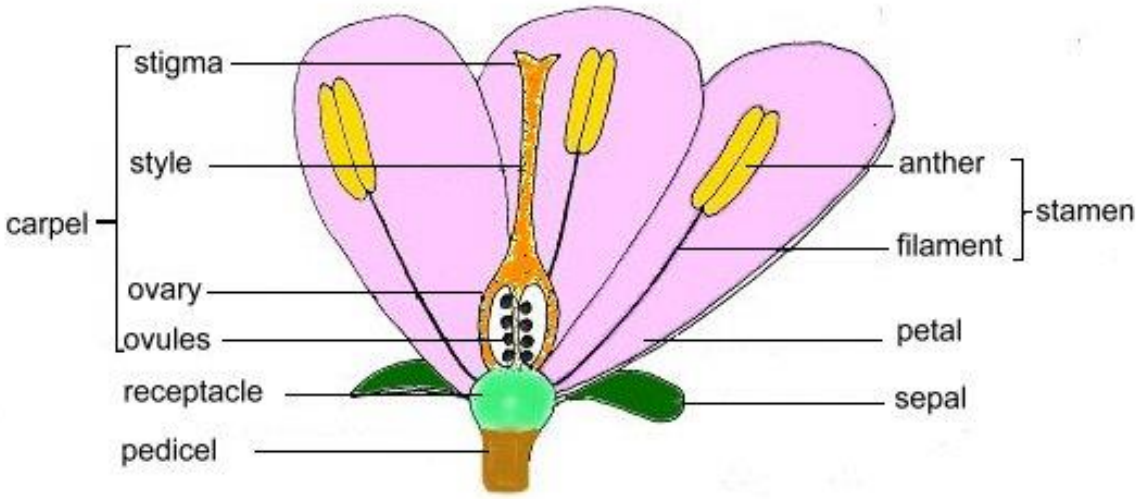
Australian Plants Society NORTH SHORE GROUP
Ku-ring-gai Wildflower Garden

Flowers, Inflorescences and Fruits

FLOWERS

In common usage the word 'flower' is used for both a single flower and a number of flowers grouped together, for example a *Banksia* spike. Closer examination shows it is made up of single flowers, all with a similar structure.

A flower is the sexual reproductive shoot of a plant, consisting of a receptacle that bears the sepals, petals, stamens and carpels – the four basic parts of a flower. Broadly speaking, the parts are in concentric rings.



Sepal: Makes up the outer ring, usually green and leaf-like, and in the bud stage encloses and protects the other flower parts. Collectively known as the **calyx.** Sepals could be free, wholly or partly united, they could fall early or remain as part of the fruit.

Petal: Makes up the next inner ring, usually conspicuous, brightly coloured, to attract pollinators. Collectively known as the **corolla**. They could also be free, part or fully united giving rise to variety of types.

Tepal: A free segment of a perianth not recognized as a petal or a sepal.

Perianth: Usually consisting of a whorl of sepals and/or a whorl of petals, or two whorls of tepals.

Pedicel: (stalk) of a flower, if not present the flower is sessile.

Female part of the flower

Gynoecium: the carpel (if solitary) or carpels of a flower.
Carpel: A unit of the female organ of the flower, with an **ovary** bearing one or more **ovules (female cells),** usually a **style** (stalk), joining the ovary and a pollen receptive **stigma** of various shapes and size. A simple stigma has no structures present.

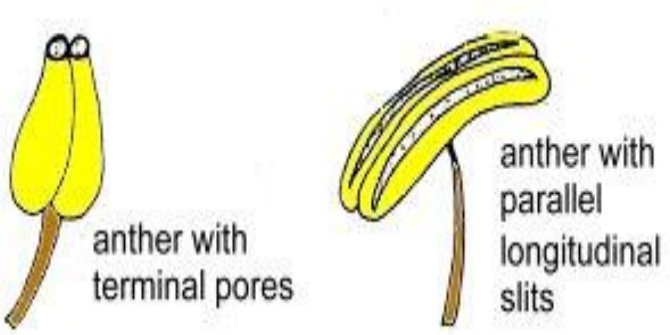
A flower can have a solitary carpel or numerous carpels; these could be free or fused together. The ovules, if fertilized by compatible pollen, develop into seeds, and the ovary into the fruit.

Male part of the flower

Androecium: consists of the stamens of a flower.

Stamen: A unit of the male organs of the flower, with an **anther** and often a **filament** or stalk. The anther, located at the terminal part of a stamen, bears pollen sacs containing pollen grains (**male cells**).

Staminodes are sterile stamens which do not produce pollen, or the anthers are deformed or absent, in this case the filament may look like a petal.
Anthers may open by longitudinal slits, valves or pores on the apex. They could be united, free, have appendages and be attached to filaments from the base, from the back or be pendulous.



Bract: A modified leaf, often small and associated with a flower or group of flowers

Bracteole(s): One or two bract-like structures on the stalk or on the calyx of a flower.

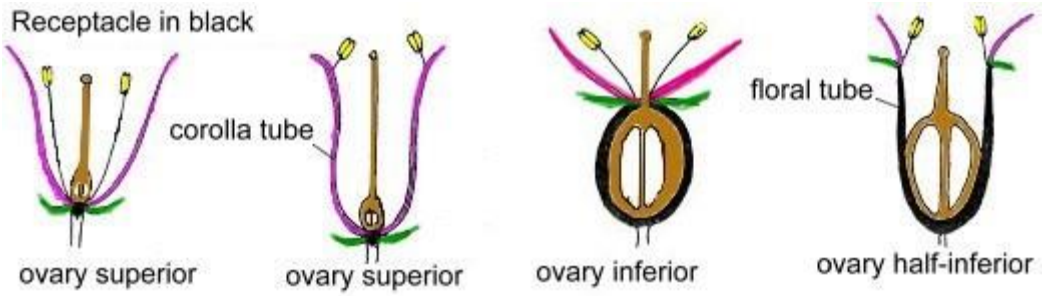
Hypanthium or Floral tube: The fused bases of perianth parts (calyx and /or corolla) and stamens. Usually a cup- like or tubular structure present in some flowers, for example *Eucalypts* and *Leptospermum*, which appear to be an upward growth from or part of the receptacle, of the edge of the ovary to casual observation.

Corolla tube: Formed by the basal section of petals being joined to each other. The **throat** is the top of the tube and the **limb** is the expanded part of the corolla, for example *Epacris longiflora.*

Free: Parts not joined together are called free.

Connate: Same parts of a flower joined together even for only part of their length; for example stamens in many of the pea flowers, melaleucas or petals in the tubular corolla of *Epacris longiflora.*

Adnate : Similar to connate but different parts of the flower joined together, for example stamens joined to tepals as in some *Banksia* and *Grevillea* species in the Proteaceae family.



Superior ovary: Perianth and stamens are inserted on the receptacle below the ovary.

Inferior ovary: The receptacle is fused to the sides and often over the top of the ovary and the perianth and stamens are attached at the top of the ovary.

Half-inferior ovary occurs when the receptacle is fused only part of the way up the ovary wall.

Placentation: Arrangement of the ovules in the ovary

Regular flower (Actinomorphic): Perianth is radially symmetrical, the individual petals and sepals are alike. Perianth can be divided into equal parts by centrally cutting in more than one plane

Irregular flower (Zygomorphic): Petals and sepals are not alike. The perianth can be divided into 2 equal parts by cutting in one plane only.

Classification and naming of the flowering plants since Linnaeus in 1753 has been based on the structure of the flower. Parts of a flower may vary in number, size, colour, shape, arrangement and in having additional structures such as hairs, staminodes, spurs, hoods and bracts. This variation is the basis of classification into species, although with modern technology genetic and protein analyses are now also used, together with ecology.

A flower at its most basic is a receptacle with carpel and/or stamens. In other words, a flower may not have petals or sepals, and it is then referred to as a **naked flower**.

Flowers that have a carpel and stamens are called bisexual. If the flower has only either a carpel or a stamen(s), it is called unisexual. Unisexual flowers may both (male and female) occur on the one plant (**monoecious**) or on separate male and female plants (**dioecious**).

Recommended reading

Clarke, I. & Lee, H. *Name that Flower.* Melbourne University Press, Burwood, Vic. 2003.
Harden, Gwen & Williams, John. *How to Identify Plants*. Univ. New England, Namoi.1990
Harden, Gwen & Murray, Louisa H. *Supplement to Flora of NSW* Vol 1. UNSW Press, Royal Botanic Gardens, Sydney. 2020.

INFLORESCENCES

Did you know that,

- An inflorescence is the flowering shoot of a plant.
- It can range from a single flower to a very complex arrangement of many flowers.
- A *Banksia* 'flower' or a *Telopea* (Waratah) 'flower' is such a group of many individual flowers with similar flower structure.

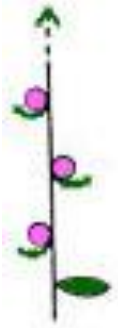
The stalk of an individual flower is called a **pedicel**. The main stalk of an inflorescence is a **peduncle**. Individual flowers may be called pedicellate (with a stalk) or sessile (without a stalk). The stem-like flowering stalk of a plant with leaves clustered at the base is a **scape**. In the diagrams, a circle represents a flower bud and an arrow represents a vegetative bud.

A single flower is described as **solitary**.

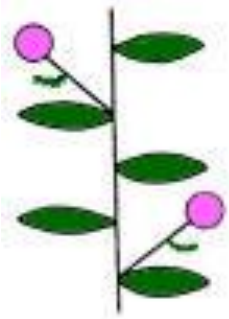
The flowering shoot is called an **inflorescence**:

Solitary on scape
e.g. many *Pterostylis* species

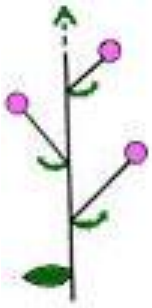
Spike:
flowers sessile
e.g. *Callistemon* sp.



Solitary in leaf axil
(the angle between the leaf and the stem)
e.g. *Boronia ledifolia*

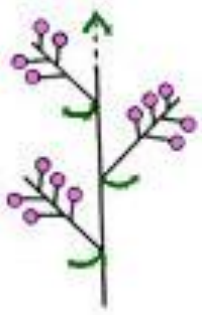


Raceme:
flowers pedicellate
e.g. *Hardenbergia violacea*



An inflorescence which has internal branching is called a **compound inflorescence**

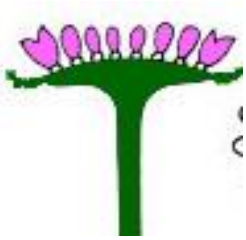
Panicle:
main axis has branches which may be further branched e.g. *Dianella* sp.



Corymb:
all the flowers are at the same level though the pedicels arise at different levels e.g. *Poranthera* sp.

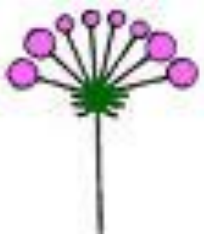
Spadix:
a spike with a thickened axis being surrounded by a spathe e.g. *Alocasia brisbanensis*

Head:
a dense cluster of more or less sessile flowers e.g. Asteraceae a group of florets sessile on a common receptacle



Cyathium:
a group of reduced unisexual flowers surrounded by a whorl of bracts e.g. *Euphorbia* sp.

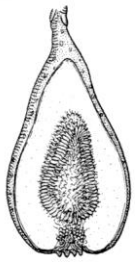
Umbel:
All flowers arise from one point at the top of the peduncle
e.g. *Actinotus* sp.



Spikelet:
an axis bearing glumes enclosing florets e.g. Poaceae (grasses)

Compound Umbel:
branched umbel
e.g. *Platysace* sp.

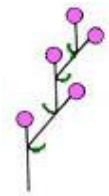
Invaginated inflorescence
a pocket formed by turning in on itself e.g. *Ficus* spp. where the minute flowers and fruits are actually inside the axis



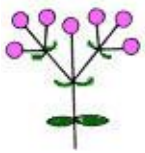
Inflorescences can be described as **racemose** or **cymose**. In most inflorescences the oldest flowers are at the base and end in a vegetative (non-floral) bud thus allowing further growth of the axis: these are called racemose inflorescences. However, in others the flower terminates the axis and expansion takes place through the growth of axillary buds which also end in a flower, these are called cymose.

Types of cyme

Monochasial cyme:
a cyme with the branches arising singly

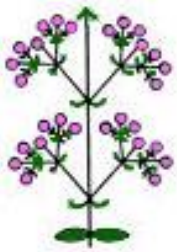


Dichasial cyme:
a cyme with the branches arising in opposite pairs



Mixed type:

Thyrse:
a compound inflorescence ending in a vegetative bud i.e. racemose, but with lateral branches ending in a flower i.e. cymose e.g. *Goodenia ovata*



Acknowledgments: These notes contain hyperlinks to materials, including images, illustrations, plant descriptions and a glossary from PlantNET, with the courtesy of The Royal Botanic Gardens & Domain Trust, 2020.
For general access to PlantNET see also http://plantnet.rbgsyd.nsw.gov.au/

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IDENTIFYING PLANTS BY THEIR FRUITS

Did you know that,

- The fruit of the *Blueberry Ash* is not a berry.
- The fruit of the *Macadamia* is not a nut.
- The fruit of a *Banksia* is not a cone.
- Some fruits are poisonous.

Introduction

A fruit is the seed-bearing structure of a plant whether fleshy or dry. These fruits or seed cases and the seeds they contain are the most complex structures plants produce. They are the essential elements which ensure the continuation of the species and it is the only phase in the life of most plants when they can travel. Dispersal is a key element in plant survival and many plants have evolved methods to ensure the seeds are dispersed. For example, through the succulent fruit eaten and dispersed by animals or the exploding pods of legumes, to the winged seeds contained in many seed cases and the burrs which can travel in an animal's fur.

Do not eat fruits that you do not know to be safe to eat.

We are going to look at the ways plants package their seeds to ensure survival and this will help in the identification and classification of native plants.

Following are some useful terms which will be used in this talk.

Glossary

Carpel: The female part of a flower consisting of the stigma, style and ovary

Cauliflory: The production of flowers or fruits on well-developed trunks and branches

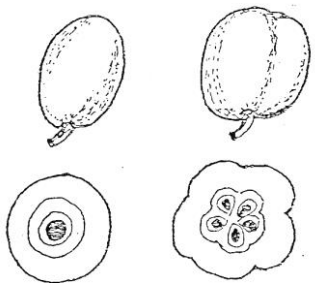
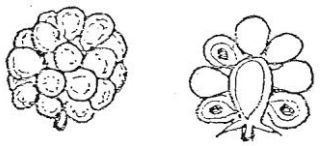
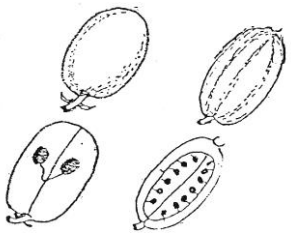
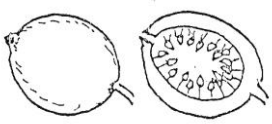
Dehiscent: Opening on maturity to release the seed

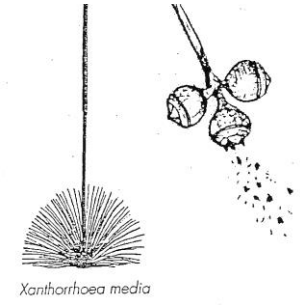
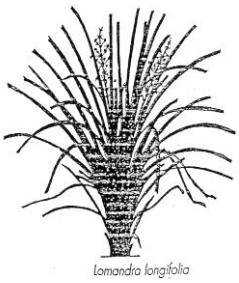
Indehiscent: Not opening on maturity to release seed

Dioecious: With male and female flowers on separate plants

Monoecious: Having male and female flowers on the same plant

Native Fruits and other Seed Cases

Fruit type/ Seed Case	Description		Native Plant example
Drupe	An indehiscent (not opening) succulent fruit derived from one or more carpels in which the pericarp consists of three layers: the seed(s) enclosed in the inner stony layer – ENDOCARP, a soft fleshy layer MESOCARP and an outer skin EPICARP.		*Davidsonia jerseyana,* (Davidson's Plum), *Acronychia acidula,* (Lemon Aspen), *Elaeocarpus reticulatus,* (Blueberry Ash), *Persoonia pinifolia,* (Geebung).
Aggregate drupe	A cluster of individual drupelets derived from a single flower in which the carpels are free from each other. Although commonly referred to as berries e.g. raspberry, blackberry, these are not berries.		*Rubus rosifolius,* (Native Raspberry).
Berry	A fleshy indehiscent fruit with one or more seeds embedded in the fleshy tissue with no endocarp. May be formed from either a superior or inferior ovary e.g. ovary above floral parts or ovary below floral parts. Berries change colour and become soft as they ripen.		*Eupomatia laurina,* (Bolwarra), *Cordyline rubra, Dianella caerulea, Syzygium australe.*
Follicle	A dry fruit derived from a single carpel and opening along one side. In *Banksias* the fruits are actually a number of individual follicles joined together on a woody cone. Some fruit have winged seeds e.g. *Hakea*. In some *Banksia* species follicles open after bush fires e.g. *B. serrata, B. ericifolia.*		*Stenocarpus sinuatus,* (Firewheel Tree), *Grevillea hilliana, Hakea gibbosa, Banksia serrata, Banksia ericifolia, Macadamia tetraphylla.*
Syconium	The multiple fruit formed in figs where the minute flowers and fruits are actually inside the swollen inflorescence stem. The flowers are pollinated by wasps specific to each species. Some fig species produce fruit on the trunk and major branches. This process is called cauliflory e.g. *Ficus leptoclada*. The mature fruit of the fig are eaten by birds and animals and dispersed.		*Ficus leptoclada,* (Cauliflory Fig), *Ficus coronata,* (Sandpaper Fig).

Grain or Caryopsis	Grains are single seeded fruits produced by grasses. Flowers of these species are insignificant and usually in large flower heads that occur on tall stems. In most cases each flower head will develop to contain many individual grains. Grains become dry, change in colour from green to brown and release easily from the plant when mature. In *Themeda australis* each grain has a bristle-like attachment called an awn. The awn acts to 'screw' the grain into the ground.		*Themeda australis,* (Kangaroo Grass).
Woody capsule	A dry dehiscent fruit that usually contains several or numerous seeds. Capsules take from 4 to 24 months to reach maturity after flowering. They become dry, hard and woody when the seed is mature. Seeds are released from valves on the tops of capsules. The seed is usually small and various shades of brown or black.		*Eucalyptus spp., Xanthorrhoea media, Callistemon viminalis, Leptospermum squarrosum, Melaleuca hypericifolia.*
Non-woody capsule	Many Australian native plants contain seed in non-woody capsules. These capsules range from papery and brittle to leathery or slightly woody. Non-woody capsules usually open to release seed soon after maturity. Depending on the species each capsule contains 2-10 seeds ranging from dust-like to 2-3mm in diameter.		*Lomandra longifolia, Pittosporum revolutum, Auranticarpa rhombifolia, Toona ciliata.*
Cone	Specialized scale-like structures bearing the seeds arranged tightly on a central axis. Plants with cones do not produce flowers, instead the seeds develop on the scale-like structures that eventually form the cones.		*Araucaria bidwillii,* (Bunya Pine), *Macrozamia communis,* (Burrawang).
Pod or legume	A long dry dehiscent fruit formed from one carpel and opening down two sides. Depending on the species pods range from papery to leathery at maturity. As pods mature, they change colour from green to various shades of brown or black and become dry and brittle. Pods split down both sides to release seed upon maturity. Pods of some species open explosively during hot weather.		*Castanospermum australe*, (Black Bean), *Acacia spp*.

A selection of Species found at Ku-ring-gai Wildflower Garden

SCIENTIFIC NAME	COMMON NAME	SEED CASE TYPE
Elaeocarpus reticulatus	Blueberry Ash	Drupe
Persoonia levis	Broad-leaved Geebung	Drupe
Persoonia pinifolia	Pine-leaved Geebung	Drupe
Hicksbeachia pinnatifolia	Red Bopple Nut	Drupe
Davidsonia jerseyana	Davidson's Plum	Drupe
Trochocarpa laurina	Tree Heath	Drupe
Dianella caerulea	Flax Lily	Berry
Eupomatia laurina	Bolwarra	Berry
Syzygium australe	Brush Cherry	Berry
Stenocarpus sinuatus	Firewheel Tree	Follicle
Buckinghamia celsissima	Ivory Curl Tree	Follicle
Macadamia tetraphylla	Macadamia Nut	Follicle
Banksia serrata	Saw-tooth Banksia	Follicle
Banksia ericifolia	Heath Banksia	Follicle
Telopea speciosissima	Waratah	Follicle
Hakea gibbosa	Needle Bush	Follicle
Grevillea sericea	Pink Spider Flower	Follicle
Grevillea linearifolia	Fine-leaved Grevillea	Follicle
Ficus coronata	Sandpaper Fig	Syconium
Ficus rubiginosa	Port Jackson Fig	Syconium
Themeda australis	Kangaroo Grass	Grain or Caryopsis
Xanthorrhoea sp.	Grass Tree	Woody capsule
Eucalyptus haemastoma	Scribbly Gum	Woody capsule
Callistemon viminalis	Weeping Bottle Brush	Woody capsule
Lomandra longifolia	Mat Rush	Non-Woody capsule
Auranticarpa rhombifolia	Holly-leaved Pittosporum	Non-Woody capsule
Pittosporum revolutum	Rough fruit Pittosporum	Non-Woody capsule
Toona ciliata	Red Cedar	Non-Woody capsule
Araucaria bidwillii	Bunya Pine	Cone
Araucaria cunninghamii	Hoop Pine	Cone
Macrozamia communis	Burrawang	Cone
Allocasuarina distyla	Scrub or Black She-oak	Samara
Casuarina glauca	Swamp Oak	Samara
Castanospermum australe	Black Bean	Pod or Legume
Indigofera australis	Native Indigo	Pod or Legume
Acacia sp.	Wattle	Pod or Legume
Morinda jasminoides	Sweet Morinda	Syncarp
Gahnia sp.	Saw Sedge	Nut

Produced for Australian Plants Society-North Shore Group by David Chandler 2015
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