

## Fruit Morphology and Seed Morphology: Building from the Flower in Solanaceae and Rosaceae

果实和种子的形态学：以茄科和蔷薇科为例

The chief parts of the flower are the petals (**corolla**), the sepals (**calyx**), the **stamens** (which produce pollen) and **pistil** which contains the ovaries and form the fruit. All of these arise from the floral **receptacle**. The based on the position of the pistil or carpel in relation to the receptacle, flowers may be said to have a **superior ovary (hypogyny)**, when the petals arise from the receptacle below the pistil), a **inferior ovary (epigyny)**, when the petals and sepals arise from above of the ovary) or **perigyny** when the condition is in between. The family Rosaceae includes a spectrum from inferior to superior and producing a range of fruit types and thus provides good examples of how flowers develop into fruits. Other families are more highly consistent such as the Solanaceae which consistly has superior ovaries in its flowers which tend to form berries (fleshy fruits with many seeds) or dry berry-like capsules. By examining the fruits of various species in these families, which are familiar as many common food plants it is possible to become familiar with the basic range of variation in how fruits form and what their structures are called, especially for fleshy fruits.

花的主要组成部分包括**花冠**、**花萼**、**雄蕊**（产生花粉）、**雌蕊**（包括子房并形成果实）。这些都从**花托**上发育出来。根据雌蕊或心皮与花托的关系，可以分成**下位式**（上位子房），**上位式**（下位子房）和**周位式**。蔷薇科包括了上述各类因此是很好的例子来说明如何从花变到果实。其他科别更显示上述之一的特征，如茄科全部都是上位子房（下位式）因此形成浆果（肉质果有很多种子）或者蒴果（干果）。通过观察这两个科的不同种属，可以熟悉一般食用植物的基本特征和各结构名称。

术语：

hypogyny 下位式：雄蕊、花瓣、萼片着生于子房的下部，子房位置高于花的其他各部分

epigyny 上位式：雄蕊、花瓣和萼片着生于子房的顶部，子房位置低于花的其他部分

perigyny 周位式：雄蕊、花瓣及萼片着生于花萼筒（托杯）上，但并不真正接触上位的子房

ovary 子房：雌蕊膨大的基部，内含胚珠

ovules 胚珠：未成熟的种子

stamen 雄蕊：花的雄性生殖器官

pistil 雌蕊：花的雌性生殖器官

corolla ( petal ) 花冠 ( 花瓣 )：所有花瓣的总称

calyx ( sepal ) 花萼 ( 萼片 ) : 所有萼片的总称

exocarp 外果皮

mesocarp 中果皮

endocarp 内果皮

pericarp 果皮

seed 种子 : 成熟的胚珠

seed coat 种皮 : 种子的外层包裹 , 源于胚珠的珠被

axile placentation 中轴胎座式 : 胚珠着生在二室或多室子房的中轴上

basal placentation 基生胎座式 : 胚珠着生在单室子房的基部

free central placentation 特立中央胎座式 胚珠着生于单室子房中央一个直立且与子房上部分离的柱上

parietal placentation 侧膜胎座式 : 胚珠着生于子房周缘壁上

drupe 核果 : 通常具单个种子并由石质内果皮包围的不开裂肉质果实

stone 果核 : 包裹着核果种子的木质坚硬内果皮

pseudocarps 假果 : 不是由子房而是由花托发育形成的果实 , 如梨果

aggregate fruit 聚合果 : 通常指由单花的许多离生雌蕊形成的一簇或一组的小型肉质果。如悬钩子的簇生小核果

### **Solanaceae: the example of the tomato 茄科：以西红柿为例**

Selected taxonomy of the Solanaceae

Solanaceae (superior ovaries, hypogyny, fleshy fruits)

Tomatoes (*Lycopersicon esculentum*) 西红柿、番茄

Native South America 南美起源

Peppers/ chillis (*Capsicum annum*, other minor *Capsicum* spp.) 辣椒

Native South America 南美起源

China Wolfberry (*Lycium chinense*) 枸杞

Native China 中国起源

Aubergines/ eggplants (*Solanum melongena*) 茄子

Native Southeast Asia & India 东南亚、印度起源

Tobacco (*Nicotiana* spp.) 烟草

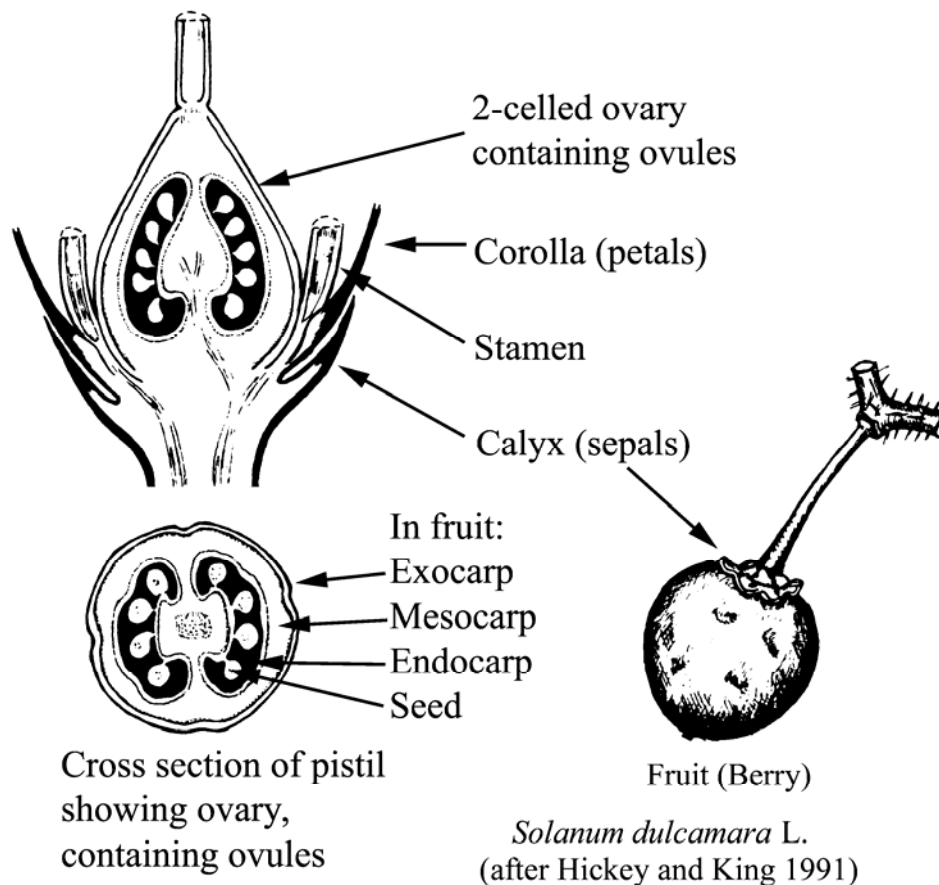
Native Americas 美洲起源

Potato (*Solanum tuberosum*) 马铃薯、土豆

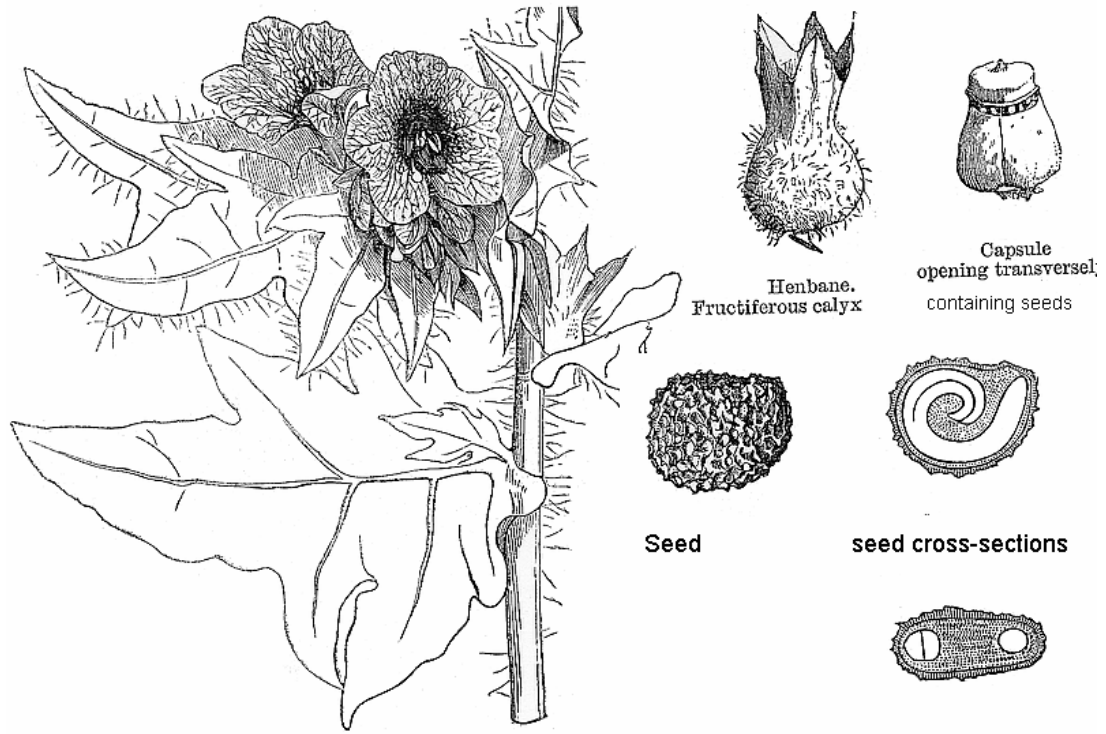
Native South America 南美起源

This family also includes many weedy species, usually poisonous, including species native to Eurasia, e.g. *Solanum nigrum*, *Hyoscyamus niger*, *Datura* spp.

这科也包括很多杂草，一般有毒，欧亚原生的有龙葵、天仙子（莨菪）、曼陀罗属



In the Solanaceae family resemblance can be readily seen by dissecting and comparing the fruits of common ‘vegetables’ in the group, such as aubergines (*Solanum melongea*, tomatoes (*Lycopersicon esculentum*), and sweet or chilli peppers (*Capsicum annum*). Slice them open longitudinally (radially) and latitudinally (transversely) and examine their structure. All share the basic structure typical of their family as seen in the figure above. In all cases the small orbicular seeds are attached to tissue in the middle of the fruit which derives from a division in the ovary (technically a false septum). This form of arrangement of the seeds derives directly from the arrangement of ovules in the flower and is called *axile placentation* 中轴胎座式 as the ovules arise from the central axis of the ovary. The cells of the ovary that contain the seeds form the endocarp of the fruit, which in tomatoes is quite watery while in peppers it is a vacuous air pocket, and in eggplants this hollow has been reduced to nothing. The denser flesh of the fruit is the *mesocarp* while the outer skin in the *exocarp*. Because the flower is hypogynous 下位式 the sepals are often visible on the fruit as leaf-like scales at the base of the fruit where it attaches to a branch.



*Hyoscyamus niger*, English: henbane

## Rosaceae 蔷薇科

The Rosaceae is a much larger and more diverse family that illustrates a range of fruit types, although these also reveal their evolutionary relationships. Once again this family is represented by a range of well-known fruits and garden plants which can be easily obtained and dissected. The Rosaceae can be broken into a number of quite distinct subfamilies, of which three with familiar representatives will be emphasised. 蔷薇科更大更多样化，不过仍然可以看出之间的亲缘关系。

Rosaceae, subfamilies:

Spiraeoideae, 绣线菊亚科

actually a group of distinct lineages that form a grade (or paraphyletic group) at the evolutionary base (or primitive end) of the family. These show many of the basic characters that develop in the better known subfamilies.

Neuradoideae (another small, less common subfamily)

Rosoideae 蔷薇亚科

*Rubus* spp. (Blackberries, raspberries) 悬钩子属 (黑莓、覆盆子)

*Fragaria* spp. (strawberries) 草莓属

*Potentilla* spp. (garden cinquefoils) 委陵菜属 (洋莓属)

*Rosa* spp. (roses)

Prunoideae (or Amygdaloideae) 李亚科? (见附表)

*Prunus* spp. (cherries, plums, peaches, apricots) 李属 (樱桃、李子、桃、杏)

*Amygdalus communis* (almonds) 扁桃

Maloideae 梨果

Apples (*Malus* spp.)

Pears (*Pyrus* spp.)

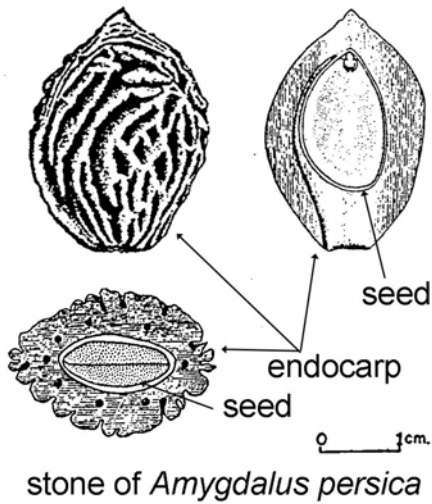
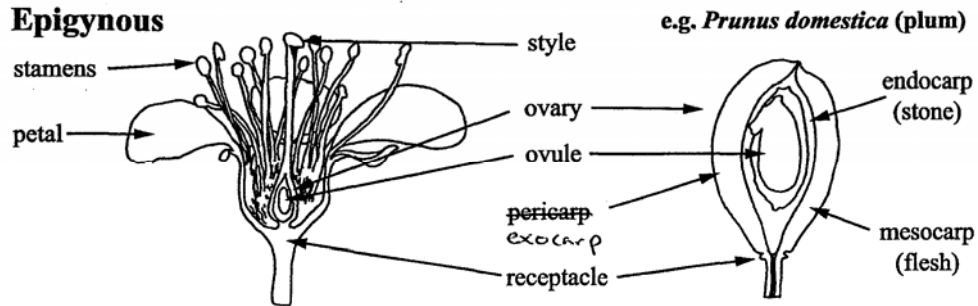
Loquats (*Eriobotrya* spp.) 枇杷

Medlars (*Mespilus* spp.) 欧楂果

Quinces (*Cydonia* spp.) 榲桲果

**Prunoideae**

Simple epigynous 上位式 flowers, with single-celled ovules and single-ovule carpels, producing simple drupes containing a stone (seed with hard endocarp).  
 Examples: plum, apricot, peach, cherry, almond.

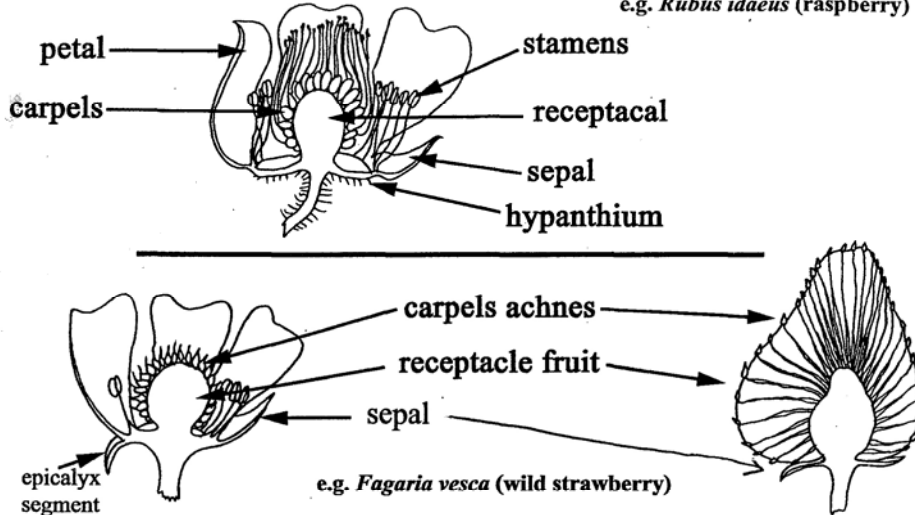


**Rosoideae**

Flowers with multiple ovules, producing multi-seeded fruits (or pseudo-fruits, *pseudocarps* 假果) such as roses and strawberries, or aggregate fruits 聚合果, such as the *agglomeration of drupelets* 簇生小核果 found in blackberry and raspberry

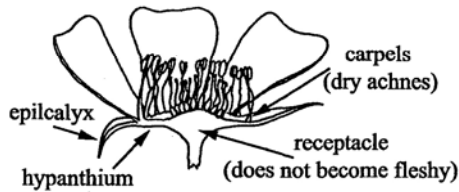
**Hypogynous - all floral parts are attached below the gynoecium**

e.g. *Rubus idaeus* (raspberry)



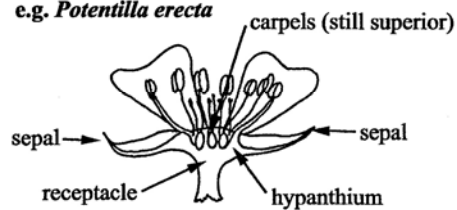
**Almost Perigynous**

e.g. *Potentilla sterilis* (barren strawberry)



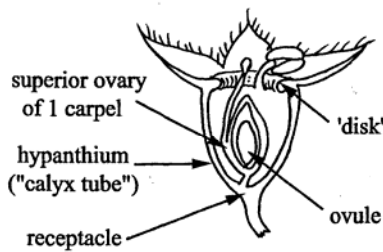
**Clearly Perigynous**

e.g. *Potentilla erecta*



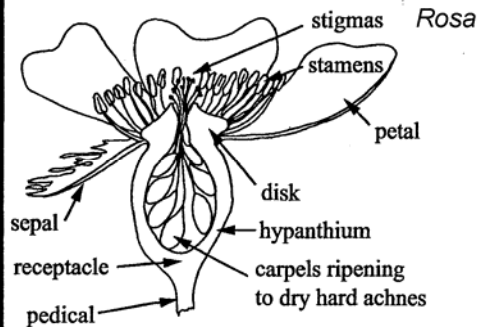
**Highly Perigynous (ovary superior)**

e.g. *Aphanes arvensis* (parsley piert)



**Extreme Perigyny (verging on epigynous, ovary still seen as superior)**

*Rosa*

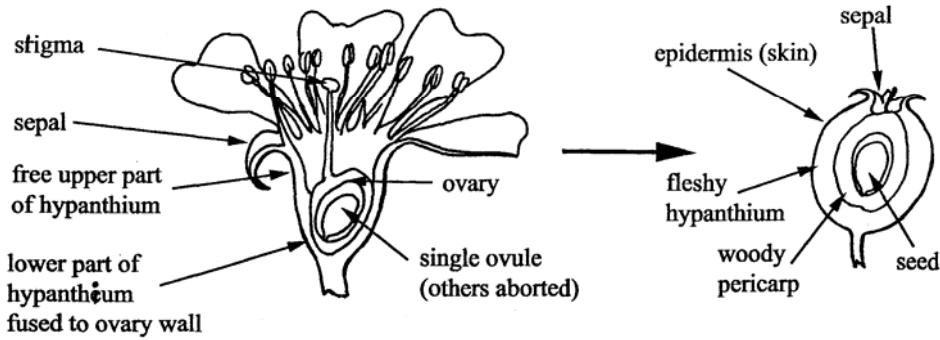




**Maloideae**

Flowers epigynous, in which fruit development is focused on the swelling of a fleshy receptacle which envelopes the fruit, as in apples, pears and hawthorns.

**More or less Epigynous (ovary inferior)**  
 e.g. *Crataegus monogyna* (hawthorn)



**Totally Epigynous - ovary inferior**  
 e.g. *Malus domestica* (apple)

