

COMMON FAMILIES OF
FLOWERING PLANTS

MICHAEL HICKEY AND
CLIVE KING

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This book provides a basic introduction to twenty-five commonly occurring families of flowering plants, chosen for their economic, ornamental and ecological importance. It is designed to enable students of botany and related disciplines to gain some knowledge of the general characteristics of each family and the relationships between them. It will also be helpful to those pursuing courses in botanical illustration, field studies, and other activities requiring a knowledge of flower structure. An introductory section provides basic botanical information which is often assumed to be known and which is essential for a proper consideration of the families themselves. These are described in the second section of the book. For each family, information on its distribution, classification, general features and economic importance precedes a detailed description of a typical representative species. For the larger or more varied families several representative species are included. The text is illustrated throughout with clear and accurate line drawings taken from life and these are accompanied by a written commentary. There are also numerous explanatory diagrams. An exhaustive glossary is provided as an additional aid to the reader.

Common families of flowering plants

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Michael Hickey
and Clive King



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Foreword

The success of 'The 100 Families', as the book by Michael Hickey and Clive King first published in 1981 became popularly known, makes it virtually certain that this new work of theirs will be welcomed by an even wider range of botanical and horticultural users. It is a great pleasure for me to see the book completed and ready for the Press, and to contribute a short Foreword, as I was in at the beginning of the authors' partnership when I was Director of the Cambridge University Botanic Garden.

The decision to make radical changes in the book, and in particular to restrict its coverage to 25 common Angiosperm families, is one which cannot have been taken easily. Some of us would indeed have preferred to have both a third edition of the existing work, updated but not radically revised, as well as this new book concentrating on the 25 most important families and treating them in greater detail. Perhaps - who knows? - we can have both in the future if, as I confidently predict, 'The Common Families' sells really well.

However that may be, we can all unreservedly welcome the new 30-page section on basic botany. It is a fact that there is a large and growing demand from older students, many of them really enthusiastic gardeners and field botanists, who would like to move their hobby from a casual to a more committed interest, and have the enthusiasm and ability to do this. For them this new book caters supremely well. At the same time, it recognises that the university students of today, faced with ever-increasing pressure to learn exciting new areas of botany, may well find a basic, clear, authoritative text covering traditional areas very valuable indeed. I cannot improve, in this Foreword, on my closing remarks in the Foreword to the original '100 Families' written fifteen years ago: 'Generations of students will, I hope, test the value of this book, and come to appreciate its worth.'

S.M. Walters
1 Symonds Lane
Grantchester
Cambridge
CB3 9NU

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M.H.
C.J.K

Preface

The structure of flowering plants and their grouping into families is a complex subject, but we hope that, by means of a concise text and numerous illustrations, we have provided an interesting and informative introduction to this particular aspect of botany.

The book is divided into two main parts. The first part contains some details of plant structure, nowadays less often taught in schools and colleges than previously, which we feel is nevertheless essential to the understanding of plant families. For this reason, we have included vegetative as well as floral features of flowering plants, information that was standard in botanical text-books of the past. We considered that it would be helpful to the reader to have this basic information readily to hand when dealing with the descriptions of families and their representative plants that follow later and form the major part of the book.

The second part is devoted to descriptions of 25 common plant families, arranged in taxonomic order and chosen for their economic, ornamental and ecological importance. Occasionally, we have made reference to other families in order to clarify a particular point, for example, the often confusing similarity between grasses, rushes and sedges. Each of the texts includes a section on the classification and importance of the family

concerned, followed by the detailed description of a typical representative of that family, illustrated by original line drawings showing the parts of the flower, together with their measurements. In the case of the larger or more varied families several examples have been used to show the range of variation, and pages of flowers or fruits added where a family is especially diverse.

The book is intended primarily as a practical manual, and the user is encouraged to have the text to hand as the chosen flower or its alternative is being studied and dissected. Most of the floral parts can be seen either with the naked eye or with a x10 lens, and only rarely will a low-powered microscope be required.

It must be emphasised that the measurements for the floral parts are those of the specimens used for the drawings, and care was taken to ensure that these were typical in form. However, variation within a species or developmental factors may mean that certain parts do not agree exactly with the description or dimensions given.

We hope that this book will be of use to students of botany, both amateur and professional, and also to those pursuing courses in botanical illustration, field studies, and other activities requiring a knowledge of flower structure.

M.H.
C.J.K.

Systematic grouping of plants

The basic unit of classification in the plant kingdom is the species, species being grouped into a genus, genera into a family, families into an order, and so on.

In the list of Families in Systematic Order on page *vii*, the flowering plants are divided according to the usual practice into dicotyledons and monocotyledons. The next division into orders (ending in '-ales') has been omitted since this book covers only 25 families in detail. It will be noticed that all the family names end in '-aceae' with the exception of certain long-established families where we have kept the traditional names. However, the more recently created alternative names for these families, ending in '-aceae', have also been given. In the Classification section of the family texts it will be found that there is quite often, particularly in the case of the larger families, a further division into subfamilies, with names ending in '-oideae', and/or tribes, ending in '-eae'. The endings of these ranks are those prescribed by the International Code of Botanical Nomenclature.

Signs and abbreviations

*	indicates a family not dealt with in detail in this book
∞	indefinite number
\times	hybrid
()	united
A	androecium (stamens)
C	corolla
\bar{G}	gynoecium (ovary inferior)
\underline{G}	gynoecium (ovary superior)
K	calyx
P	perianth
L.S.	longitudinal section
T.S.	transverse section
c.	circa
cm	centimetre(s)
m	metre(s)
mm	millimetre(s)
adj.	adjective
plur.	plural

A measurement given without qualification refers to length. Two measurements connected by 'x' indicate length followed by width.

In the Classification section for each family, the number in brackets after a genus indicates the number of species known throughout the world.

Authorities

At the beginning of each family text the name of the family is followed by a personal name, often in an abbreviated form, e.g. Ranunculaceae Juss. (= Jussieu). Similarly at the beginning of the species text, the name of the species is also followed by a personal name, e.g. *Ranunculus repens* L. (= Linnaeus). This is the method used, in accordance with the International Code of Botanical Nomenclature, to refer to the name of a plant in a more precise way by indicating the person (or 'author') who first validly published that name.

The name of a species will sometimes have a 'double citation', e.g. *Consolida ajacis* (L.) Schur. In this case, the plant was first called *Delphinium ajacis* (by Linnaeus), and later transferred to the genus *Consolida* by Schur. Another use of double citation is when a plant first described as a species is now considered to be of lower rank, e.g. a subspecies or variety. The reverse process, an upgrading in rank, also results in a double citation.

Floral formula

Some of the signs and abbreviations already listed occur in the floral formula, which is a convenient form of 'shorthand' for representing the structure of a flower. The letters K, C, A, and G are used to indicate the whorls of floral parts, beginning with the outermost whorl and working inwards towards the centre of the flower. Where there is no separation into calyx and corolla the letter P is used in place of K and C.

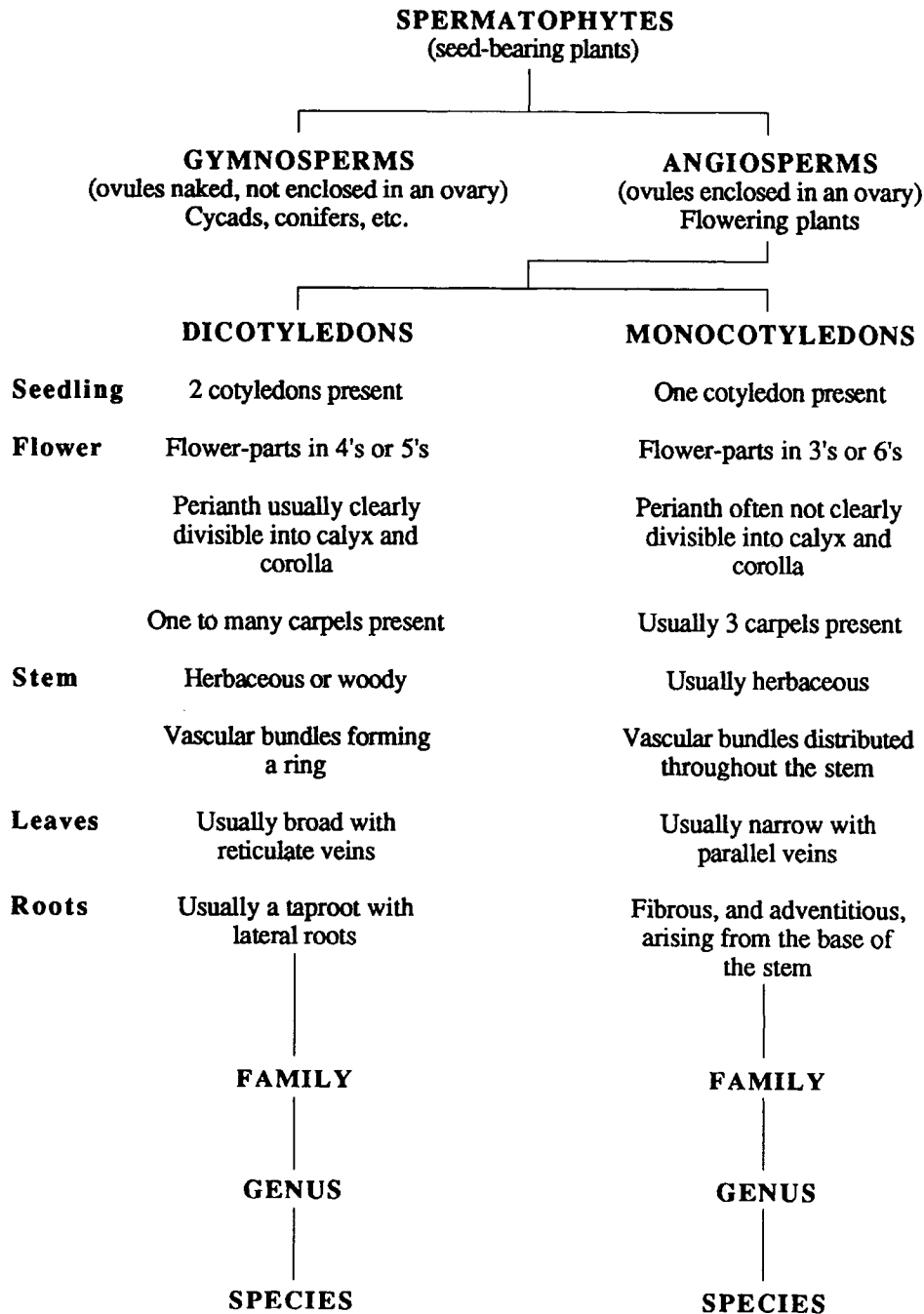
Each letter is followed by one or more figures showing the number of parts comprising each whorl, e.g. A5 indicates that the flower has 5 stamens, while A5 + 5 shows that there are 2 whorls of stamens with 5 in each whorl. Where the number of parts is large and imprecise the sign ' ∞ ' is used.

If the number of parts in a whorl is variable, a dash joining 2 figures indicates the range of variation, e.g. A2-4 (in *Arum maculatum*) means that from 2 to 4 stamens may be found in a flower of this species.

The parts forming a whorl are sometimes joined, e.g. G(3) denotes a gynoecium of 3 united carpels.

The position of the ovary is shown by a line above or below the letter G, representing an inferior or superior ovary respectively.

Summary of classification



N.B. SPECIES may be further divided into SUBSPECIES and VARIETIES.
 Horticultural varieties grown in cultivation are known as CULTIVARS, e.g. *Rosa* 'Queen Elizabeth', *Clematis* 'Nellie Moser' and *Solanum tuberosum* 'Arran Pilot'.
 HYBRIDS sometimes occur between genera, e.g. \times *Triticale*, a cross between *Triticum*, Wheat, and *Secale*, Rye.
 The majority occur between species of the same genus. Examples mentioned in this book include *Spiraea* \times *arguta*, *Malus* \times *domestica* and *Doronicum* \times *excelsum*.

General botany

THE PLANT KINGDOM

It is now generally accepted that land-dwelling organisms evolved from unicellular aquatic ancestors such as bacteria and blue-green algae. From these primitive beginnings developed the variety of complex life-forms that are found in the world today. In the course of this period, covering hundreds of millions of years, individual species or groups appeared and disappeared, but the broad categories to which they belonged, once established, have persisted until the present time. Traditionally all forms of life were considered to be either animals or plants, but more recent research has shown that this simple classification is no longer satisfactory. Indeed there are strong grounds for excluding viruses, bacteria, blue-green algae, and even fungi from the plant kingdom. This new, more restricted concept of the plant kingdom includes the following groups:

1. Non-vascular plants

- (i) algae (unicellular or multicellular freshwater or marine plants, e.g. seaweeds)
- (ii) bryophytes (mosses, liverworts)

2. Vascular plants (plants having a vascular system for conducting water and food solutions)

- (i) pteridophytes (ferns, horsetails, clubmosses)
- (ii) gymnosperms (conifers, cycads)
- (iii) angiosperms (flowering plants)

As may be seen from the geological time scale, non-vascular plants were the first to appear, followed at intervals by various kinds of vascular plants. The earliest of these were the pteridophytes, spore-bearing plants with a preference for damp and shady habitats. Then came the gymnosperms, woody plants bearing cones with naked seeds (i.e., not enclosed in an ovary). In this group pollen-grains from the male cones are carried by the wind directly on to the ovules (unfertilised seeds) produced on the scales of the female cones. The most recent group to arise are the angiosperms or flowering plants which have their ovules enclosed in a protective structure, the ovary. This is usually extended upwards to form the style and stigma. Pollen-grains landing on the stigma can only reach the ovules by forming a tube which grows down through the style and into the ovary.

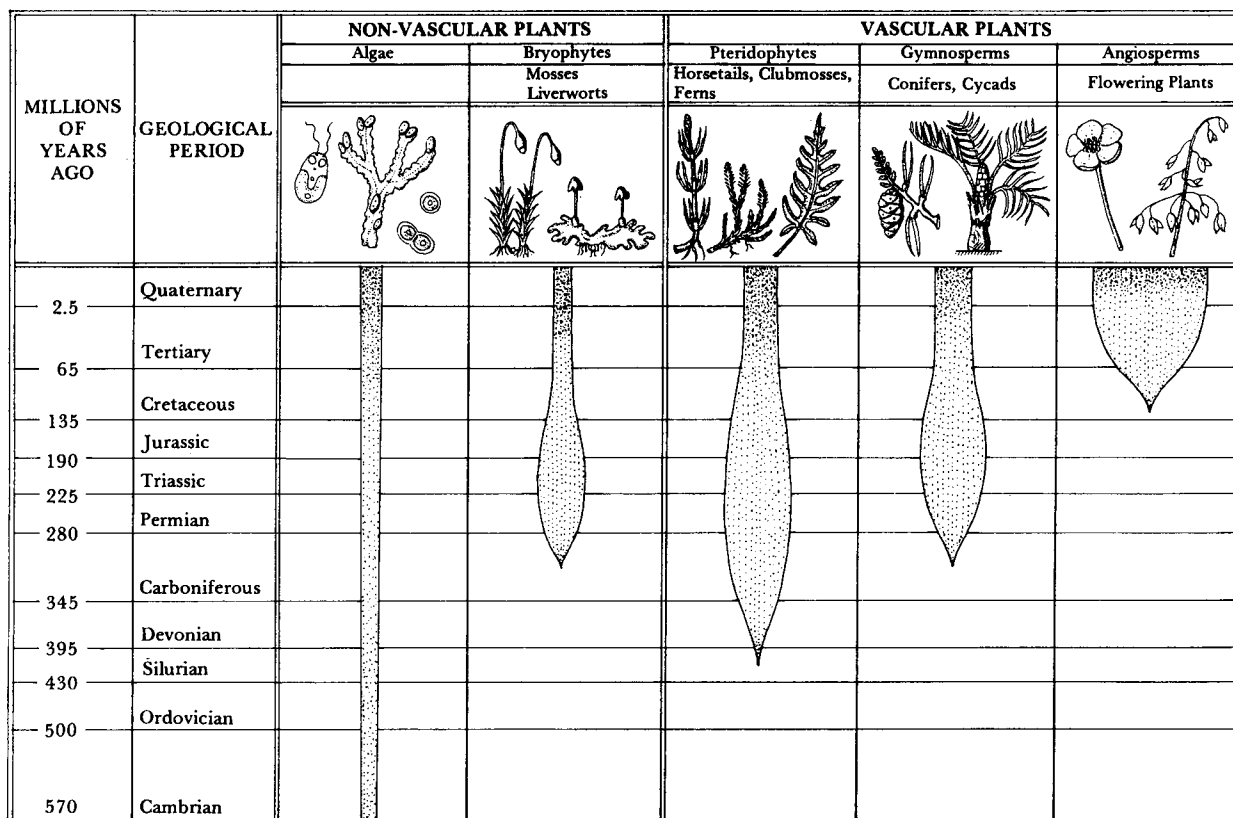


Fig. 1. Geological time-scale.

2 General botany

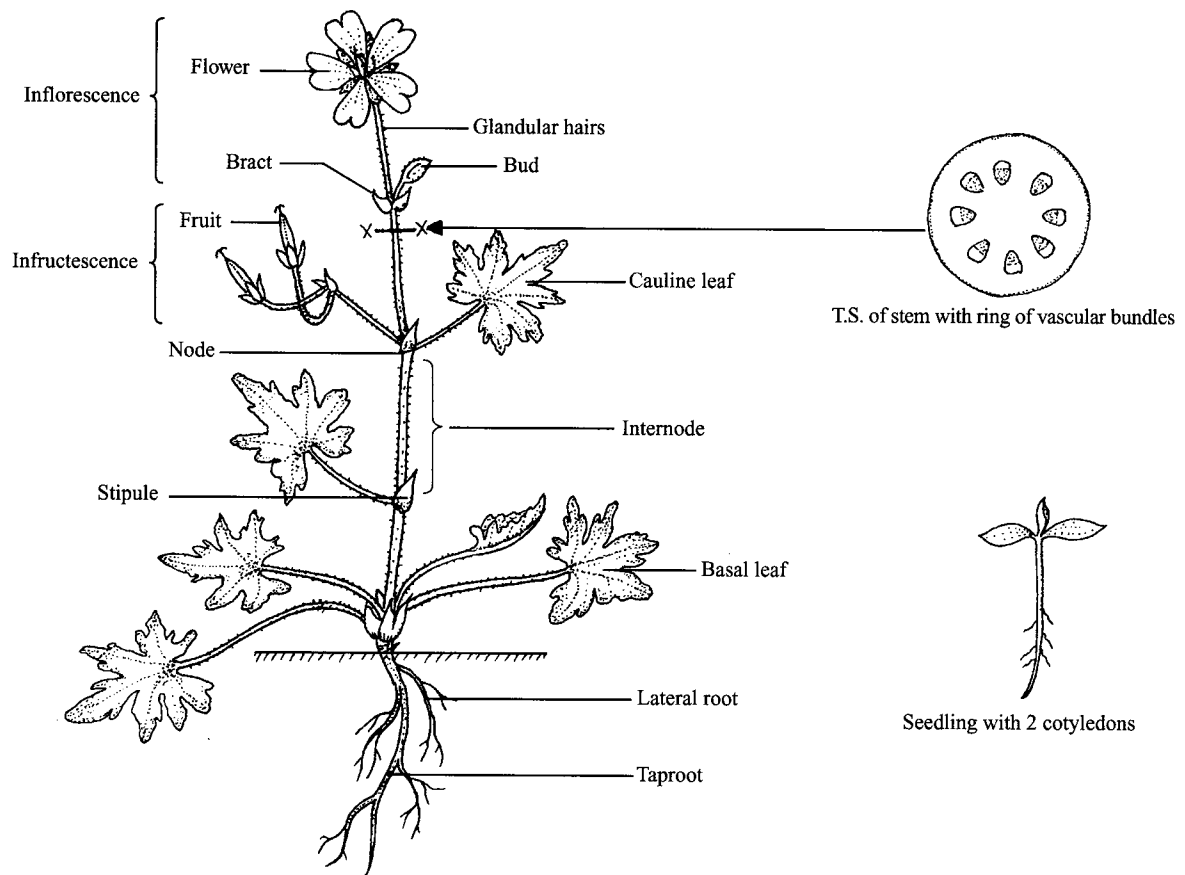


Fig. 2. Main parts of a dicotyledon: *Geranium* (Geraniaceae).

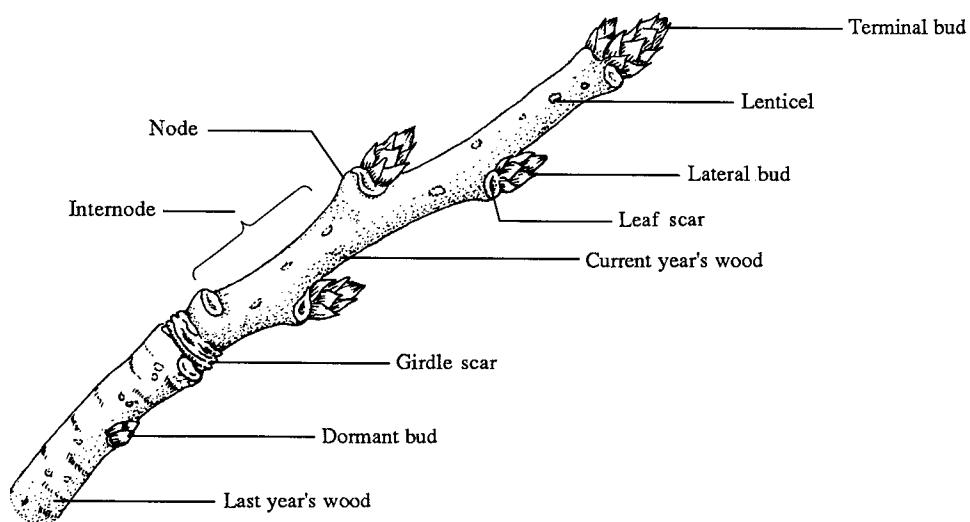


Fig. 3. Stem of a woody dicotyledon: *Prunus* (Rosaceae).

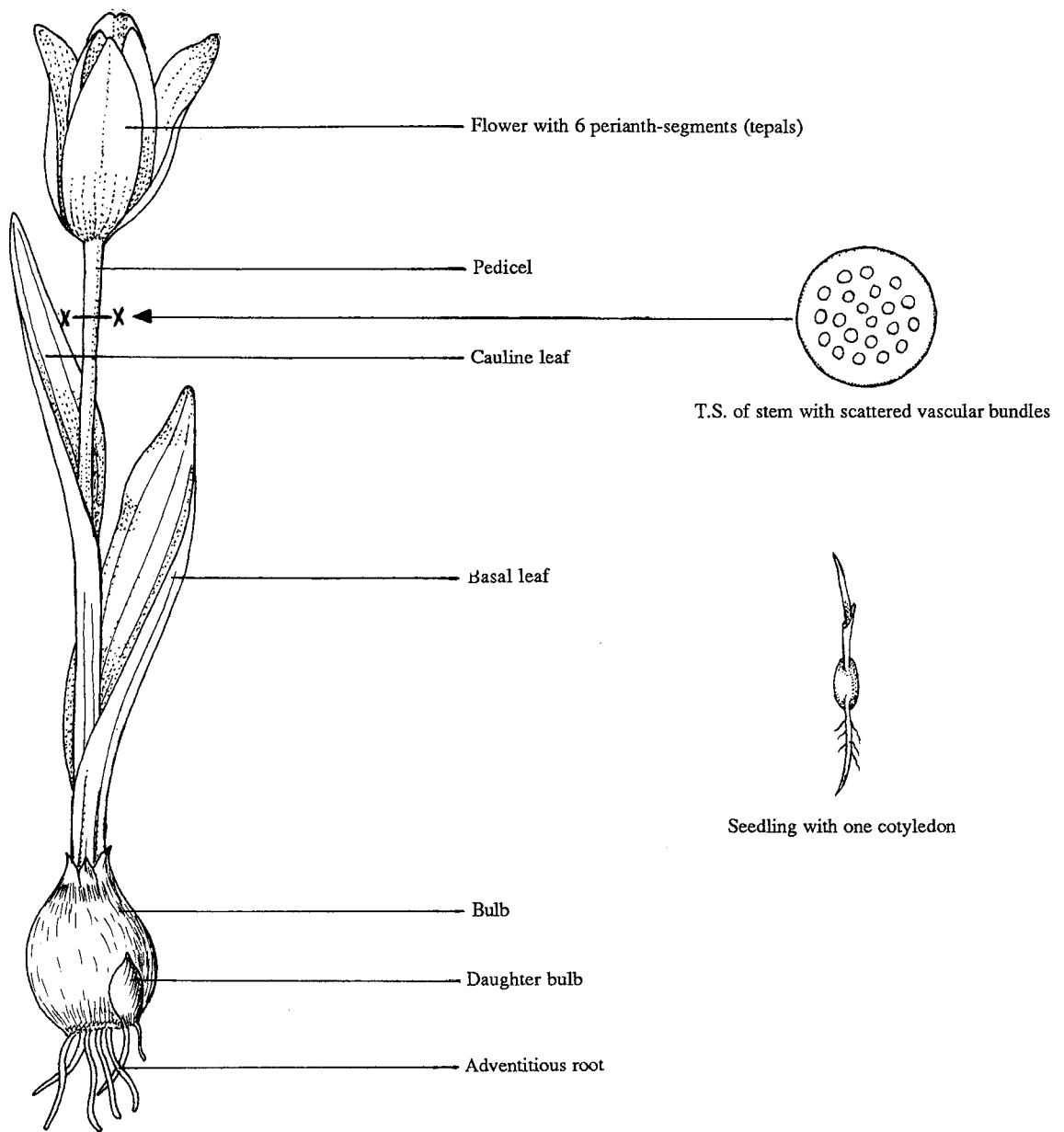
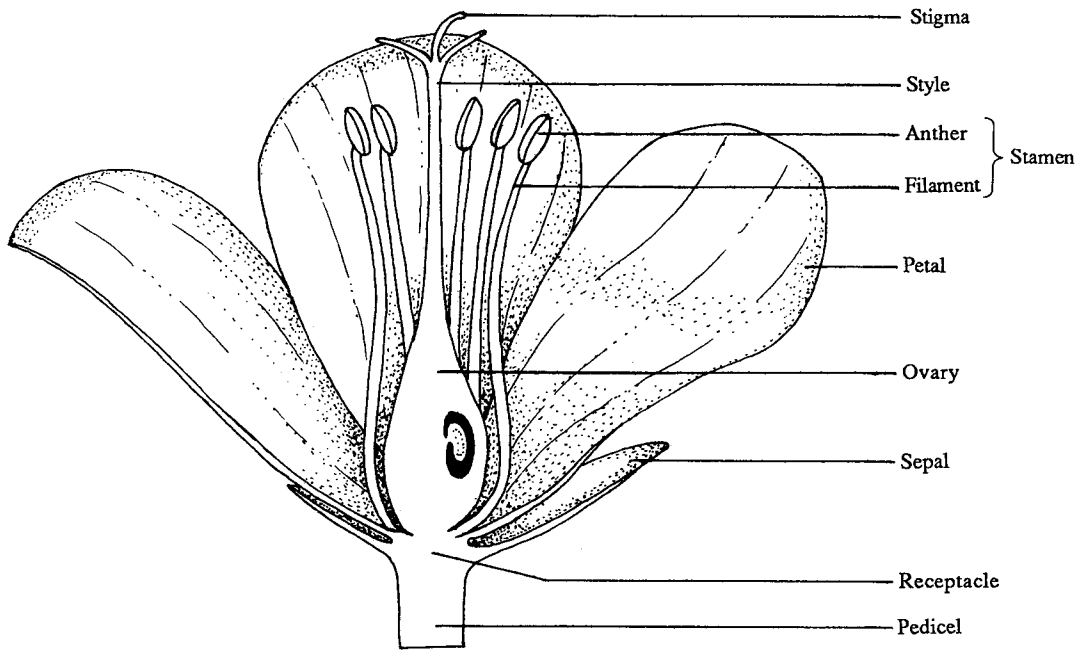
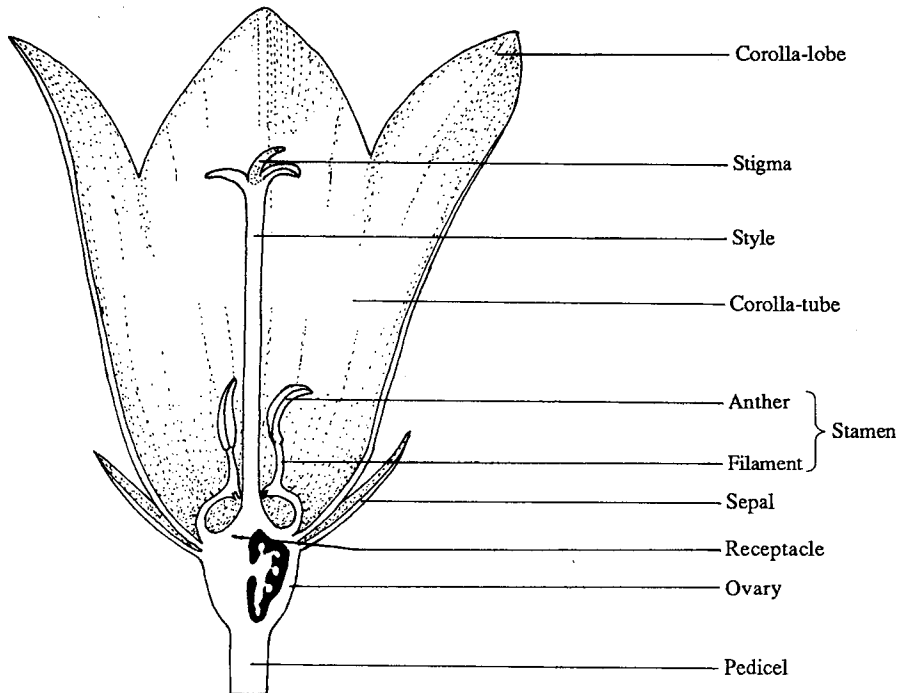


Fig. 4. Main parts of a monocotyledon: *Tulipa* (Liliaceae).

4 General botany

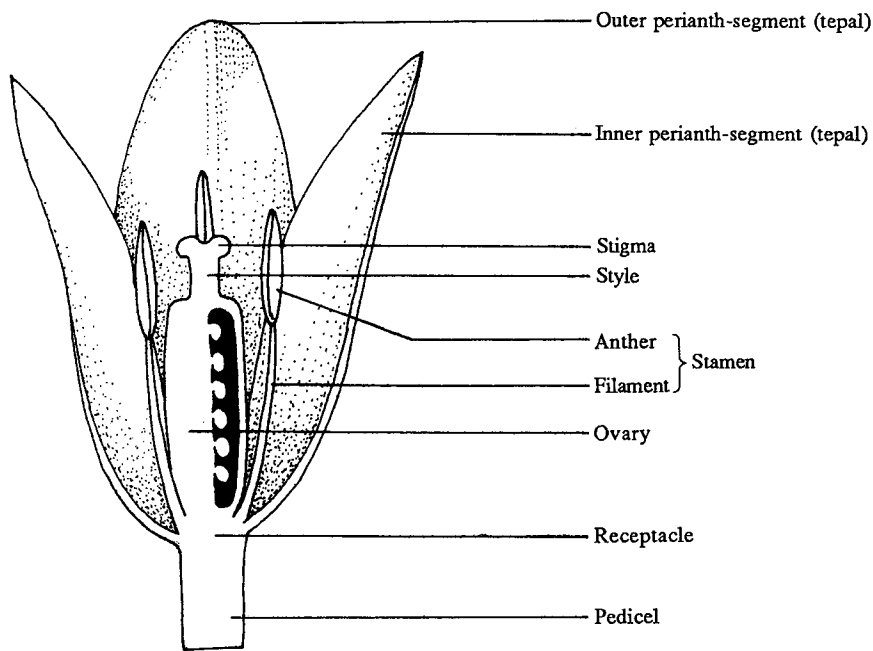


L.S. of *Geranium*, a flower with 5 free sepals, 5 free petals, and a superior ovary.

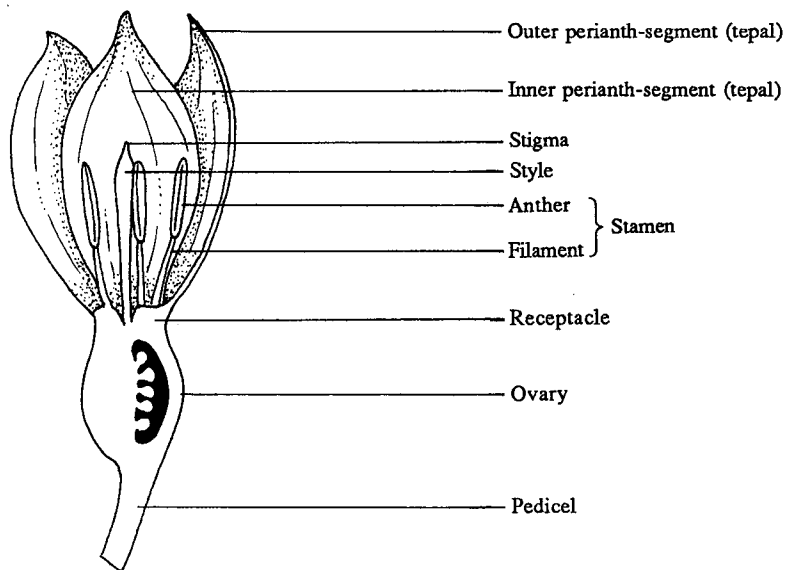


L.S. of *Campanula*, a flower with 5 united sepals, 5 united petals, and an inferior ovary.

Fig. 5. Flower of a dicotyledon (parts usually in multiples of 4 or 5 or else numerous).



L.S. of *Tulipa*, a flower with a superior ovary.



L.S. of *Leucojum*, a flower with an inferior ovary.

Fig. 6. Flower of a monocotyledon (parts usually in multiples of 3).

Note: In many monocotyledons, the perianth is not easily divisible into calyx and corolla, and the term 'perianth-segments' or 'tepals' is used to include both sepals and petals.

THE FLOWERING PLANTS

Classification and evolution

The classification of the flowering plants or angiosperms is based upon comparative study of the structure of their flowers and fruits. Thus, one of the most obvious differences between plants, namely whether they are trees, shrubs, or herbs, is not a character used in the main classification into different families, and indeed many important families, such as Rosaceae and Compositae, contain both woody and herbaceous representatives. But it is significant, and also useful in identification, that certain families, such as those comprising the catkin-bearing group or Amentiferae, are wholly or very largely composed of woody plants, whilst others are entirely herbaceous. It is generally assumed that the change from woody to herbaceous forms, and vice versa, has occurred many times within different evolutionary lines of flowering plants. Many botanists also hold the view that the primitive angiosperm was a dicotyledon with woody stems and large, terminal flowers like the modern *Magnolia*, but this theory has not been proved to the satisfaction of all. Neither is it certain how the monocotyledons originated, though it may be that the common ancestor of both monocotyledons and dicotyledons was some shrubby angiosperm with primitive floral structure belonging to a group that is now completely extinct. Although the form of the earliest flowering plants is still unknown, it seems clear from the fossil record that they arose in the early Cretaceous period (120 million years ago) and that before the end of that period (80-90 million years ago) they had ousted the conifers and cycads from their position of dominance and established themselves as the characteristic form of land plant, a place they have continued to hold to the present day.

Structure of the whole plant

With very few exceptions, growth in flowering plants is maintained underground by a **root** system and above ground by a **shoot** system. Root systems are divided into two main types. The first type, typical of dicotyledons, consists of a vertical **taproot** that has developed from the radicle of a seedling, and **lateral roots** that have grown out from the central part of that root. The second type, common in monocotyledons, occurs when the primary root system is replaced by fibrous **adventitious roots**. It is also found in species of dicotyledons where stolons or runners root at the nodes, e.g. *Fragaria* × *ananassa* (Strawberry), and in climbing plants such as *Hedera helix* (Common Ivy) where the climbing

stems produce adventitious roots in order to cling to supports of various kinds.

Roots, and other parts of plants too, sometimes act as **storage organs**, enlarging as they do so. A particular structure may appear more frequently in one family or genus than in another. For example, root tubers are a feature of the genus *Ophrys* (Orchidaceae), and rhizomes are common in many species of *Iris*, while bulbs are common to all lilies. These organs, as well as being able to store food during unfavourable climatic periods, are in many cases very efficient methods of vegetative reproduction. Some of the types of root and storage organ most often found are listed below:

Taproot. The main root becomes swollen to act as an anchorage and to store food. From this primary root small lateral roots grow out to take in water and nutrients from the soil, e.g. *Pastinaca sativa* (Parsnip) and *Taraxacum officinale* (Dandelion).

Tuberous roots. Root branches develop near the base of the plant and become swollen. These root tubers are often modified adventitious roots and may be egg-shaped or cylindrical in shape. They occur in both dicotyledons, e.g. *Dahlia*, and in monocotyledons, e.g. *Ophrys* (Bee and Fly Orchids).

Buttress, stilt, or prop roots are found mainly in the tropical flora, e.g. mangroves. An example from cooler regions is the prop roots that grow out from the 2 or 3 nodes above the surface of the ground to support the tall stem of *Zea mays* (Maize).

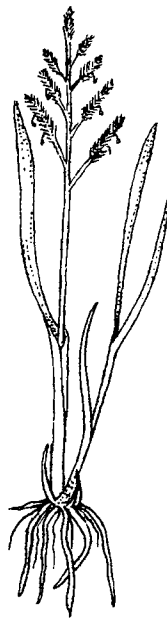
Epiphytic roots are aerial roots produced by plants growing on the branches of trees. Many tropical orchids and ferns are epiphytic and their roots obtain water and nutrients from the moisture of the atmosphere.

Stem tubers are swollen underground stems. They differ from root tubers, for when exposed to light they may produce chlorophyll, as when potatoes turn green.

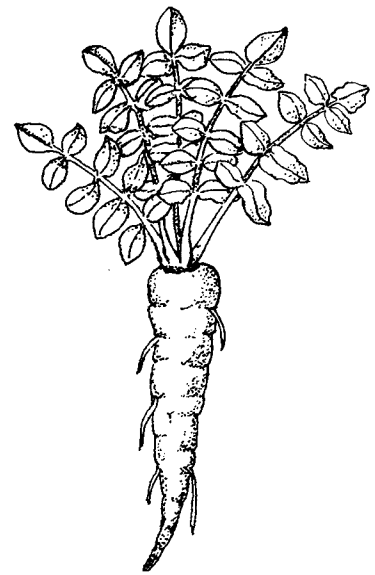
Swollen stems. The genus *Brassica* (Cruciferae) provides several examples. In Kohlrabi, a variety of *B. oleracea*, the base of the stem is swollen, and, together with the attached leaves, forms a useful food crop. In the Turnip (*B. rapa*), the swollen portion is mainly the transition area between the root and the stem, known as the **hypocotyl**. In the Swede, (*B. napus* var. *napobrassica*), both the hypocotyl and the base



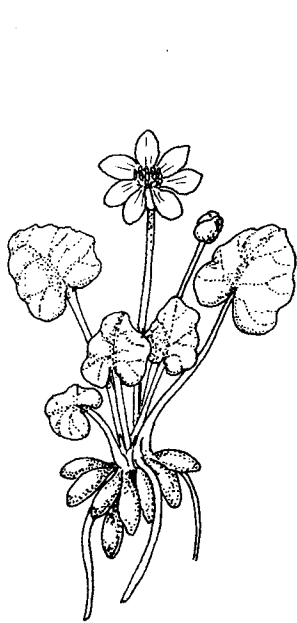
Fibrous roots of a Chickweed seedling,
Cerastium sp. (Caryophyllaceae)



Adventitious roots of a grass
(Gramineae)



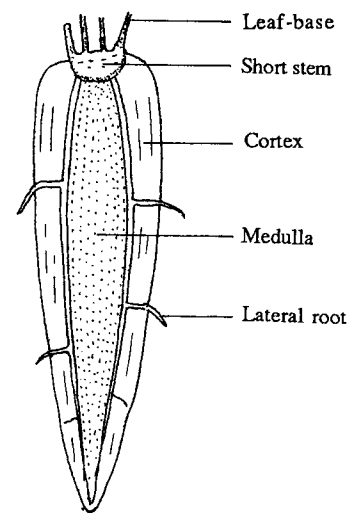
Taproot of a Parsnip,
Pastinaca sativa (Umbelliferae)



Root tubers of Lesser Celandine,
Ranunculus ficaria (Ranunculaceae)

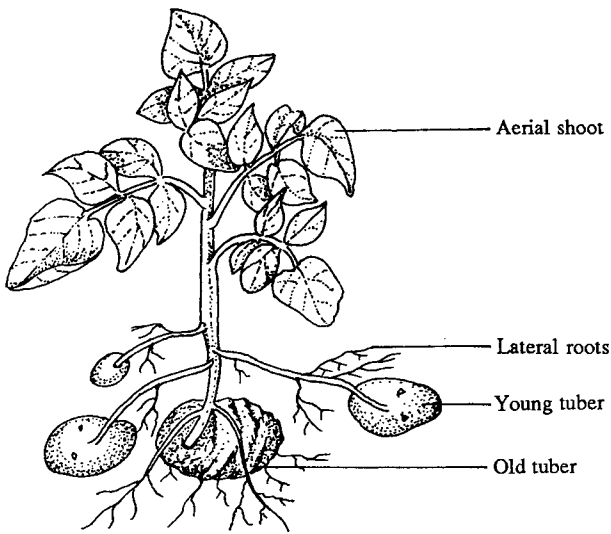


Root tubers of Bee Orchid,
Ophrys apifera (Orchidaceae)

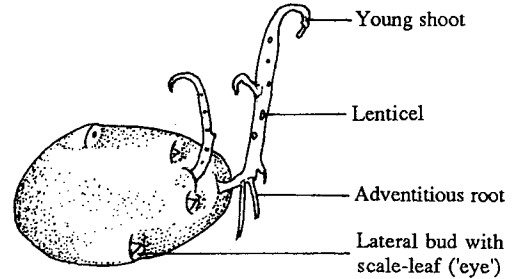


L.S. of a taproot

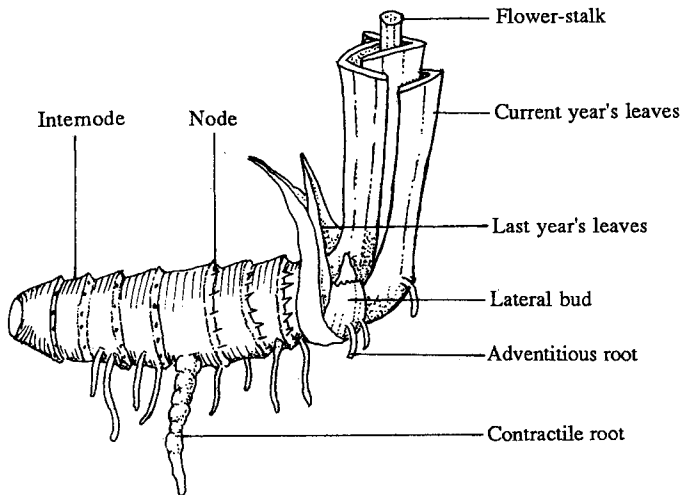
Fig. 7. Roots and root tubers.



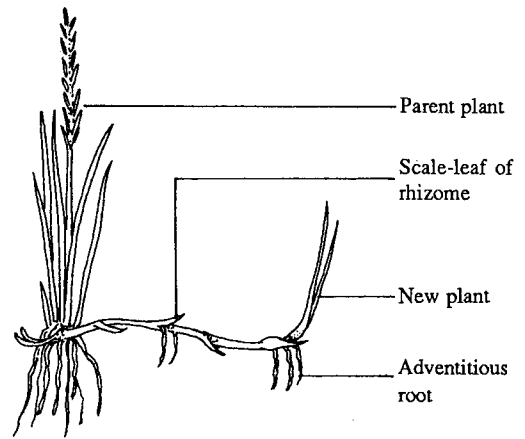
Stem tubers of a Potato plant, *Solanum tuberosum* (Solanaceae)



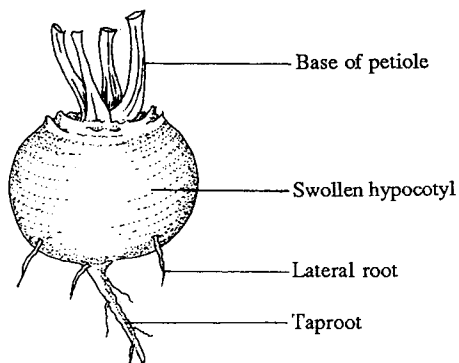
Sprouting Potato tuber



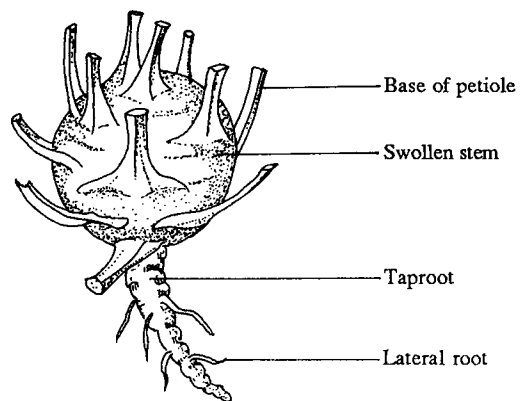
Rhizome of *Iris* (Iridaceae)



Couch-grass with rhizome, *Agropyron repens* (Gramineae)

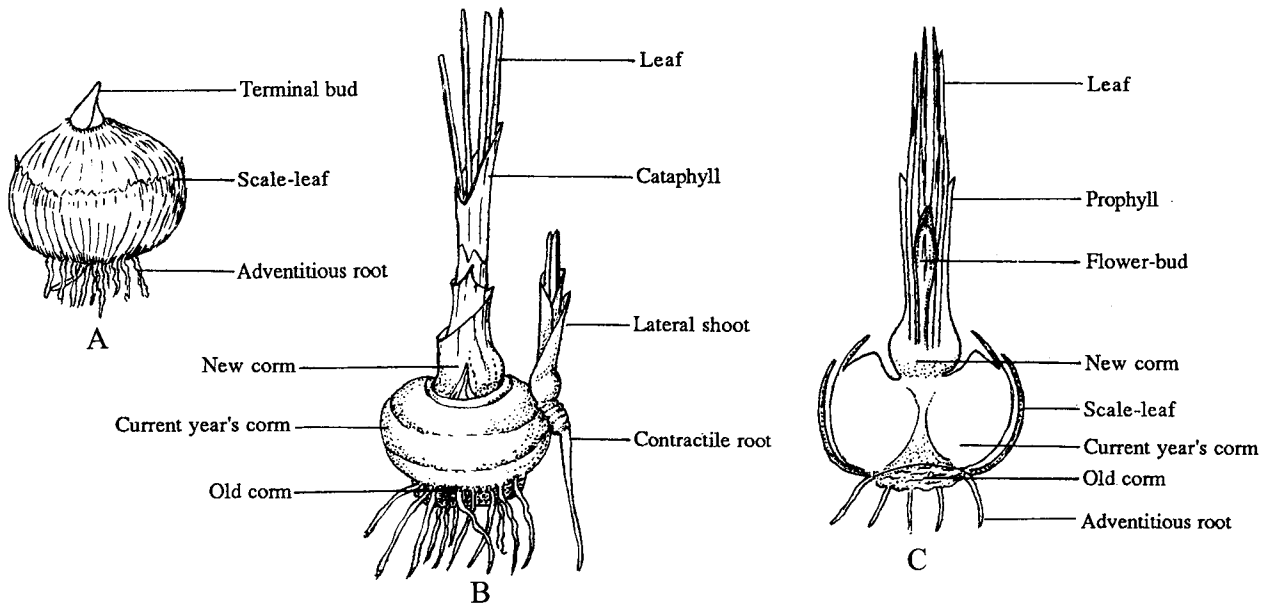


Swollen hypocotyl of Turnip, *Brassica rapa* (Cruciferae)

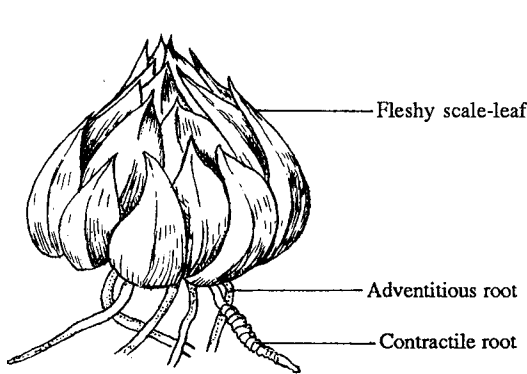


Swollen stem of Kohlrabi, a variety of *Brassica oleracea* (Cruciferae)

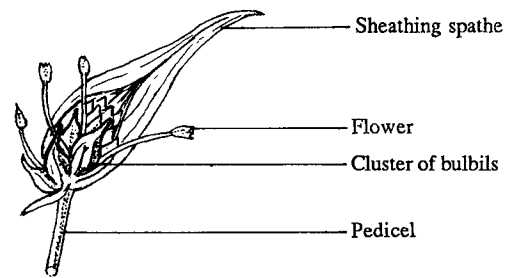
Fig. 8. Stem tubers and rhizomes.



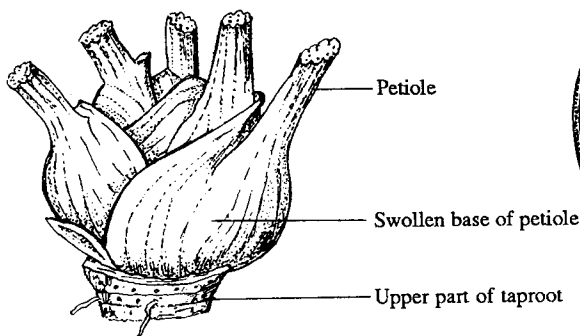
Corm of *Crocus* (Iridaceae) A. Dormant stage B. Growing stage with scale-leaves removed C. L.S. of corm



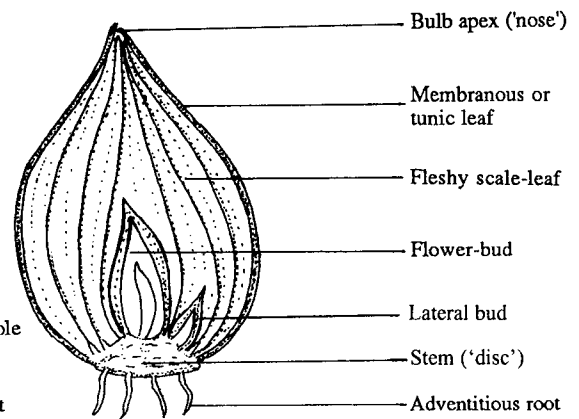
Bulb of Lily, *Lilium* (Liliaceae)



Inflorescence of Garlic with bulbils *Allium sativum* (Liliaceae)



Swollen leaf-bases of Florentine Fennel, *Foeniculum vulgare* var. *dulce* (Umbelliferae)



L.S. of Onion, *Allium cepa* (Liliaceae)

Fig. 9. Corms and bulbs.