaf (contd.)

## Leaf, entire (contd.)

103. Potato, Sweet or *Ipomoea aquatica* and *ericaipa*, Convolvulaceae (VEG)
264. Rosemary or *Rosmarinus officinalis*, Labiatae (FLA)
266. Sage or *Salvia officinalis*, Labiatae (FLA)
269. Savory or *Satureja hortensis* and *montana*, Labiatae (FLA)
112. Spinach or *Spinacia oleracea*, Chenopodiaceae (VEG)
73. Spinach beet or *Beta vulgaris* var. *ciela*, Chenopodiaceae (VEG)
272. Tamarind or *Tamarindus indica*, Leguminosae (FLA)
273. Tarragon or *Artemisia dracunculus*, Compositae (FLA)
287. Tea or *Camellia sinensis* and *Camellia sinensis* var. *asamica*, Theaceae (ALK)
288. Tea substitute  
*Angraecum fragrans*, Orchidaceae (Monocotyledoneae) (TESUB)  
 Bilberry or *Vaccinium myrtillus*, Ericaceae (TESUB)  
 Blackberry or *Rubus fruticosus*, Rosaceae (TESUB)

## Leaf (contd.)

## Leaf, entire (contd.)

288. Tea substitute (contd.)  
*Camellia japonica*,  
 Theaceae  
 (TESUB)  
*Coffea* spp., Rubiaceae (TESUB)  
 Cranberry or *Vaccinium vitis-idaea*,  
 Ericaceae (TESUB)  
 Morello cherry or  
*Prunus cerasus*,  
 Rosaceae  
 (TESUB)  
 Mulberry or *Morus alba*, Moraceae  
 (TESUB)  
 Peppermint or  
*Mentha piperata*,  
 Labiatae (TESUB)  
 Raspberry or *Rubus idaeus*, Rosaceae  
 (TESUB)  
 298. Tobacco or *Nicotiana tabacum*, Solanaceae  
 (FUM, MAST)  
 116. Turnip or *Brassica rapa*  
 var. *rapa*, Cruciferae  
 (VEG)  
 188. Walnut or *Juglans regia*, Juglandaceae (TESUB)  
 Woodruff or *Asperula odorata*, Rubiaceae (TESUB)  
 Aizoaceae (VEG)

## Midrib

67. Cardoon or *Cynara cardunculus*, Compositae (VEG)

## Leaf (contd.)

## Swollen base of the leaf

88. Leek or *Allium porrum*,  
 Liliaceae (Monocotyledoneae (VEG))

## Petiole

72. Celery or *Apium graveolens* var.  
*dulce*, Umbelliferae  
 (VEG)  
 106. Rhubarb or *Rheum rhabonticum*, Polygonaceae (VEG, FLA)  
 109. Seakale or *Crambe maritima*, Cruciferae  
 (VEG)

## Swollen base of the petiole

84. Fennel or *Foeniculum vulgare* var. *dulce*,  
 Umbelliferae (VEG)

## Main bud

64. Cabbage or *Brassica oleracea* var. *capitata*,  
 Cruciferae (VEG)  
 Savoy cabbage  
 (green):  
*B. o.* var. *bullata*  
 Red cabbage:  
*B. o.* var. *capitata*,  
*f. purpurea*  
 90. Head lettuce or *Lactuca sativa* var. *capitata*  
 and *L. s.* var. *longifolia* (Cos or Romain), Compositae  
 (VEG)

## Axillary bud

63. Brussels sprout or  
*Brassica oleracea*  
 var. *gemmifera*,  
 Cruciferae (VEG)

## Leaf (contd.)

## Bulb (Underground bud)

247. Garlic or *Allium sativum*, Liliaceae  
 (Monocotyledoneae)  
 (FLA)  
 94. Onion or *Allium cepa*,  
 Liliaceae (Monocotyledoneae) (VEG, FLA)  
 Species and varieties:  
*A. ampeloprasum*  
*A. chinense*  
*A. fistulosa*  
*A. cepa* var.  
*proliferum*  
*A. cepa* var.  
*viviparum*

## Leafy shoot

280. Cassine or *Ilex vomitoria*, Aquifoliaceae  
 (ALK)  
 77. Cress, Garden or  
*Lepidium sativum*,  
 Cruciferae (VEG,  
 FLA)  
 78. Cress, Water- or *Nasturtium officinalis*,  
 Cruciferae (VEG,  
 FLA)  
 77. Cress, Winter or  
*Barbarea verna*,  
 Cruciferae (VEG,  
 FLA)  
 107. Roselle (Jamaican  
 sorrel) or *Hibiscus sabdariffa* var. *sabdariffa*, Malvaceae  
 (VEG, FLA)  
 273. Tarragon (Estragon) or  
*Artemisia dracunculoides*, Compositae  
 (FLA)

## Leaf (contd.)

## Leaves and flowering tops (or flowering shoots)

227. Basil, sweet or *Ocimum basilicum*, Labiatae  
 (FLA)  
 296. Hemp or *Cannabis indica*, Moraceae  
 (FUM, ALK)  
 257. Marjoram or *Majiorana hortensis*,  
 Labiatae (FLA)  
 Adulterants:  
*Cistus albidus*  
*C. salvifolius*  
*Tilia argentea*  
*Althaea officinalis*  
 258. Mugwort or *Artemisia vulgaris*, Compositae  
 (FLA)  
 260. Origanum or *Origanum vulgare*, Labiatae  
 (FLA)  
 260. More pungent Origanum or *Lippia graveolens, berlandii*  
 etc., Verbenaceae  
 (FLA)  
 262. Peppermint or *Mentha piperata*, Labiatae  
 (FLA)  
 269. Savory or *Satureja hortensis* and *montana* (Summer and Winter savory),  
 Labiatae (FLA)  
 270. Spearmint or *Mentha spicata*, Labiatae  
 (FLA)  
 275. Thyme or *Thymus vulgaris*, Labiatae  
 (FLA)

## Leaf (contd.)

## Leaves and flowering tops (or flowering shoots) (contd.)

278. Wormwood or *Artemisia absinthium*, Compositae (FLA)
279. Wormwood, Roman or *Artemisia pontica*, Compositae (FLA)

## Flower

## Solitary flower

274. Tea-scenting flowers  
*Aglaya odorata*  
(Meliaceae)  
(FLA)
- Chloranthus inconspicuus* (Chloranthaceae) (FLA)
- Gardenia jasminoides* var. *florida* (Rubiaceae) (FLA)
- Jasminum sambac*  
(Oleaceae) (FLA)
- Murraya exotica*  
(Rutaceae) (FLA)
- Osmunthus fragrans* or *oleafragrans*  
(Oleaceae) (FLA)

## Inflorescence (entire)

82. Elder or *Sambucus niger*, Caprifoliaceae (FLA)
82. Wattle tree or *Acacia* spp. Mimosaceae (FLA)

## Calyx

- [107.] Roselle or *Hibiscus sabdariffa* var. *sabdariffa*, Malvaceae (FLA)

## Flower (contd.)

## Stigma and the tip of the style

216. Saffron or *Crocus sativus*, Iridaceae (Monocotyledoneae) (DYE)
265. Saffron or *Crocus sativus*, Iridaceae (Monocotyledoneae) (FLA)

## Adulterants:

- Calendula officinalis* (Compositae)
- Caltha palustris* or Marigold (Compositae)
- Carthamus tinctorius* or Safflower (Compositae)
- Lycperia crocea* (Scrophulariaceae)
- Tritonia aurea* (Iridaceae—Monocotyledoneae)

## Flower bud

40. Artichoke, Globe or *Cynara scolymus*, Compositae (VEG)
233. Caper or *Capparis spinosa*, Compositae (FLA)
241. Clove or *Syzygium aromaticum* (syn. *Eugenia caryophyllata* or *caryophyllum*) Myrtaceae (FLA)
241. Clove or *Syzygium aromaticum*—krettek (PUM)

## Flower (contd.)

## Swollen inflorescence

62. Broccoli or *Brassica oleracea* var. *botrytis* f. *asparagoides*, Cruciferae (VEG)
70. Cauliflower or *Brassica oleracea* var. *botrytis*, Cruciferae (VEG)

## Fruit—Simple

## DRY

## Achenial

## Caryopsis

- [1–12.] Only if whole grains are consumed (CER)
- [1.] Barley or *Hordeum vulgare* var. *distichum* and *hexastichum*, Gramineae, tribe Triticeae (Monocotyledoneae) (SUG)
- [1.] Barley or *Hordeum vulgare*, etc. (ALC)
282. Barley or *Hordeum vulgare*, etc. (COFSUB)
- [2.] Maize or *Zea mays*, Gramineae, tribe Maydeae (Monocotyledoneae) (ALC)
282. Maize or *Zea mays*, etc. (COFSUB)
- [7.] Millet, Proso or *Panicum millaceum*, Gramineae, tribe Paniceae (Monocotyledoneae) (ALC)
- [8.] Oat or *Avena* spp., Gramineae, tribe Aveneae (Monocotyledoneae) (ALC)
282. Oat or *Avena* spp. etc. (COFSUB)

## Fruit—Simple (contd.)

## DRY, Achenial (contd.)

## Caryopsis (contd.)

- [9.] Rice or *Oryza* spp., Gramineae, tribe Oryzaceae (Monocotyledoneae) (ALC)
- [10.] Rye or *Secale cereale*, Gramineae, tribe Triticeae (Monocotyledoneae) (ALC)
282. Rye or *Secale cereale*, etc. (COFSUB)
- [11.] Sorghum or *Sorghum vulgare*, Gramineae, tribe Andropogoneae (Monocotyledoneae) (ALC)
- [12.] Wheat or *Triticum* spp., Gramineae, tribe Triticeae (Monocotyledoneae) (ALC)
- [12.] Wheat or *Triticum* spp. etc. (COFSUB)

## Capsular

## Capsule

92. Okra or *Hibiscus esculentus*, Malvaceae (VEG)
235. Cardamom or *Elettaria cardamomum*, Zingiberaceae (Monocotyledoneae) (FLA)
277. Vanilla or *Vanilla planifolia*, Orchidaceae (Monocotyledoneae) (FLA)

## Follicle

225. Anise, Star or *Illicium verum*, Magnoliaceae (FLA)

## Fruit—Simple (contd.)

DRY, Capsular (contd.)

## Legume (Immature)

48. Bean, Broad or *Vicia faba*, Leguminosae (VEG)
49. Bean, French or *Phaseolus vulgaris*, Leguminosae (VEG)
50. Bean, Goa or *Psophocarpus tetragonolobus*, Leguminosae (VEG)
52. Bean, Lablab or *Lablab niger*, Leguminosae (VEG)
53. Bean, Lima or *Phaseolus lunatus* var. *macrocarpus* (*P. limensis*), Leguminosae (VEG)
54. Bean, Moth or Mat or *Phaseolus aconitifolius*, Leguminosae (VEG)
55. Bean: Mung (Green or Golden gram) or *Phaseolus aureus* (*Vigna aureus*) Leguminosae (VEG)
56. Bean, Scarlet runner or *Phaseolus coccineus* or *multiflorus*, Leguminosae (VEG)
57. Bean, Soya or *Glycine max*, Leguminosae (VEG)
89. Lentil or *Lens culinaris*, Leguminosae (VEG)

## Fruit—Simple (contd.)

DRY, Capsular (contd.)

## Legume (Immature) (contd.)

97. Pea (Garden and Field) or *Pisum sativum* (var. *hortense* and *arvense*), Leguminosae (VEG)
98. Pea, Chick or *Cicer arietinum*, Leguminosae (VEG)
99. Pea, Cow- or *Vigna* spp., Leguminosae (VEG)  
*V. catjang*  
*V. sinensis*  
*V. sesquipedalis*
101. Pea, Pigeon or *Cajanus cajan*, Leguminosae (VEG)

## Legume (Mature)

129. Carob (St. John's bread or Locust) or *Ceratonia siliqua*, Leguminosae (FRU). Only the pulp in which the seeds are embedded is consumed.
245. Fenugreek or *Trigonella foenum-graecum*, Leguminosae (FLA)

## Siliqua (Immature)

105. Radish, Rat tailed or *Raphanus caudatum*, Cruciferae (VEG, FLA)
196. Rape or *Brassica napus* Cruciferae (OIL)

## Fruit—Simple (contd.)

DRY (contd.)

## Schizocarpic

## Creomercarp (not splitting)

242. Coriander or *Coriandrum sativum*, Umbelliferae (FLA)

## Meriacarp (Creomercarp splitting into two mericarps)

224. Anise or *Pimpinella anisum*, Umbelliferae (FLA)
234. Caraway or *Carum carvi*, Umbelliferae (FLA)
234. Adulterant of caraway or *Carum bulbocastanum*, Umbelliferae (FLA)
- [72.] Celery or *Apium graveolens* var. *dulce*, Umbelliferae (FLA)
243. Cumin or *Cuminum cyminum*, Umbelliferae (FLA)
244. Dill or *Anethum graveolens*, Umbelliferae (FLA)
- [84.] Fennel or *Foeniculum vulgare*, Umbelliferae (FLA)

FLESHY

## Baccate fruit (Berry)

221. Allspice (Pimento) or *Pimenta dioica*, Myrtales (FLA)
43. Avocado (Alligator pear) or *Persea americana*, Lauraceae (VEG)

## Fruit—Simple (contd.)

FLESHY (contd.)

## Baccate fruit (Berry) (contd.)

124. Banana or *Musa* spp. Musaceae (Monocotyledoneae) (FRU)  
Cultivated species:  
*M. balbisiana*  
*M. cavendishii*  
*M. paradisiaca*  
*M. paradisiaca* var. *sapientum*
126. Bilberry or *Vaccinium myrtillus*, Ericaceae (FRU)  
American species  
*V. ashei*  
*V. australe*  
*V. lamarkii*  
*V. membranaceum*  
*V. myrtilloides*  
*V. ovatum*
66. Capsicum or Red pepper, Paprika etc. or *Capsicum annum*, Solanaceae (VEG)
- [66.] Capsicum or Red pepper (*Capsicum annum*) and Cayenne pepper (*Capsicum frutescens*) Solanaceae (FLA)
128. Carambola or *Averrhoa carambola*, Oxalidaceae (FRU)  
Other species:  
*A. bilimbi*
131. Ceriman (Monster plant) or *Monstera deliciosa*, Araceae (Monocotyledoneae) (FRU)



## Fruit—Simple (contd.)

FLESHY (contd.)

## Baccate fruit (Berry) (contd.)

134. Cranberry or *Vaccinium* spp., Ericaceae (FRU)  
American species:  
*V. macrocarpus*  
*V. vitis-idaea* var. *minus*  
European variety  
*V. vitis-idaea* var. *vitis-idaea*  
Cranberry from northern hemisphere  
*V. oxycoccos* (Mossberry)
135. Currant or *Ribes* spp., Saxifragaceae (FRU)  
*Ribes sativum* (Red currant)  
*Ribes niger* (Black currant)
137. Date palm or *Phoenix dactylifera*, Palmaeaceae (Monocotyledoneae) (FRU)
282. Date or *Phoenix dactylifera*, Palmaeaceae (Monocotyledoneae) (COFSUB)
82. Elder or *Sambucus niger*, Sambucaceae (FLA)
81. Egg-plant (Aubergine) or *Solanum melano-gena*, Solanaceae (VEG)
216. Elder or *Sambucus niger*, Sambucaceae (DYE)

## Fruit—Simple (contd.)

FLESHY (contd.)

## Baccate fruit (Berry) (contd.)

140. Gooseberry or *Grossularia reclinata* (*Ribes uva-crispa*), Saxifragaceae (FRU)  
American species:  
*R. hirtellum*  
*R. missouriense*
141. Grape or *Vitis* spp., Vitaceae (FRU, ALC)  
[141.] Grape or *Vitis* spp., Vitaceae (ALC, VIN)
143. Guava or *Psidium guajaca*, Myrtaceae (FRU)  
Cultivars:  
*P. g.* var. *pomiferum*  
*P. g.* var. *pyriferum*  
*P. g.* var. *cattlianum* or *littorale*
152. Mangosteen or *Garcinia mangostana*, Guttiferae (FRU)
158. Papaya (Pawpaw) or *Carica papaya*, Caricaceae (FRU)
158. Papaya (Pawpaw) or *Carica papaya*, Caryaceae, unripe (VEG)
159. Passion fruit or *Passiflora edulis*, Passifloraceae (FRU, FLA).  
Edible parts are mainly the arils  
Another important species:  
*P. quadrangularis*

## Fruit—Simple (contd.)

FLESHY (contd.)

## Baccate fruit (Berry) (contd.)

162. Persimmon, Japanese or *Diospyros kaki*, Ebenaceae (FRU)  
*D. lotus* (Date plum)  
*D. virginiana*
124. Plantain or *Musa paradisiaca* var. *paradisiaca*, Musaceae (Monocotyledoneae) (VEG)
165. Pomegranate or *Punica granatum*, Punicaceae (FRU)
141. Raisin or *Vitis* spp., Vitaceae (FLA)
170. Sapotilla (Chiku) or *Mamillara achras* (syn. *M. zapotilla* or *Zapota achras*), Sapotaceae (FRU)
115. Tomato or *Lycopersicon esculentum* (or *Solanum lycopersicum*), Solanaceae (VEG)  
Varieties:  
*L. e.* var. *cerasiforme*  
*L. e.* var. *commune*  
*L. e.* var. *grandifolium*  
*L. e.* var. *pyriforme*  
*L. e.* var. *validum*

## Hesperidium

157. Bergamot or *Citrus aurantium* var. *bergamia*, Rutaceae (FLA)

## Fruit—Simple (contd.)

FLESHY (contd.)

## Hesperidium (contd.)

240. Citron or *Citrus medica* var. *bajura*, Rutaceae (FLA)
142. Grapefruit or *Citrus paradisi* or *maxima*, Rutaceae (FRU)
145. Kumquat or *Fortunella* spp., Rutaceae (FRU)
252. Lemon or *Citrus medica* var. *limonum*, Rutaceae (FLA)
253. Lime or *Citrus aurantifolia*, Rutaceae (FLA)
150. Mandarin, Tangerine, etc. or *Citrus nobilis* or *reticulata*, Rutaceae (FRU)
157. Orange or *Citrus aurantium*, Rutaceae (FRU, FLA)  
Varieties:  
*C. a.* var. *sinensis* (sweet orange)  
*C. a.* var. *amara* (bitter orange)  
*C. a.* var. *bergamia*
142. Shaddock (Pummelo, Pomelo) or *Citrus grandis*, Rutaceae (FRU)—a cross between *C. grandis* and *C. sinensis*
150. Ugli or a cross between *Citrus reticulata* and *C. paradisi* (FRU)

## Fruit—Simple (contd.)

FLESHY (contd.)

## Hesperidium-like berry

123. Bael (Bengal quince) or  
*Aegle marmelos*,  
Rutaceae (FRU)

## Pepo

74. Chayote or *Sechium edule*, Cucurbitaceae (VEG)
79. Cucumber or *Cucumis sativa*, Cucurbitaceae (VEG)
154. Melon or *Cucumis melo*, Cucurbitaceae (FRU)
104. Pumpkin and squash (vegetable marrow) or *Cucurbita* spp., Cucurbitaceae (VEG)
- Species and varieties:
- C. ficifolia*
- C. maxima* var. *maxima*
- C. maxima* var. *turbaniformis*
- C. mixta*
- C. moschata*
- C. pepo* var. *medullosa*
- C. pepo* var. *melo pepo*
- C. pepo* var. *pepo*
172. Watermelon or *Coccythrus citrullus*, Cucurbitaceae (FRU)

## Pome

121. Apple or *Malus pumila*, Rosaceae (FRU)
- M. p.* var. *mitis*
- M. p.* var. *sylvestris*

## Fruit—Simple (contd.)

FLESHY (contd.)

## Pome (contd.)

- [121.] Apple or *Malus pumila*, Rosaceae (ALC)
- [121.] Apple or *Malus pumila*, Rosaceae (GUM)
148. Loquat or *Eriobotrya japonica*, Rosaceae (FRU)
153. Medlar or *Mespilus germanica*, Rosaceae (FRU)
161. Pear or *Pyrus communis*, Rosaceae (FRU)
166. Quince or *Cydonia oblonga*, Rosaceae (FRU)
- Varieties:
- C. o.* var. *hesperidifolia*
- C. o.* var. *maliformis*
- C. o.* var. *marmorata*
- C. o.* var. *pyramidalis*

## Drupe

122. Apricot or *Prunus armeniaca*, Rosaceae (FRU)
- [122.] Apricot or *Prunus armeniaca*, Rosaceae (ALC)
216. Apricot or *Prunus armeniaca*, Rosaceae (DYE)

## Fruit—Simple (contd.)

FLESHY (contd.)

## Drupe (contd.)

125. Barbados cherry (Acerola or West Indian Cherry) or *Malpighia glabra*, Malpighiaceae (FRU)
236. Cassia bud or *Cinnamomum cassia*, Lauraceae (FLA)—Only unripe drupe consumed
132. Cherry, Sour (Morello cherry) or *Prunus cerasus*, Rosaceae (FRU)
- [132.] Cherry, Sour or *Prunus cerasus*, Rosaceae (ALC)
133. Cherry, Sweet or *Prunus avium*, Rosaceae (FRU)
144. Huckleberry or *Gaylussacia baccata*, Ericaceae (FRU)
149. Mamey (Mammey apple) or *Mammea americana*, Guttiferae (FRU)
151. Mango or *Mangifera indica*, Anacardiaceae (FRU)
156. Nectarine or *Prunus persica* var. *nectarina*, Rosaceae (FRU)

## Fruit—Simple (contd.)

FLESHY (contd.)

## Drupe (contd.)

194. Oil palm or *Elaeis guineensis*, Palmaceae (Monocotyledoneae) (OIL)
- Groups of oil palms:
- Dura
- Macrocarpa
- Pisifera
- Tenera
93. Olive or *Olea europaea*, Oleaceae (VEG, FLA)
- [93.] Olive or *Olea europaea*, Oleaceae (OIL)
160. Peach or *Prunus persica*, Rosaceae (FRU)
- [160.] Peach or *Prunus persica*, Rosaceae (ALC, FLA)
261. Pepper or *Piper nigrum*, Piperaceae (FLA)—Immature drupe used only
164. Plum and Prune or *Prunus* spp., Rosaceae (FRU)
- [164.] Plum or *Prunus* spp., Rosaceae (ALC)
- Types of plum:
- P. cerasifera* (myrobalan, greengage)
- P. domestica* (Victoria plum)
- P. domestica* var. *oeconomica* (Zwetschken)
- P. insititia* (mirabelle, damson)

**Fruit—Simple (contd.)****FLESHY (contd.)****Drupe (contd.)**

271. Sumac or *Rhus coriaria*,  
Anacardiaceae  
(FLA)
241. *Syzygium aromaticum*  
—new term for clove  
(*Eugenia caryo-  
phyllata*)
91. *Zyziphus lotus* and *Z.  
juzuba*, Rham-  
naceae (FRU, PCER,  
ALC)

**Accessory fleshy fruit**

130. Cashew apple or *Ana-  
cardium occidentale*,  
Anacardiaceae (FRU)
169. Rose Hip or *Rosa* spp.,  
Rosaceae (FRU)  
Species of rosehips:  
*R. acicularia*  
*R. arvensis*  
*R. canina*  
*R. laxa*  
*R. rugosa*  
*R. villosa* or *mollis*  
*R. v.* var. *pomifera*
171. Strawberry or *Fragaria*  
spp., Rosaceae (FRU)  
*F. moschata*  
*F. vesca*  
*F. vesca* var. *sem-  
perflorens*  
American species:  
*F. chiloensis*  
*F. virginiana*

**Inflorescence**

244. Dill or *Anethum*  
*graveolens*, Umbelli-  
ferae (FLA)

**Fruit—Aggregate****DRY****Etaerio of follicles**

225. Anise, Star or *Illicium*  
*verum*; see Follicle

**FLESHY****Etaerio of berries**

136. Custard apple or  
*Annona* spp., Anno-  
naceae (FRU)  
*A. reticulata*  
(Sweetsop or  
Sugar apple)  
*A. squamosa* or  
Bullock's head,  
etc.

**Etaerio of drupelets**

127. Blackberry or *Rubus*  
*fruticosus*, Rosaceae  
(FRU)  
American species  
cultivated  
*R. alleghaniensis*  
*R. argutum*  
*R. frondosus*
147. Loganberry or *Rubus*  
*loganobaccus*, Rosa-  
ceae (FRU)
168. Raspberry or *Rubus*  
*idaeus*, Rosaceae  
(FRU)  
American species:  
*R. occidentale*  
(black)  
*R. strigosus* (red)

**Fruit—****Multiple (Compound)****DRY****Strobilus**

250. Hop or *Humulus* spp.,  
Moraceae (FLA)

**Fruit—****Multiple (Compound) (contd.)****FLESHY****Sorosis**

61. Breadfruit or *Arto-  
carpus altilis*, Mora-  
ceae (VEG)
85. Jack-fruit or *Arto-  
carpus heterophyllus*,  
Moraceae, immature  
(VEG), mature  
(FRU)
155. Mulberry or *Morus*  
*alba* (White mul-  
berry) and *nigra*  
(Black mulberry),  
Moraceae (FRU)
163. Pineapple or *Ananas*  
*comosa*, Bromelia-  
ceae (Monocoty-  
ledoneae) (FRU)

**Syconium**

139. Fig or *Ficus carica*,  
Moraceae (FRU)

**Inflorescence**

244. Dill or *Anethum graveo-  
lens*, Umbelliferae  
(FLA)

**Seed****Seed of an achene**

14. Buckwheat or *Fago-  
pyrum sagittatum*,  
Polygonaceae  
(PCER)
193. Niger seed or *Guizotia*  
*abyssinica*, Compo-  
sitae (OIL)

**Seed (contd.)****Seed of an achene (contd.)**

16. Quinoa or *Cheno-  
podium quinoa*,  
Chenopodiaceae  
(PCER, VEG)  
Other species:  
*C. nuttalliae*  
*C. album*
- [16.] Quinoa or *Cheno-  
podium quinoa* etc.  
(ALC)
197. Safflower or *Carthamus*  
*tinctorius*, Compo-  
sitae (OIL)
187. Sunflower or *Helianthus*  
*annuus*, Compositae  
(NUT, OIL)
- [187.] Sunflower or *Heli-  
anthus annuus*, Com-  
positae (OIL)

**Seed of a caryopsis**

1. Barley or *Hordeum*  
*vulgare* var. *distichum*  
and *hexastichum*,  
Gramineae, tribe  
Triticeae (Mono-  
cotyledoneae) (CER)
2. Maize or *Zea mays*,  
Gramineae, tribe  
Maydeae (Mono-  
cotyledoneae) (CER)  
Varieties:  
*Z. m.* var. *ameri-  
cana*  
*Z. m.* var. *amy-  
lacea*  
*Z. m.* var. *everta*  
*Z. m.* var.  
*saccharata*  
*Z. m.* var. *praecox*  
*Z. m.* var. *tunicata*

## Seed (contd.)

## Seed of a caryopsis (contd.)

3. Millet, Finger (Bird's foot millet, korakan, marua, telabun) or *Elysiine corocana*, Gramineae, tribe Chlorideae (Monocotyledoneae) (CER)
4. Millet, Foxtail or *Setaria italica*, Gramineae, tribe Paniceae (Monocotyledoneae) (CER)
5. Millet, Japanese barnyard (Sanwa millet) or *Echinochloa crus-galli* var. *frumentacea*, Gramineae, tribe Paniceae (Monocotyledoneae) (CER)
6. Millet, Pearl (Bulrush millet) or *Pennisetum glaucum* (*P. typhoides*), Gramineae, tribe Paniceae (Monocotyledoneae) (CER)
7. Millet, Proso or *Panicum miliaceum*, Gramineae, tribe Paniceae (Monocotyledoneae) (CER)
8. Oat or *Avena* spp., Gramineae, tribe Aveneae (Monocotyledoneae) (CER)
  - A. byzantina*
  - A. fatua*
  - A. nuda*
  - A. orientalis*
  - A. sativa*

## Seed (contd.)

## Seed of a caryopsis (contd.)

9. Rice or *Oryza* spp., Gramineae, tribe Oryzaceae (Monocotyledoneae) (CER, ALC)
10. Rye or *Secale cereale*, Gramineae, tribe Triticeae (Monocotyledoneae) (CER)
11. Sorghum or *Sorghum vulgare*, Gramineae, tribe Andropogoneae (Monocotyledoneae) (CER)
  - Cultivated varieties:
    - S. v.* var. *caffrorum*
    - S. v.* var. *caudatum*
    - S. v.* var. *durra*
    - S. v.* var. *hegari*
    - S. v.* var. *nervosum*
    - S. v.* var. *rexburgii*
12. Wheat or *Triticum* spp., Gramineae, tribe Triticeae (Monocotyledoneae) (CER)
  - Einkorn group:
    - T. monococcum*
  - Tetraploid group or emmer wheat:
    - T. durum*
    - T. persicum*
    - T. polanicum*
    - T. turgidum*
  - Hexaploid or vulgare group:
    - T. compactum*
    - T. macha*
    - T. spelta*
    - T. sphaerococcum*
    - T. variloci*
    - T. vulgare* or *aestivum*

## Seed (contd.)

## Seed of a nut

174. Acorn or *Quercus* spp., Fagaceae (PCER, NUT)
  - Edible species:
    - Helm oak or *Quercus ilex*
282. Acorn, etc. (COFSUB)
176. Beechmast or *Fagus* spp., Fagaceae (PCER, NUT)
282. Beechmast, etc. (COFSUB)
178. Chestnut, Sweet or *Castanea sativa*, Fagaceae (PCER, NUT)
  - American species:
    - C. dentata*
    - C. pumila*
  - Chinese spp.
    - C. mollissima*
  - Japanese spp.
    - C. crenata*
180. Hazel nut or *Corylus* spp., Betulaceae (NUT)
  - European spp.:
    - C. avellana*
    - C. maxima*
  - Turkish spp.:
    - C. colurna*
  - N. American spp.:
    - C. americana*
    - C. rostrata*
146. Litchi or *Nephelium litchi*, Sapindaceae (FRU)
167. Rambutan or *Nephelium lappaceum* (FRU)

## Seed (contd.)

## Seed of a nut (contd.)

17. Water chestnut or *Trapa natans* (Cal-trop), Onagraceae (PCER)
  - Other spp. of the Far East:
    - T. bicornuta* (Bull's head)
  - and of tropical Asia:
    - T. bispinosa* (Singhara nut)

## Seed of a capsule

120. Akee or *Blighia sapida*, Sapindaceae (FRU)
216. Annatto or *Bixa orellana*, Bixaceae (FRU)
13. Amaranth or *Amaranthus* spp., Chenopodiaceae (PCER)
294. Betel nut or *Areca catechu*, Palmaeae (Monocotyledoneae) (MAST)
177. Brazil nut or *Bertholletia excelsa*, Lecithidaceae (NUT, OIL)
235. Cardamom or *Elettaria cardamomum*, Zingiberaceae, Monocotyledoneae (FLA)
192. Cotton or *Gossypium* spp., Malvaceae (OIL, GUM)
138. Durian or *Durio zibethicus*, Bombacaceae (FRU)

## Seed (contd.)

## Seed of a capsule (contd.)

249. Grain of Paradise or  
*Aframomum melegueta*, Zingiberaceae  
(Monocotyledoneae)  
(FLA)
284. Guarana or *Paullinia  
cupana*, Sapindaceae  
(ALK)
178. Horse chestnut or  
*Aesculus hippocastanum*, Hippocastanaceae (NUT)  
Edible species:  
*A. californica*  
*A. octandra*  
*A. turbinata*
263. Poppy or *Papaver  
sommiferum*, Papaveraceae (FUM, OIL,  
FLA)
- [263.] Poppy or *Papaver  
sommiferum*, Papaveraceae (FUM)
198. Sesame or *Sesamum  
indica* or *orientale*,  
Pedaliaceae (OIL)
- [198.] Sesame or *Sesamum  
indica*, Pedaliaceae  
(FLA)

## Seed of a legume (ripe or unripe)

44. Bambara groundnut or  
*Voandzeia subterranea*, Leguminosae (VEG)
46. Bean, Adzuki or  
*Phaseolus angularis*,  
Leguminosae (VEG)
47. Bean, Black gram or  
*Phaseolus mungo*,  
Leguminosae (VEG)

## Seed (contd.)

## Seed of a legume (ripe or unripe) (contd.)

48. Bean, Broad or *Vicia  
faba*, Leguminosae  
(VEG)
49. Bean, French or  
*Phaseolus vulgaris*,  
Leguminosae (VEG)
50. Bean, Goa (Asparagus  
bean) or *Psophocarpus  
tetragonolobus*, Leguminosae  
(VEG)
51. Bean: Horsegram or  
*Dolichos uniflorus*  
(syn. *D. biflorus*),  
Leguminosae  
(VEG)
52. Bean, Lablab or *Dolichos  
lablab* or *niger*,  
Leguminosae  
(VEG)
53. Bean, Lima (Sieva  
bean or Butter bean)  
or *Phaseolus lunatus*.  
*Phaseolus lunatus*  
var. *macrocarpus* = *P.  
limensis*, Leguminosae  
(VEG)
54. Bean, Moth (Mat bean)  
or *Phaseolus aconitifolius*, Leguminosae (VEG)
55. Bean: Mung (Green  
and Gold gram) or  
*Phaseolus aureus*  
(syn. *Vigna aureus*),  
Leguminosae (VEG)
56. Bean, Scarlet Runner or  
*Phaseolus coccineus*  
or *multiflorus*, Leguminosae (VEG)

## Seed (contd.)

## Seed of a legume (ripe or unripe) (contd.)

57. Bean, Soya or *Glycine  
max* or *G. soja* or  
*Soja hispida*, Leguminosae (VEG)
- [57.] Bean, Soya or *Glycine  
max*, etc. (OIL)
58. Bean, Tepary or  
*Phaseolus acutifolius*  
var. *latifolius*, Leguminosae (VEG)
282. Carob (syn. St. John's  
bread, Locust) or  
*Ceratonia siliqua*,  
Leguminosae  
(COFSUB)
245. Fenugreek or *Trigonella  
foenum-graecum*, Leguminosae (FLA)
44. Kerstling's groundnut  
or *Kerstlingiella  
geocarpa*, Leguminosae (VEG)
89. Lentil or *Lens culinaris*,  
Leguminosae  
(VEG)
97. Pea (Field and Garden  
pea) or *Pisum sativum*  
var. *arvense* and  
*hortense*, Leguminosae (VEG)
282. Pea (Field and Garden  
pea) or *Pisum sativum* (COFSUB)
98. Pea, Chick or *Cicer  
arietinum*, Leguminosae (VEG)
282. Pea, Chick or *Cicer  
arietinum* etc.  
(COFSUB)

## Seed (contd.)

## Seed of a legume (ripe or unripe) (contd.)

99. Pea, Cow- or *Vigna  
spp.*, Leguminosae  
(VEG)  
*V. unguiculata*  
*V. sinensis*  
*V. sesquipedalis*
100. Pea, Grass (Chickling  
Pea) or *Lathyrus  
sativus*, Leguminosae  
(VEG)
101. Pea, Pigeon or *Cajanus  
cajan*, Leguminosae  
(VEG)
183. Peanut or *Arachis  
hypogaea*, Leguminosae (NUT)
- [183.] Peanut or *Arachis  
hypogaea*, Leguminosae (OIL)

## Seed of a follicle

283. Cola or *Cola nitida*,  
Sterculiaceae  
(MAST)

## Seed of a siliqua

196. Field mustard or  
*Brassica campestris*  
var. *arvensis* and var.  
*toria*, Cruciferae  
(OIL)
196. Indian mustard or  
*Brassica juncea*,  
Cruciferae (OIL)
259. Mustard or *Brassica  
nigra* and *alba* (syn.  
*Sinapis alba* or *hirta*),  
Cruciferae (FLA)
196. Rape or *Brassica napus*,  
Cruciferae (OIL)

## Seed (contd.)

Seed of a *carcerulus*

15. Chia or *Salvia columbariae*, Labiatae (PCER)

Seed of a *lomentum*

272. Tamarind or *Tamarindus indica*, Leguminosae (NUT)

Seed of a *berry*

191. Cocoa or *Theobroma cacao*, Sterculiaceae (OIL)
256. Mace, or aril of *Myristica fragrans*, Myristicaceae (FLA)
152. Mangosteen or *Garcinia mangostana*, Guttiferae (FRU)
- \* *Madhuca* spp., Dipterocarpaceae (OIL)  
Oil yielding species  
*M. butyracea*  
*M. latifolia*  
*M. longifolia*  
*M. motleyana*
199. Shea Butter or *Butyrospermum paradoxum*, Sapotaceae (OIL)
- [256.] Nutmeg—the seed of *Myristica fragrans*, Myristicaceae (FLA)

Seed of a *pepo*

182. Oyster nut or *Telfairia pedata*, Cucurbitaceae (NUT)

Seed of a *drupe*

175. Almond or *Prunus amygdalus*, Rosaceae (NUT)

## Seed (contd.)

Seed of a *drupe* (contd.)

229. Bean, Tonka or *Dipteryx odorata*, Leguminosae (FLA)
179. Coconut or *Cocos nucifera*, Palmaceae (Monocotyledoneae) (NUT)
281. Coffee or *Coffea arabica* etc., Rubiaceae (ALK)
185. Java almond or *Canarium commune*, Burseraceae (NUT)
181. Macadamia nut (Queensland nut) or *Macadamia* spp., Proteaceae (NUT)
- Other species:  
*M. ternifolia* var. *integrifolia* (thin-shelled)  
*M. tetraphylla* (exalbuminous seed)

194. Oil palm or *Elaeis guineensis* (Monocotyledoneae) (OIL)
195. Palm oil of Brazil, Palmaceae (Monocotyledoneae) (OIL)  
*Astrocaryum murumuru* (Murumuru palm)  
*Orbygnya cohune* (Cohune palm)  
*Orbygnya martiana* or *olifera* (Bubassu palm)  
*Syagrus coronata* (Lucuri palm)

## Seed (contd.)

Seed of a *drupe* (contd.)

184. Pecan or *Carya illinoensis*, Juglandaceae (NUT)
261. Pepper or *Piper nigrum*, Piperaceae (FLA)
185. Pili nut or *Canarium* spp., Burseraceae (NUT)
186. Pistachio nut or *Pistacia vera*, Anacardiaceae (NUT)
188. Walnut, Black or *Juglans niger*, Juglandaceae (NUT)
188. Walnut, Italian or *Juglans regia*, Juglandaceae (NUT)

## Seed with seedling

77. Cress, Garden or *Lepidium sativum*, Cruciferae (VEG)
259. Mustard or *Brassica alba*, Cruciferae (VEG, FLA) (Monocotyledoneae)

## Embryo in albuminous seed

- [2.] Maize (Corn) or *Zea mays*, Gramineae, tribe Maydeae (Monocotyledoneae) (CER, OIL, ALC, COPSUB)

## Aril

120. Akee or *Blighia sapida*, Sapindaceae (FRU)
216. Annatto or *Bixa orellana*, Bixaceae (DYE)

## Avril (contd.)

138. Durian or *Durio zibethicus*, Bombacaceae (FRU)
146. Litchi or *Nephelium litchi*, Sapindaceae (FRU)
256. Mace or aril of *Myristica fragrans*, Myristicaceae (FLA)
152. Mangosteen or *Garcinia mangostana*, Guttiferae (FRU)
167. Rambutan or *Nephelium lappaceum*, Sapindaceae (FRU)

## Sap

## Sap from the stem

137. Date or *Phoenix dactylifera*, Palmaeaceae (Monocotyledoneae) (ALC, FRU, SUG)
202. Sugar maple or *Acer nigrum* and *Acer saccharum*, Aceraceae (SUG)

## Sap of the inflorescence

203. Sugar palms, Palmaeaceae (Monocotyledoneae) (SUG)  
*Arenga pinnata* (Gomuti palm)  
*Borassus flabellifer* (Palmyra palm) (SUG, ALC)  
*Caryota urens* (Toddy palm) (SUG, ALC)  
*Cocos nucifera* (Coconut) (ALC, FRU, OIL, SUG)

## Sap (contd.)

## Sap of the inflorescence (contd.)

*Phoenix sylvestris*  
(Wild date palm)  
(SUG, ALC)

291. Maguey or *Agave atrovirens*, Agavaceae (Monocotyledoneae) (ALC)

## Latex

[170.] Chiku or Sapotilla, botanically known as *Mamilkara achras*, Sapotaceae (MAST)

263. Poppy or *Papaver somniferum*, Papaveraceae (FUM)

## Resin

\* *Alhagi* spp. or Camel thorn, Leguminosae (SUG)

\* *Fraxinus ornus* (Flowering ash) Oleaceae (SUG)

296. Hemp or *Cannabis sativa*, Cannabaceae (FUM)

\* *Tamarix gallica* or French tamarisk, Leguminosae (SUG)

## Gum

- [121.] Apple or *Malus pumila* (pectin), Rosaceae (GUM)
211. Arabic, Gum or *Acacia senegal* and *Acacia drepanolobium*, Leguminosae (GUM)
- [129.] Carob (syn. St. John's bread, Locust) or *Ceratonia siliqua*, Leguminosae (GUM)
212. Ghatti, Gum or *Anogeissus latifolia*, Combretaceae (GUM)
213. Guar gum or *Cyamopsis tetragonoloba*, Leguminosae (GUM)
214. Karaya, Gum or *Sterculia urens*, Sterculiaceae (GUM)
215. Tragacanth, Gum or *Astragalus gummifer*, Leguminosae (GUM)

## Nectar

204. Nectar plants visited by insects

## GLOSSARY

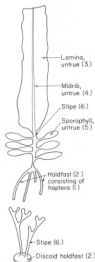
(An explanation of the morphological terms used in the text)

## THALLOPHYTA

(Lower plants with bodies (thalli) not differentiated into organs)

## ALGAE

- Hapteron** (pl. *haptera*): root-like device for anchorage of the alga.
- Holdfast**: device for anchorage, either root-like (haptera) or disc-like.
- Lamina, Untrue**: a blade-like structure formed by the thallus.
- Midrib, Untrue**: median thickening of the blade-like structure of the thallus, similar to the proper midrib of a true leaf.
- Sporophyll, Untrue**: special lamina-like structure bearing sporangia (structures containing spores).
- Stipe**: a structure of the thallus similar to the petiole (leaf stalk) of a true leaf.



ALGAE (1-6)

## FUNGI

- Ascus**: a characteristic spore-producing cell of the Ascomycetes. It is spherical, club-shaped or cylindrical and produces eight ascospores by three successive cell divisions, two of these being meiotic, leading to the production of cells having half the number of chromosomes of the parent cells and the third mitotic, leading to cells having the same number of chromosomes as the parent cells.

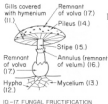




8. **Basidium:** a characteristic spore-producing cell of the Basidiomycetes. The spores develop inside the cell and then migrate into outgrowths of the cell called sterigmata, with which they are abstricted by a process of budding. The characteristic number of basidiospores is four.



9. **Conidiophore:** a spore-producing branch (hypha) of the mycelium (vegetative part of the fungal thallus consisting of network of hyphae). The conidia (spores) are abstricted from the tip of the conidiophore. In cases where the conidiophores are branched, the conidia are borne on the ultimate stalks called sterigmata which arise from branched metulae. The conidia are mostly not immediately abstricted, but appear in chains at the tip of the conidiophore.



10. **Fungal Fructification:** a spore-producing structure emerging above the substrate in which the fungus is growing, e.g., mushroom and toadstool. A typical fungal fructification consists of a cap (pileus) and a stem (stipe). Sometimes the entire fructification is enclosed by a universal veil (volva) in addition to a velum, a partial veil, enclosing the young gills in the annular cavity.



11. **Hymenium:** the superficial layer containing the ascospores or basidiospores, as well as sterile cells called paraphyses. It includes the lining of the apothecia, the cup-shaped fruiting bodies of the Ascomycetes, and the gills or tubules opening to the exterior on the lower surface of the Basidiomycetes.



12. **Hyphae:** thread-like whitish filaments constituting the body of the fungus (see *Mycelium*).
13. **Mycelium:** the vegetative fungal body, consisting of hyphae.

14. **Pileus:** the name given to the cap of the Agaricales. The gills or tubules on the lower surface bear basidiospores. The pileus is inserted into a stem (see *Fungal Fructification*).

15. **Stipe:** the stem or pillar-like part of the umbrella-shaped fructification (see *Fungal Fructification*).

16. **Velum:** a membrane stretching from the pileus to the stipe. The young gills are enclosed in the annular cavity so formed. Later the pileus expands and the velum is broken. Its remnants are left in the form of the annulus, a ring-like structure on the stipe near the cap (see also *Fungal Fructification*).

17. **Volva:** a universal veil possessed by some gill fungi in addition to the velum. It envelops both the pileus and the stipe, but ruptures when the stipe elongates, leaving a single large piece attached to the base of the stipe and eventually small pieces on the cap (see also *Fungal Fructification*).



## METAPHYTA

(True plants with the body differentiated into organs)

## PTERIDOPHYTA

(Earliest plants having conductive tissue differentiated into xylem and phloem, i.e. the lowest Tracheophyta. This group consists mainly of club mosses, horse-tails and ferns.)

## Ferns (Filicinae)

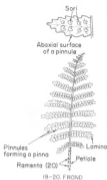
18. **Fiddlehead Ferns:** have young leaves in which the rachis (main axis) is coiled so that it resembles the head of a violin.





19. **FronD:** the most prominent part of the fern, i.e. the leaf is called a frond. It consists of a stalk (petiole) and a blade (lamina). The frond is normally a sporophyll bearing spore-filled sporangia in groups (sori) on the underneath surface.

20. **Ramenta:** chaff-like brown scales (sing. *ramentum*) consisting of a plate of cells developed from the epidermis. The ramenta cover the young leaves and the bases of old leaves.



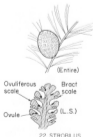
## GYMNOSPERMAE

(Plants with naked seeds)

21. **Cupule (Aril):** a fleshy covering of the seed e.g. in juniper, where it develops from the uppermost three scales of the cone.



22. **Strobilus:** the reproductive structure of the conifers, commonly called a cone. In the ovulate strobilus of the pine, a central axis bears bracts or bract scales; ovuliferous scales are developed in the axils of the bract scales. The ovuliferous scales each bear two ovules, which finally produce two naked seeds, each with a large wing. These wings develop from the superficial layer of the ovuliferous scale and when the seed is to be freed for dispersal it splits off from the scale, together with the wing.



## ANGIOSPERMAE

(Plants bearing seeds in a closed cavity called a seedbox)

23. **Abaxial (or Dorsal):** refers to the side of a leaf facing away from the stem, i.e. to the underneath surface (see *Adaxial*).

24. **Achene:** a dry, indehiscent (not opening), one-seeded fruit, in which the pericarp (the matured seed-box wall) is separated from the testa (seed-coat).

— **Adaxial:** refers to the side of a leaf turned towards the stem, normally the upper surface (see *Abaxial*).

— **Androecium:** male organs of the flower, i.e. the collective name for all the statements in a flower (see *Stamen*).

— **Anther:** see *Stamen*.

25. **Aril:** the additional investment (covering) of the seed, overlaying the testa and developing from the funicle or micropyle.

The term aril is also incorrectly used in angiosperms for the *cupule*. This is a structure formed outside the fruit, and not outside the seed like the aril. A typical example is the saucer-like structure partly surrounding the acorn, the fruit of the oak.



26. **Bark:** a non-technical term used in various ways, but it normally refers to all the tissue outside the vascular cambium.



27. **Berry:** a simple fleshy fruit enclosing the seeds, or exceptionally enclosing a single seed. The pericarp comprises the epicarp which forms the skin and the mesocarp and endocarp together, which develop into the flesh, e.g. the grape.





28 BUD



29 BULB (L.S.)



30 BULBILS



31 CALYX



32 CAPITULUM



33 CAPSULE (OF POPPY)



34 CARCERULUS

28. **Bud:** an immature shoot of a shortened stem on which overlapping, underdeveloped leaves are crowded together. The bud at the tip of the stem is the terminal bud, whilst those developing in the axils of leaves are called axillary buds. Accessory buds are additional buds in the axils of leaves and adventitious buds are those which occur elsewhere than at the tip of the stem or in the leaf axils. Some buds develop into leafy shoots, some produce flowers, while mixed buds produce both flowers and leaves.

29. **Bulb:** a shortened underground shoot or bud, covered with dry scale leaves which may be either small and overlapping (scaly bulbs) or large, reaching from the base of the bulb to its apex (tunicate bulbs).

30. **Bulbils:** small bulbs which may form instead of flowers or axillary buds.

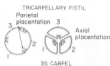
31. **Calyx:** outermost part of the flower, consisting of sepals; usually green, leaf-like structures.

32. **Capitulum:** a racemose inflorescence in which all the flowers are crowded together on the disc representing the reduced main axis, e.g. globe artichoke and sunflower.

33. **Capsule:** a syncarpous, dry, dehiscent fruit, normally with many seeds. A good example is the capsule of the poppy plant.

34. **Carceralus:** is a schizocarpic fruit developing from a superior ovary of two carpels with axially placed placenta and found in the Labiatae and Boraginaceae. When ripe, the fruit splits into four mericarps, each containing one seed. The split is facilitated by the presence of a false septum in each loculus. In certain Malvaceae, the carceralus splits into more than four one-seeded portions, while in certain Geraniaceae, it forms only three.

35. **Carpel:** a sporophyll, i.e. a leaf producing spores and a fundamental unit of the pistil. The pistil may consist of one or more carpels, being described as monocarpellary, dicarpellary, tricarpellary or polycarpellary.

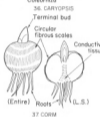


36. **Caryopsis:** achenial, dry, indehiscent fruit, containing one seed in which the pericarp is fused with the testa and forms a single indivisible covering of the seed. The caryopsis is the typical fruit of all cereals.



— **Cork Cambium:** see *Phellogen*.

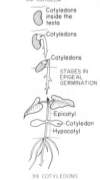
37. **Corm:** a rounded, swollen, short underground stem full of reserve food which facilitates perennation. It is a solid structure covered with scale leaves. The buds usually appear at the top of the corm.



38. **Corolla:** the second accessory part of the flower, consisting of petals, usually coloured and showy.



39. **Cotyledon:** embryonic leaf: the cotyledons store food reserves or digest and eventually absorb the food stored in the endosperm. In epigeal germination the cotyledons are raised above the ground and function as foliage leaves (i.e. photosynthesis occurs) after the reserve food has been utilized. Alternatively, in hypogeal germination, the cotyledons remain underground.





40. **Cremocarp:** the schizocarpic fruit of the Umbelliferae. Its ovary consists of two one-seeded carpels which, when ripe, separate from each other by the splitting of the stylopod with carpophore. The indehiscent single-seeded carpels are known as mericarps. A well known example of a cremocarp is caraway.

41. **Cymose Inflorescence:** is one which shows sympodial branching. Its main axis ends in a flower.

— **Dioecious:** describes plants in which unisexual flowers (pistillate or staminate) are borne on different plants (see *Monoecious*).

42. **Drupe:** a fleshy fruit with a stone. The pericarp can be distinguished in three layers, the epicarp forming the skin of the fruit, the mesocarp producing the flesh and the endocarp, which is transformed into the stone, a woody encasement of the seed.

— **Embryo:** normally develops from a fertilized egg cell and consists of a radicle, hypocotyl, epicotyl and cotyledons (q.v.).

— **Endocarp:** the innermost layer of the pericarp, forming the stone in a drupaceous fruit (see *Drupe*).

43. **Endosperm:** food reserve tissue enclosing the embryo and developed from the fertilized fusion nucleus, the triploid endosperm nucleus. Although the endosperm is formed in every seed, in some it disappears before the seeds are developed. Such seeds are called non-endospermous (exalbuminous), e.g. French bean and sunflower seeds. Seeds in which the endosperm is retained are called endospermous (albuminous), e.g. castor oil seeds and cereal grains.

## GLOSSARY

— **Epicarp:** the outermost layer of the pericarp which is represented by the skin of the fruit (see *Berry* and *Drupe*).

— **Epicotyl:** the stem above the cotyledons (see *Hypocotyl*).

44. **Epigyny:** describes the condition when the carpels are embedded in the receptacle (torus) to form an inferior gynaecium. The flower is said to be epigynous e.g. apple (see *Hypogyny*).

45. **Etaerio:** an aggregation of fruits, e.g. of drupelets in blackberry or raspberry.

46. **Flower:** an organ of sexual reproduction often consisting of four parts, two accessory (sepals and petals) and two essential (stamens and pistils).

47. **Follicle:** a dry dehiscent fruit of a single free carpel opening along one suture.

48. **Fruit:** a true fruit is strictly the structure which develops only from the seed-box wall enclosing the seeds. However, there are many so-called fruits which are formed partly from other components.

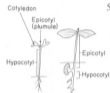
49. **Funicle:** the stalk by which the seed (ovule) is attached to the placenta, a swelling in the seed-box wall.

— **Gynaecium:** collective name for the pistil or pistils in the flower. Polycarpellary gynaecia are of two kinds, either the carpels are united into one pistil (syncarpous gynaecium, e.g. poppy) or each carpel forms one pistil (apocarpous gynaecium, e.g. strawberry).





50. HESPERIDIUM



51. HYPOCOTYL



52. INFLORESCENCE



53. INFRACTESCENCE



54. INTEGUMENTS

50. **Hesperidium:** the berry-like citrus fruit. It has a rind which represents the epicarp and mesocarp and which can be separated easily from the juicy part, formed of endocarpous sacs filled with juice, occupying the cavities of the carpels.

51. **Hypocotyl:** the part of the stem bearing the cotyledons. If the cotyledons are brought above ground, the hypocotyl appears as the aerial part of the plant (epigeal germination) but if the germination is hypogeal, both the cotyledons and the hypocotyl remain buried in the soil.

— **Hypogyny:** when the sepals, petals and stamens are inserted below the seed-box, the gynaecium is said to be superior and the flower hypogynous (see *Epigyny*, also *Flower*).

52. **Inflorescence:** a group of flowers, usually set apart from the foliage leaves. The inflorescence is classified according to its mode of branching, which may be racemose (indefinite and not terminating in a flower) or cymose (definite, terminating in a flower).

53. **Infrafructescence:** the inflorescence converted into fruits.

54. **Integument:** the ovule is covered by one or two integuments which develop into the seed-coat.

55. **Involute:** the collection of bracts which for example completely encloses the young inflorescences of the capitulum.

— **Lamina:** a leaf-blade (for illustration, see *Infrafructescence*).

— **Latex:** milky fluid exuded from the plant when injured.

56. **Legume:** dry dehiscent monocarpellary fruit which opens along both sutures (ventral and dorsal).

57. **Lomentum:** a legume or siliqua constricted between the seeds. It breaks when ripe, into indehiscent one-seeded compartments.

— **Mesocarp:** the middle layer of the pericarp, developing into flesh in the drupes (see *Drupe*).

— **Micropyle:** the pore left by the integument for fertilization. It persists in the ripe seed in the testa.

— **Monoecious:** refers to plants bearing unisexual flowers, both staminate and pistillate on the same individual.

— **Nectar:** sugary secretion of the nectaries, sucked by pollinating insects.

58. **Nectary:** organ that secretes sugar-containing nectar. It is either a special structure on the receptacle or a glandular surface of the various floral parts.

— **Nucellus:** the tissue of the ovule excluding the megaspore and integuments.

59. **Nut:** a dry indehiscent one-seed fruit with a woody pericarp.



55. INVOLUCRE



56. LEGUME (POOI)



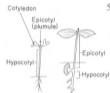
57. LOMENTUM

58. NECTARIES  
Forming a disc between the stamens and ovary.

59. NUT



50. HESPERIDIUM



51. HYPOCOTYL



52. INFLORESCENCE



53. INFRACTESCENCE



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— **Latex:** milky fluid exuded from the plant when injured.

56. **Legume:** dry dehiscent monocarpellary fruit which opens along both sutures (ventral and dorsal).

57. **Lomentum:** a legume or siliqua constricted between the seeds. It breaks when ripe, into indehiscent one-seeded compartments.

— **Mesocarp:** the middle layer of the pericarp, developing into flesh in the drupes (see *Drupe*).

— **Micropyle:** the pore left by the integument for fertilization. It persists in the ripe seed in the testa.

— **Monoecious:** refers to plants bearing unisexual flowers, both staminate and pistillate on the same individual.

— **Nectar:** sugary secretion of the nectaries, sucked by pollinating insects.

58. **Nectary:** organ that secretes sugar-containing nectar. It is either a special structure on the receptacle or a glandular surface of the various floral parts.

— **Nucellus:** the tissue of the ovule excluding the megaspore and integuments.

59. **Nut:** a dry indehiscent one-seed fruit with a woody pericarp.



55. INVOLUCRE



56. LEGUME (POOI)



57. LOMENTUM

58. NECTARIES  
Forming a disc  
between the  
stamens and  
ovary.

59. NUT

- **Ovary:** or seed-box wall. It is the basal portion of the pistil covering the ovules.
- **Ovule:** an outgrowth of the carpel (sporophyll), attached by a funicle. The ovule contains the embryo sac which develops from the megaspore. The ovum or oosphere is in the embryo sac and when fertilized, the embryo develops. The endosperm is formed from the fertilized fusion nucleus, while the seed develops from the entire ovule (see *Funicle*).



60. PANICLE



61. PEDUNCLE



62. PEPO (CUCUMBER)



63. PERIANTH (TULIP)



64. PERIDERM



65. PERISPERM

- 60. **Panicle:** a raceme of spikelets.
- **Pedical:** the stalk of an individual flower in an inflorescence (see *Peduncle*).
- 61. **Peduncle:** the main and also eventually the secondary axis of the inflorescence.
- 62. **Pepo:** the berry-like fruit of the Cucurbitaceae. The rind is derived from the receptacle and cannot be separated, peeled from the flesh. The fruit of a *Cucurbita* (e.g. a cucumber) has an inferior gynoecium.
- 63. **Perianth:** the calyx (sepals) together with the corolla (petals). In many flowers, especially monocotyledons, the sepals cannot be distinguished from the petals and the term perianth is then applied.

- **Pericarp:** the whole structure developed from the seed-box. It can be divided into epicarp, mesocarp and endocarp (see *Nut*).
- 64. **Periderm:** the cork (phellem) and phellogen, together with the cork cambium (phelloderm).
- 65. **Perisperm:** the reserve food materials stored in the seed and located in the tissue developed from the nucellus (see *Nucellus*).

- **Petals:** leaf-like structures forming the corolla, usually coloured and showy (see *Corolla*).
- **Petiole:** stalk of the leaf (for illustration, see *Infructescence*).
- **Phellem:** cork produced by the cork cambium (see *Periderm*).
- **Phelloderm:** the tissue centripetally cut off by the cork cambium (see *Periderm*).
- **Phellogen:** cork cambium; the meristematic (dividing) tissue, cutting cork outwards and phelloderm inwards (see *Periderm*).
- 66. **Phloem:** the food-conducting tissue of the stele, consisting mainly of sieve tubes, companion cells and fibres.
- 67. **Pistil:** is a flask-shaped structure with a large hollow base known as the ovary or seed-box, from which projects a column or style, ending in a tip or stigma specially adapted for pollination.
- 68. **Pith:** the central part of the stem or root enclosed in a hollow vascular cylinder. It is formed of parenchymatous (i.e. the least differentiated) tissue and functions as a food-storing structure.
- **Placenta:** cushion-like swelling of the carpel, where the funicle, the stalk of the ovule arises.
- **Plumule:** synonym for epicotyl (see *Epicotyl*).
- 69. **Pome:** a berry-like fruit of some Rosaceae, formed mainly from the receptacle.



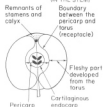
66. PHLOEM (L.S.)



67. PISTIL



68. PITH (IN THE STEM)



69. POME (L.S.)

- **Raceme:** a typical raceme consists of a peduncle and pedicellate flowers (see *Peduncle*).
- **Racemose Inflorescence:** shows monopodial branching. Raceme, corymb, spike, spadix, umbel and capitulum are different kinds of racemose inflorescences (see separate headings).
70. **Radicle:** the embryonic root, appearing as a continuation of the hypocotyl.
71. **Raphe:** the portion of the funicle fused with the ovule.
- **Receptacle:** the tip of the pedicel into which the floral parts are inserted. Another name for the receptacle is the torus.
- **Resins:** the oxidation products of various essential oils. Resins, which are insoluble in water and resemble heavy glue, are exuded when the plants are injured.
72. **Rhizome:** an underground stem normally growing horizontally below the surface. As a stem, it must always bear leaves and buds. The leaves may be large foliage leaves rising above the ground, or more frequently, scale leaves, i.e. membranous degenerated scales with buds in their axils.
73. **Root:** generally an organ that absorbs water with mineral salts from the soil, conducts water, mineral salts and food, anchors the plant and stores food. Two types of root are distinguished, primary roots and adventitious roots. The primary root system is derived from the radicle, i.e. from the embryonic root, and consists of the taproot and its branches. The adventitious roots are derived from structures other than the radicle, mainly from the base of the stem.



70. RADICLE



71. RAPHE



72. RHIZOME



73. ROOT

74. **Root, Swollen Tap:** the main root developed from the radicle may be swollen and fleshy at its base due to the accumulation of food reserves. The hypocotyl is normally incorporated in the swelling.
75. **Root Tubers:** Tubers occur on adventitious roots. They have a reproductive function, being associated with buds capable of growing into a new plant.
76. **Sarcotesta:** the gelatinous covering of the seed developed from the outer integument.
- **Scutellum:** is another name for the single cotyledon in monocotyledonous plants, being so named because early botanists failed to recognize this structure as a cotyledon.
77. **Seed:** the structure enclosed by the testa and containing the embryo, together with (eventually) the endosperm and also the perisperm.
- **Sepal:** leaf-like, usually green structure. Sepals together form the outermost floral whorl, the calyx (see *Calyx*).
78. **Siliqua:** elongated cylindrical fruit opening along the opposite sutures, but leaving behind the false septum bearing the seeds. The placenta is also left behind, forming the replum, the framework of the false septum, rendering the fruit bilocular.
79. **Sorosis:** a composite fruit which is formed of a spike in which the axis and fleshy flowers fuse together, e.g. as in the breadfruit.
80. **Spadix:** a racemose inflorescence similar to the spike, but distinguished from it by the swollen fleshy peduncle to which the sessile flowers adhere.



74. TAPROOT, SWOLLEN



75. ROOT TUBERS



76. SARCOTESTA

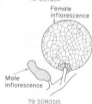
Surface of testa



77. SEED



78. SILIQUA



79. SOROSIS



80. SPADIX

81. **Spathe:** a bract enveloping the whole spadix (a massive fleshy spike) as in the Arum, or a single flower as in the daffodil.
82. **Spike:** a racemose inflorescence in which the pedicels are suppressed and thus the flowers are sessile, appearing straight on the peduncle.
83. **Spikelet:** the unit of the inflorescences in grasses. The inflorescence of a grass consists not of individual flowers but of groups of flowers called spikelets. The number of flowers in the spikelets varies. In some cases, only one flower is perfectly formed, the other being degenerate.
84. **Stamen:** the male organ of the flower. Collectively, the stamens in a flower form the androecium. Each stamen consists of a stalk or filament and an anther, in which are produced the pollen grains.
85. **Stem:** an organ displaying leaves and also conducting water with mineral salts and food. If the stem is herbaceous, it performs a photosynthetic function as well. The places where the leaves arise from the stem are called nodes, while the parts of the stem between two successive nodes are called internodes. The stem thus consists mainly of internodes (not present in roots), and bears leaves as well as buds.
86. **Stem Tuber:** organ of vegetative propagation. They are swollen ends of underground stems and bear buds in the axils of scale-like leaves. The best known example is the potato tuber.

— **Stigma and Style:** the parts of the pistil forming the free end of the seed-box. The style is a column with the sticky stigma at its tip. The stigma is a surface specially adapted to retain the pollen grain at pollination (see *Pistil*).



81. SPATHE



82. SPIKE



83. SPIKELET



84. STAMEN



85. STEM (SUGAR CANE)



86. STEM TUBER

87. **Stolon:** a runner, a slender stem that runs along the surface of the ground, producing at intervals, buds which are able to reproduce the plant. These occur in strawberries, for example.



87. STOLON

88. **Strobilus:** dry composite fruit of hop developing from an axis bearing numerous membranous scales. In the axil of each scale are two pistillate flowers. The fruit is called a strobilus because of its cone-like appearance.



88. STROBILUS (HOP)

— **Style:** see *Stigma* and *Style*.

89. **Syconium:** a composite fleshy fruit developed from a large number of flowers enclosed in a flask-shaped receptacle. A well known example is the fig.



89. SYCONIUM

— **Tepal:** when the sepals are indistinguishable from the petals, the term tepal is applied to both structures (see *Perianth*).



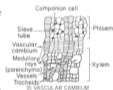
90. UMBEL

— **Testa:** the seed coat developed from the integuments or integument (see *Seed*).

— **Torus:** another name for the receptacle.

— **Tracheid:** (see *Xylem*).

90. **Umbel:** a racemose inflorescence in which the development of the peduncle is suppressed and all the pedicels arise at the same level.



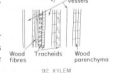
91. VASCULAR CAMBIUM

91. **Vascular Cambium:** the meristematic tissue (i.e. dividing tissue) from which the secondary xylem is cut centripetally and the secondary phloem centrifugally.



92. XYLEM

92. **Xylem:** the conductive tissue for water with mineral salts in the stele. Xylem consists mainly of water-conducting elements, i.e. the tracheids and vessels.



92. XYLEM



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Key: Cyanophyta (C); Algae (A); Fungi (F); Bacteria (B); Pteridophyta (P); Gymnospermae (G); Monocotyledoneae (M); Dicotyledoneae—all other entries.

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