



# The Flowering Plants Handbook

A practical guide to families  
and genera of the world

James W. Byng

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**A practical guide to families and genera of the world**

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**James W. Byng**

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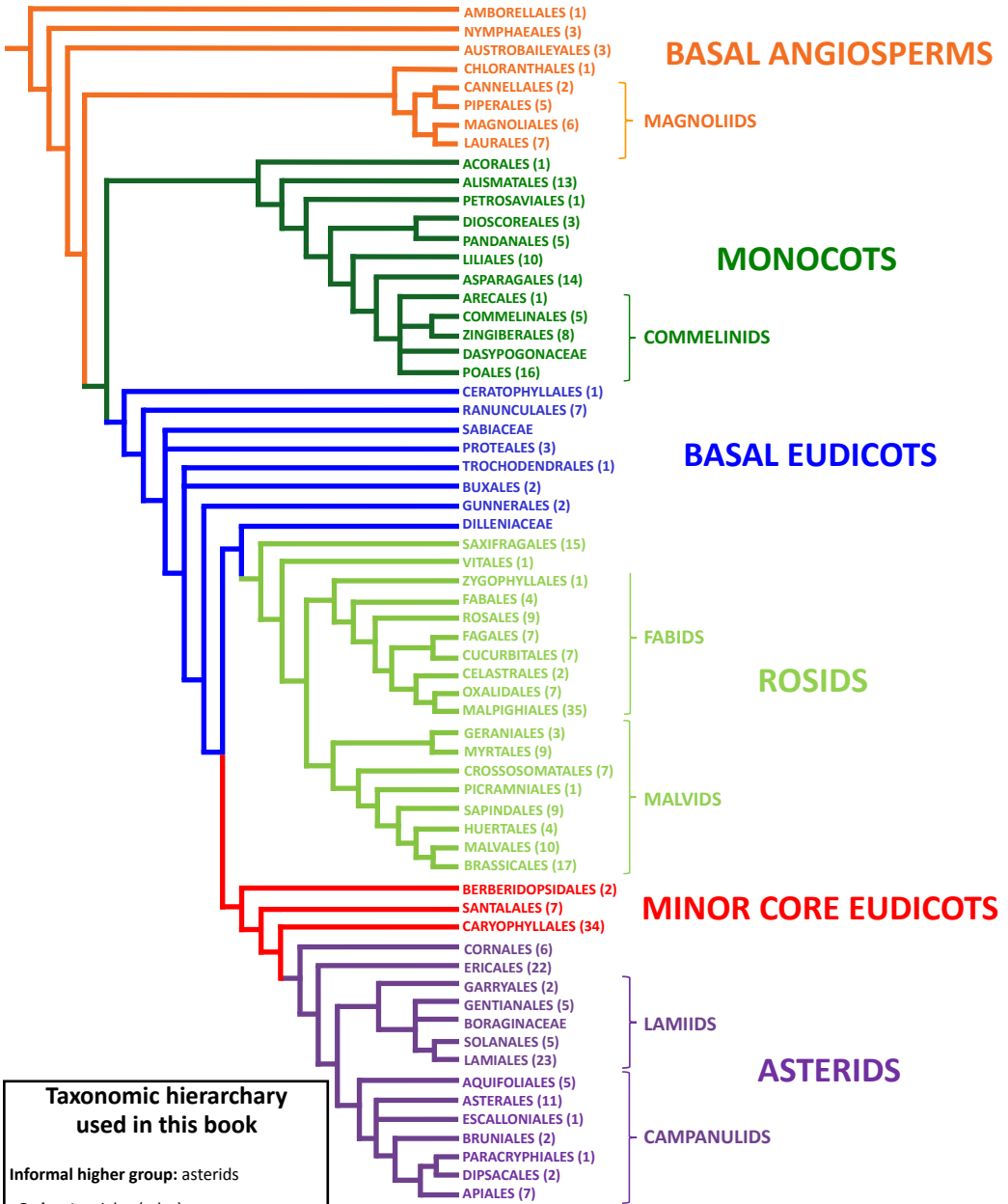
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# Classification of Flowering Plants

Phylogenetic tree showing relationships of accepted orders and unplaced families of flowering plants divided into the six informal higher groups used in this work. Major clades are also highlighted for reference but not discussed further.



**Taxonomic hierarchy used in this book**

Informal higher group: asterids

Order: Lamiales (-ales)

Family: Gesneriaceae (-aceae)

Subfamily: Didymocarpoideae (-oideae)

Tribe: Trichosporeae (-eae)

Subtribe: Jerdoniinae (-inae)

Genus: *Jerdonia*

Species: *indica*

**Traditional family names still accepted**

Compositae (= Asteraceae)  
 Cruciferae (= Brassicaceae)  
 Gramineae (= Poaceae)  
 Guttiferae (= Clusiaceae)  
 Labiatae (= Lamiaceae)  
 Leguminosae (= Fabaceae)  
 Palmae (= Arecaceae)  
 Umbelliferae (= Apiaceae)

Family names end in “-aceae”. However, some of the largest families were traditionally known by previous names and these names are still widely used. It was agreed amongst botanists to keep these names in use, alongside more modern names following the standard “-aceae” ending.

# KEY TO MAJOR PLANT GROUPS

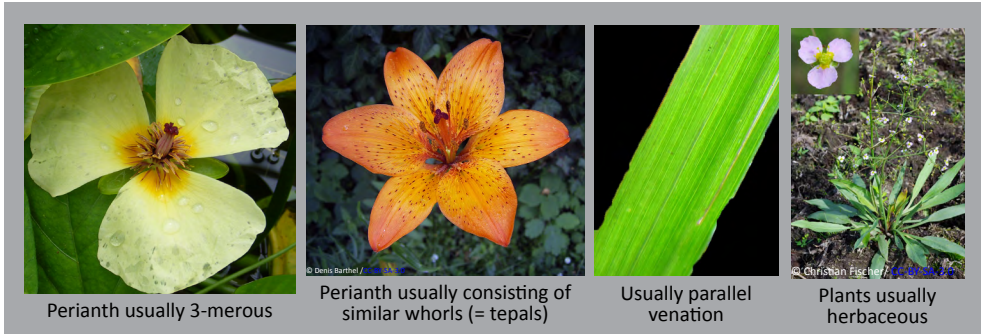
Flowers are needed for flowering plant identification though when there are only fruits present it is still possible but becomes more difficult. In most cases a combination of vegetative and reproductive parts are needed and in some cases a combination of both floral and fruit characters. Plants without a perianth (i.e. both sepals and petals absent) and parasitic plants have evolved several times and are scattered across the following six higher groups. For these plants it is best to try and identify by a process of elimination from the [list of families with diagnostic characters](#) pages.

## BASAL ANGIOSPERMS

earliest lineages



## MONOCOTS



### NOTABLE GROUPS IN THE MONOCOTS



**Acoraceae & Araceae:**  
Flowers condensed into spadix with bract-like spathe



**Asparagales & Liliales:**  
Bulbous plants



**Arecales (also Asparagales & Pandanales):** Palm-like plants



**Zingiberales:**  
Prominent midrib with parallel secondary venation



**Poales:** Grass-like plants

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# AMBORELLALES

**Notes:** Plants in the order can be distinguished from other basal angiosperm families on New Caledonia by the woody habit, alternate leaves, absence of stipules, spiralling perianth and unisexual flowers.

## 1. AMBORELLACEAE

**Shrubs** or small **trees**, up to 8 m. **Leaves** simple, alternate; margin entire to toothed; petioles present; stipules absent. **Inflorescences** axillary with 2–30 flowers; bracteate. **Flowers** ca. 3–5 mm in diameter, functionally unisexual (plant dioecious), actinomorphic. **Perianth** slightly fused basally, spirally arranged, inner tepals larger than outer; white to cream. **Stamens** filaments short to absent; anthers introrse; often staminodes 1–2 in female flowers. **Ovary** superior, on a short stalk; carpels free; ovule 1; placentation marginal. **Fruit** a red drupelet, small (ca. 5–7 mm long, ca. 5 mm in diameter).

**Genus** 1/**species** 1; *Amborella trichopoda*.

**Distribution:** New Caledonia [especially from Plateau de Dogny to the valley of the Tipindje River].

**Floral formula:** Female flowers  $P7-8 A(0-1)^{-2} \underline{G}(3-5)(-8)$

Male flowers  $P(6-9)-11(-15) A(6-)-12-22 \underline{G}0$

**Confused with:** Monimiaceae – leaves usually opposite and differs in ovule number.

**Notes:** The genus was previously placed in Monimiaceae and recent studies have shown it to be the most basal lineage of extant flowering plants. *Amborella* notably lacks developed wood vessels like Winteraceae (Canellales) and Trochodendraceae (Trochodendrales). The female flowers are smaller with fewer floral parts than the male flowers.

**Literature:** Endress & Igersheim 2000; Jérémie 1982; Philipson 1993a; Qiu *et al.* 1999; Ronse de Craene 2010; Soltis *et al.* 1999b; Thien *et al.* 2003; WCSP 2014.



Male flower of *Amborella trichopoda*



Male flowers of *Amborella trichopoda*



## AUSTROBAILEYALES

**Notes:** Plants in the order have a woody habit, superior ovaries, often a many parted and spiralling perianth, many stamens and carpels free or 1. In addition, Schisandraceae have alternate, often gland-dotted and aromatic leaves; Trimeniaceae have opposite, often gland-dotted and aromatic leaves, flowers aggregated and not solitary and staminodes absent; and Austrobaileyaaceae are woody climbers endemic to Australia with opposite leaves and flowers with a rotting-fish smell.

- 1. Leaves opposite.....2
- 1. Leaves alternate..... 7. Schisandraceae
- 2. Flowers about 5–6 cm in diameter.....5. Austrobaileyaaceae
- 2. Flowers less than 1 cm in diameter..... 6. Trimeniaceae

### 5. AUSTROBAILEYACEAE

**Woody climbers**, up to 15 m tall. **Leaves** simple, opposite (rarely sub-opposite); margins entire; petioles present; stipules present? deciduous and small or absent. **Inflorescences** axillary or rarely terminal solitary flowers or 2–3 aggregated; bracteate. **Flowers** 5–6 cm in diameter, bisexual, actinomorphic; bracteolate. **Perianth** tepal-like, imbricate; outer whorl often sepaloid; inner whorl often petaloid, greenish-yellow, sometimes with brown to purple spots. **Stamens** greenish and purple-blotched at the apex; anthers introrse; staminodes smaller than stamens, ±warty purple-spots. **Ovary** superior; carpels free; locules (4–)6–9(–14); ovules several per locule; placentation marginal; stigma 2-lobed. **Fruit** berry-like and orange.



*Austrobaileya scandens*

**Genus** 1/species 2; *Austrobaileya*.

**Distribution:** Australia [tropical Queensland, Atherton Tableland].

**Floral formula:** P(9–)12–23(–many) A6–11+6°–16° G(4–)6–9(–14)

**Notes:** The flowers are fly pollinated and have an odour like rotting fish and the gland-like warts on the stamens and staminodes are thought to produce this unpleasant smell.

**Literature:** Bailey & Swamy 1949; Endress 1980b, 1993a, 2001.



Habit of *Austrobaileya scandens*

#### Species synopsis

- *A. maculata* (stamens and staminodes have conspicuous embossed brown to purple spots).
- *A. scandens* (stamen and staminodes lack spots; only found in Daintree Rainforest).

### 6. TRIMENIACEAE

**Trees, shrubs or woody climbers**, up to 25 m tall. **Leaves** often gland-dotted, sometimes aromatic, simple, opposite; leaf apex acute to acuminate; margins entire to toothed; petioles present; stipules absent; hairs reddish, woolly or absent. **Inflorescences** cymes, racemes or panicles. **Flowers** ca. 5–7 mm in diameter, bisexual or unisexual, actinomorphic. **Perianth** spirally arranged tepals, imbricate, merging into bracteoles, deciduous; white to cream. **Stamens** many, ca. 4 mm long, spirally arranged; anthers basifixed. **Ovary** superior; carpel 1, rarely 2, reduced to absent in male flowers; locule 1; ovule 1; placentation apical; style absent. **Fruit** a drupe or berry, red to purple or black when mature.

**Genus** 1/species 8; *Trimenia*.

**Distribution:** Scattered from Malesia to Pacific Islands and eastern Australia.

**Floral formula:** P2–many A6–many G1(–2)

**Confused with:** Austrobaileyaaceae – carpels 3–8; flowers ca. 3–5 mm in diameter.

**Notes:** The generic name *Piptocalyx* is synonymous with *Trimenia*.

**Literature:** Endress 2001; Endress & Sampson 1983; Philipson 1986, 1987a, 1993d; Qui *et al.* 1999; Rodenburg 1971; Wagner & Lorence 1999; Whiffin 2007.

**Species synopsis**

- *T. bougainvilleensis* (Solomon Islands).
- *T. neocaledonica* (leaves obovate; New Caledonia).
- *T. nukuhivensis* (Marquesas Island [Nuku Hiva]).
- *T. macrura* (woody climbers, tepals  $\leq 10$ ; New Guinea).
- *T. marquesensis* (Marquesas Islands [Hiva Oa and Tahuata]).
- *T. moorei* (woody climbers; tepals  $< 11$ ; northeast New South Wales to southern Queensland [Australia]).
- *T. papuana* (plants polygamous, stamen filaments long and thin; Sulawesi and Moluccas [Indonesia], New Guinea).
- *T. weinmannifolia* (stamen filaments short and broad; Samoa, Fiji).



*Trimenia moorei*

**7. SCHISANDRACEAE**

**Woody climbers** or small **trees** to **shrubs**. **Leaves** usually gland-dotted, aromatic (peppery in *Illicium*) simple, alternate (spiral); margins usually entire, sometimes toothed with chloranthoid teeth; petioles present; stipules absent. **Inflorescences** usually axillary solitary flowers or a few aggregated; sometimes cauliflorous. **Flowers** bisexual (*Illicium*) or unisexual (plants monoecious or dioecious: *Kadsura*, *Schisandra*), actinomorphic; often bracteolate. **Perianth** spirally arranged tepals; outer whorl sepaloïd, bract-like; inner whorl petaloïd, white, yellow to red. **Stamen** filaments free (*Illicium*) or fused basally (e.g. *K. coccinea*, *Schisandra*) or filaments  $\pm$ fused (most *Kadsura*); anthers basifixed; often 3–22 staminodes. **Ovary** superior; carpels free; ovule(s) 1 (*Illicium*), 2–3 (*Schisandra*), 2–5(–11) (*Kadsura*); placentation marginal to basal. **Fruit** an aggregation of free carpels which are fleshy (red to yellow when mature) in *Kadsura* and *Schisandra* or star-shaped aggregated follicles (*Illicium*).

**Genera** 3/species ca. 80.

**Distribution:** Sri Lanka, east and southeast Asia to western Malesia, southeast USA, eastern Mexico and large Caribbean Islands.

**Floral formula:** P(5–)9–15(–many) A4–many  $\underline{G}$ 5–many

**Useful species:** *Illicium verum* (star anise).

**Notes:** The family have spirally arranged tepals, stamens and staminodes. *Illicium* is sometimes treated as a separate family. The flowers of *Illicium floridanum* have a faint but unpleasant odour.

**Literature:** Endress 2001; Hao *et al.* 2000, 2001; Panero & Aranda 1998; Saunders 1998, 2000; Xia & Saunders 2009; Xia *et al.* 2009.

**Generic synopsis**

- *Illicium* (trees or shrubs; fruit a follicle; southeast Asia, southeast USA and the Caribbean; ca. 40 spp.).
- *Kadsura* (woody climbers; fruits berry-like and widely separated in a spike; Sri Lanka to the Philippines and from Java [Indonesia] to South Korea and Japan, particularly species rich in southern China; ca. 16 spp.).
- *Schisandra* (woody climbers; aggregated berry-like fruits are close together and often globose; Russian Far East to Java and Bali [Indonesia] and Uttar Pradesh [India] to the west, *S. glabra* from southeast USA and Mexico; ca. 22 spp.).

**STAR ANISE FAMILY**



*Illicium anisatum*



*Illicium henryi*



Aggregated fruits of *Kadsura japonica*



*Schisandra chinensis*



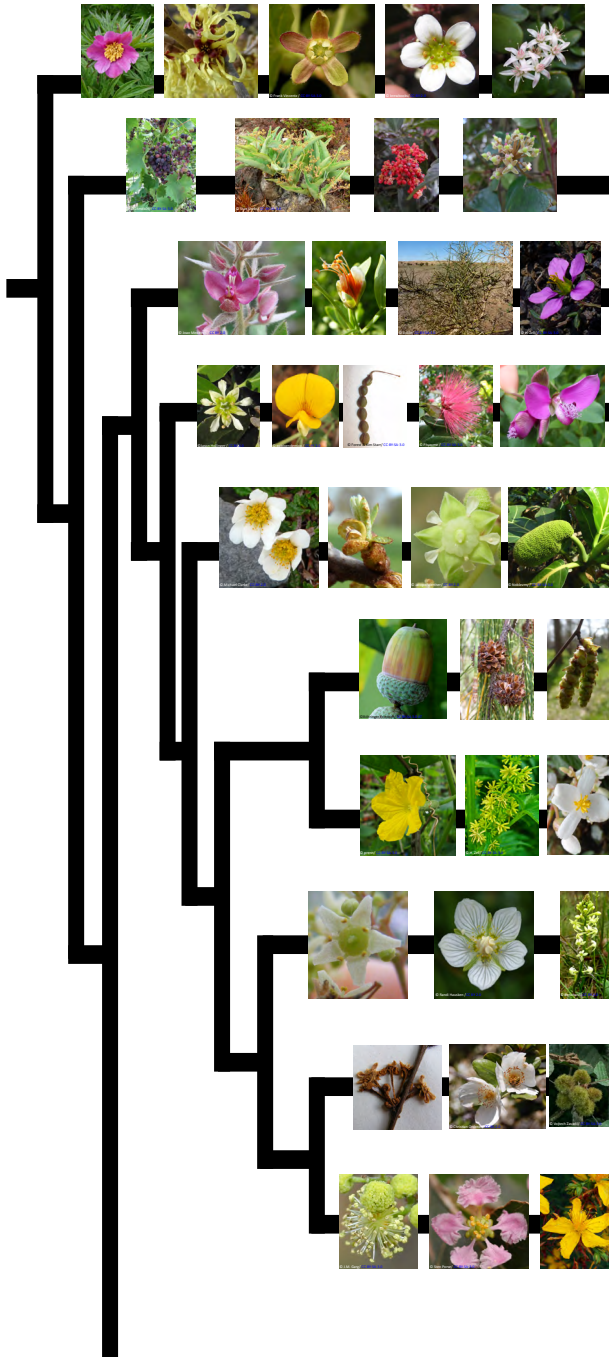
Fruits of *Illicium verum*



*Schisandra rubriflora*

# ROSIDS

Rosids are a diverse group usually with **free petals**, sometimes a **hypanthium and/or nectar disk** present and stamens usually **equal or more than the petals**. They comprise about 25% of all angiosperms diversity with 17 orders and 176 families. Rosid orders are often morphologically diverse but most large families usually have distinctive characters. A few families have a fused perianth which could be confused with many asterids, notably Cucurbitaceae and Thymelaeaceae.



**SAXIFRAGALES** - Trees, shrubs, woody climbers or herbs, sometimes succulent; flowers bisexual or unisexual; perianth conspicuous or inconspicuous to absent; hypanthium sometimes present; carpels usually 2; fruits often dry. **Variable order.**

**VITALES** - Woody climbers, shrubs or herbs, often tendrils present; bark often with lenticels; leaf venation palmate venation; stipules usually present; ovary superior; fruit a berry.

**ZYGOPHYLLALES** - Trees, shrubs, or herbs, often thorny in saline habitats or hemiparasites; stipules present, if absent flowers zygomorphic; ovary superior; fruits dry or a drupe (then plants spiny).

**FABALES** - Trees, shrubs, woody climbers or herbs; leaves simple or compound with usually carpel 1 and legume fruits; stipules present or rarely absent; flowers often zygomorphic; stamens usually 8-many; ovary superior; fruits dry or fleshy.

**ROSALES** - Trees, shrubs, woody climbers or herbs; stipules present or absent; usually flowers bisexual with few to many stamens and conspicuous perianth **OR** unisexual with reduced to absent perianth, often wind-pollinated, usually few stamens and sometimes exudates present, stinging hairs or cystoliths present. **Variable order.**

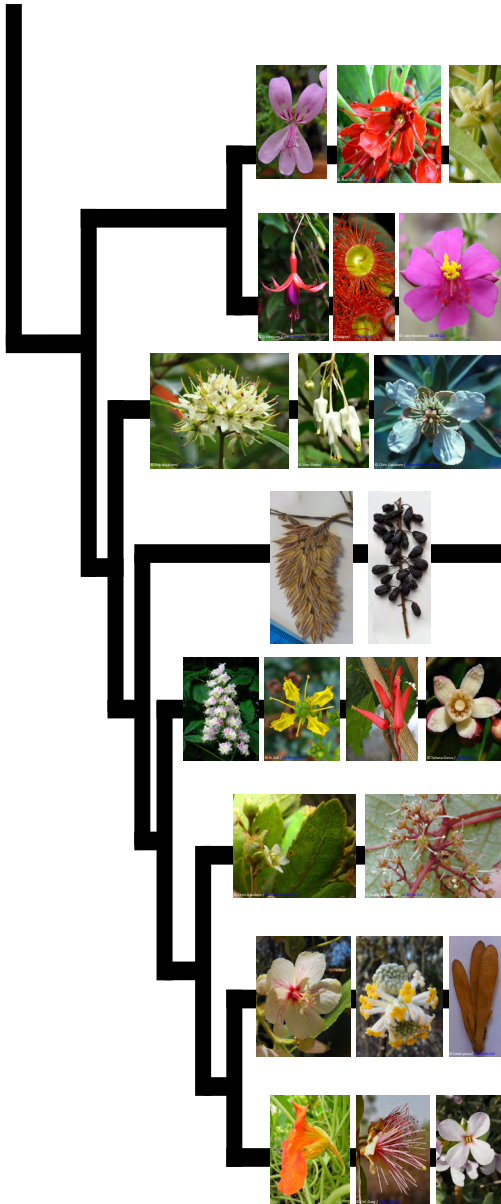
**FAGALES** - Usually trees or shrubs; stipules present; flowers usually unisexual, often in catkins or spikes, usually wind-pollinated; perianth often reduced to absent; ovary often inferior; fruits dry.

**CUCURBITALES** - Erect or climbing herbs or shrubs, rarely trees; stipules present or absent; flowers usually unisexual; petals fused, free or absent, often valvate; leaf venation often palmate or 3–9-veined from base; ovary usually inferior (if superior then flowers often bisexual).

**CELASTRALES** - Trees, shrubs or woody climbers, rarely herbs; stipules present or absent; leaves usually simple; stamens 1-whorled (if 2-whorled then 1-foliolate leaves); usually conspicuous nectar disk present; ovary superior.

**OXALIDALES** - Trees, shrubs, woody climbers or herbs; leaves compound (if simple then plants carnivorous **OR** with garlic-odour **OR** petals valvate with often fringed apices); stipules present or absent; stamens 1–2-whorled; ovary superior.

**MALPIGHIALES** - Trees, shrubs, woody climbers or herbs, sometimes succulents; flowers actinomorphic or rarely zygomorphic; stipules often present in most families; petals present or absent; stamens 1–2-whorled; ovary usually superior. **Variable order.**



**GERANIALES** - Herbs, shrubs or trees; leaves simple or compound; stipules absent; flowers usually bisexual, usually nectaries present; sepals often persistent; ovary superior; carpels 3–5; placentation often axile; fruits dry.

**MYRTALES** - Trees, shrubs, woody climbers or herbs; stipules reduced to absent; leaves often opposite, sometimes gland-dotted and aromatic or conspicuously 3–9-veined; flowers usually bisexual, often hypanthium present; carpels fused with single style; ovary superior or more often inferior.

**CROSSOSOMATALES** - Trees or shrubs; leaves simple (if compound then leaves opposite, leaflet margins toothed and stamens 5); stipules often inconspicuous or absent; flowers bisexual, actinomorphic; usually hypanthium present; ovary superior.

**PICRAMNIALES** - Trees or shrubs; leaves compound, odd-pinnate, leaflet margins entire; stipules absent; flowers unisexual; stamens 1-whorled; ovary superior. New World distribution.

**SAPINDALES** - Trees, shrubs, woody climbers or rarely herbs; leaves compound, sometimes aromatic or resins present in bark/branches (if leaves simple then usually aromatic or with resins); stipules usually absent; flowers unisexual or bisexual; nectar disks usually well-developed; ovary usually superior.

**HUERTEALES** - Trees or shrubs; leaf margins toothed; usually small stipules present; flowers actinomorphic, hypanthium present; disk usually present; ovary superior; fruits usually fleshy.

**MALVALES** - Trees, shrubs, woody climbers or herbs; leaves simple or compound, venation often palmate; stipules usually present; flowers usually bisexual and actinomorphic; stamens 2-whorled to many; hypanthium and disk usually absent; ovary superior (if inferior then usually plant a root-parasite, or growing in semi-arid habitats with spiny fruits).

**BRASSICALES** - Trees, shrubs or herbs; leaves simple or compound, usually alternate, sometimes with mustard odour; stipules usually absent; flowers usually bisexual; stamens sometimes unequal or many; hypanthium usually absent; ovary superior, sometimes stalked (= gynophore).

### 130. DAPHNIPHYLLACEAE

**Trees or shrubs**; branchlets with leaf scars and lenticels. **Leaves** simple, alternate (spiral) or rarely opposite, often clustered at branch ends; margins entire; petioles present; stipules absent. **Inflorescences** axillary racemes; bracts conspicuous. **Flowers** unisexual (plants dioecious, rarely polygamodioecious), actinomorphic. **Sepals** free, ±imbricate or sometimes absent. **Petals** absent. **Male flowers**: stamen filaments often shorter than anthers; anthers basifixed. **Female flowers**: ovary superior; carpels fused; locules 2; ovules (1–)2 per locule; placentation axile or apical; stigmas recurved; sometimes staminodes. **Fruit** a drupe.

**Genus** 1/species ca. 30; *Daphniphyllum*.

**Distribution**: India to Australia and East Asia.

**Floral formula**:  $K(0-2)-6 C0 A5-14(-24) \underline{G}2(-4)$

**Literature**: Endress & Igersheim 1999; Fishbein *et al.* 2001; Fishbein & Soltis 2004; Huang 1965, 1966; Kubitzki 2006d; Min & Kubitzki 2004.



Male flowers of *Daphniphyllum teijsmannii*



*Daphniphyllum macropodum*

### 131. ITEACEAE

**Trees or shrubs**, sometimes climbing (*Itea*). **Leaves** simple (spiral), alternate; margins often spiny toothed to entire; petioles present; stipules tiny or absent. **Inflorescences** racemes or panicles (*Itea*), or cymes to corymbs (*Pterostemon*). **Flowers** bisexual or rarely polygamous, actinomorphic, hypanthium. **Sepals** free or basally fused, valvate, persistent. **Petals** free, persistent, clawed (*Pterostemon*). **Stamens** alternating with petals (*Itea*) or sepals (*Pterostemon*); anthers dorsifixed, introrse; staminodes 5 (*Pterostemon*). **Ovary** superior to part-inferior (*Itea*) or inferior (*Pterostemon*); carpels fused; locules 2 or 5; ovules 4–6 (*Pterostemon*) or many (*Itea*) per locule; placentation axile. **Fruit** a capsule.

**Genera** 2/species ca. 18.

**Distribution**: Tropical to northern temperate regions.

**Floral formula**: *Itea*  $K5 C5 A5 \underline{G}2$      *Pterostemon*  $K5 C5 A5+5^* \underline{G}5$

**Notes**: Both genera were previously associated with Escalloniaceae.

**Literature**: Bohm *et al.* 1999; Kubitzki 2006f, 2006h; Fishbein *et al.* 2001; Fishbein & Soltis 2004;

#### Generic synopsis

- *Itea* (southeast Asia to western Malesia, eastern North America, East to South Africa; ca. 16 spp.).
- *Pterostemon* (much-branched shrubs; Oaxaca [Mexico]; ca. 2 spp.).



*Itea virginica*



*Itea ilicifolia*

### 132. GROSSULARIACEAE

### GOOSEBERRY FAMILY

**Shrubs**, sometimes climbing, often spiny; often glandular hairs. **Leaves** aromatic, usually deciduous, simple, alternate; venation pinnate to 3-veined-palmate; margins lobed or toothed; petioles present; stipules usually present or absent. **Inflorescences** racemes, usually on short-shoots; sometimes bracteate, hairy. **Flowers** bisexual or rarely unisexual (plants dioecious, e.g. *R. diacanthum*), actinomorphic, hypanthium well-developed (and lobed) and petaloid; green, white, yellow or red; sometimes bracteolate. **Sepals** fused, persistent. **Petals** rarely absent or free, imbricate, sometimes interpreted as staminodes, smaller than sepals. **Stamens** opposite the sepals; anthers basifixed. **Ovary** inferior to part-inferior; carpels fused; locule 1; ovules 4–many; placentation parietal; style 2. **Fruit** a berry, with persistent perianth.

**Genus** 1/species ca. 150; *Ribes*.

**Distribution**: Temperate northern hemisphere and Andes to southern South America.

**Floral formula**:  $K(3-5)(-9) C(0-3-5)(-9) A4-5 \underline{G}2$

**Useful species**: *R. nigrum* (black currant); *R. rubrum* (red currant); *R. uva-crispa* (gooseberry).

**Notes**: *Ribes speciosum* is 4-merous.

**Literature**: Fishbein *et al.* 2001; Fishbein & Soltis 2004; Messinger *et al.* 1999; Morin 2009; Selters & Soltis 2003; Schultheis & Donoghue 2004; Weigend 2006c; Weigend *et al.* 2002.



*Ribes malvaceum*



*Ribes uva-crispa*

## ROSE FAMILY

## 147. ROSACEAE

**Trees, shrubs** or perennial or annuals **herbs**; stems sometimes with prickles or thorns (e.g. *Rosa*, *Rubus*). **Leaves** usually deciduous, simple or compound, alternate (spiral) or rarely opposite (*Coleogyne*, *Lyonothamnus*, *Rhodotypos*); venation usually pinnate or palmate; petioles present, sometimes with extra-floral glands (e.g. some *Rosa* and *Prunus*); stipules present, rarely absent (*Oemleria*), sometimes fused to petiole. **Inflorescences** cymes, panicles, racemes, corymbs, umbels, fascicles or solitary flowers; bracteate, sometimes bracts on the sepals (= epicalyx). **Flowers** bisexual or rarely unisexual (e.g. *Cliffortia*, *Kageneckia*, *Poterium*, some *Rubus*), usually actinomorphic, often with nectariferous hypanthium. **Sepals** fused or free, often lobes on hypanthium, persistent or deciduous. **Petals** free or absent (e.g. *Alchemilla*, *Cercocarpus*, *Neviusia*, some Sanguisorbeae), usually imbricate, often clawed. **Stamen** filaments usually free, attached to hypanthium; anthers dorsifixed; often stamindes 5–50, petaloid. **Ovary** superior or part-inferior to inferior (e.g. *Eriobotrya*, *Malus*, *Pyrus*, *Sorbus*); carpels free or fused or 1 (e.g. *Prunus*); locules 1–many; ovules 1–2(–many) per locule; placentation usually basal, less often axile or marginal, rarely apical. **Fruit** a follicle, drupe, achene, berry or pome, sometimes aggregated in compound fruits with fleshy receptacles or torus.

**Genera** 91/species ca. 2500.

**Distribution:** Worldwide, especially northern hemisphere.

**Floral formula:** K(3–)5(–10) C(0–)3–5(–10) A(1–)10–many  $\underline{\hat{G}}$ 1–many

**Useful species:** *Malus domestica* (apple); *Fragaria* spp. (strawberry); *Prunus armeniaca* (apricot); *Prunus avium* (cherry); *Prunus dulcis* (almond); *Prunus persica* (peach); *Pyrus* spp. (pear); *Rubus* spp. (raspberry). Species of *Cotoneaster*, *Prunus*, *Rosa* and *Sorbus* are popular ornamental shrubs.

**Confused with:** Ranunculaceae – fruits usually groups of follicles or achenes; epicalyx absent. Saxifragaceae – ovules few to many (vs. usually 1–2).

**Notes:** The circumscription of many genera has changed with molecular data and in many cases personal preference. Potentillae is one group where the limits are becoming clearer but make require further changes. The classification presented here is broadly based on that by Potter *et al.* (2007a). The following generic names are synonymous: *Aphanes*, *Lachemilla*, and *Zygalechemilla* = *Alchemilla*; *Farinopsis* = *Comarum*; *Pentaphylloides* = *Dasiphora*; *Acomastylis*, *Novosieversia*, *Oncostylus*, *Orthurus*, *Taihangia*, and *Waldstenia* = *Geum*; *Eriogynia* = *Luetkea*; *Tetraglochin* = *Margyricarpus*; *Stephanandra* = *Neillia*; *Argentina*, *Comarella*, *Duchesnea*, *Horkelia*, *Horkeliella*, *Ivesia*, *Purpusia*, and *Stellariopsis* = *Potentilla*; *Bencomia*, *Marcetella*, *Dendriopoterium*, and *Sarcopoterium* = *Poterium*; *Plagiospermum* = *Prinsepia*; *Amygdalus*, *Armeniaca*, *Cerasus*, *Laurocerasus*, *Maddenia*, *Padus*, and *Pygeum* = *Prunus*; *Cowania* = *Purshia*; *Hulthemia* = *Rosa*; *Dalibarda* = *Rubus*; and *Schistophyllidium* = *Sibbaldianthe*.

**Literature:** Ball *et al.* 1968; Dickinson *et al.* 2007; Dobes & Paule 2010; Eriksson *et al.* 2003; Evans *et al.* 2002; Gehrke *et al.* 2008; Hutchinson 1964; Kalkman 2004; Kerr 2004; Kurto & Eriksson 2003; Lee & Wen 2001; Lee & Hong 2011; Lo & Donoghue 2012; Lo *et al.* 2007; Morgan *et al.* 1994; Potter 2003; Potter *et al.* 2002, 2007a, 2007b; Soják 2008; Wen *et al.* 2008.

### Generic synopsis

**Dryadoideae** (subshrubs, shrubs or small trees; leaves usually simple or rarely compound in *Chamaebatia*; stipules present; epicalyx absent; hypanthium free from ovary; carpels free and 1–many; ovule 1 per locule; fruit an achene)

- *Cercocarpus* (sepals valvate; petals absent; carpels 1(–2); western North America).
- *Chamaebatia* (sepals imbricate; petals white; carpel 1; California [USA]).
- *Dryas* (flowers 7–10-merous; petals white or yellow; pedicels long; carpels 4–many; styles hairy; northern temperate regions, often alpine or rocky areas).
- *Purshia* (flowers 5-merous; petals white or yellow; carpel 1–many; southwest USA and northwestern Mexico).

**Rosoideae** (perennial or rarely annual herbs, shrubs or rarely trees; leaves alternate and usually compound; stipules present; carpels 1–many and free; receptacle sometimes enlarged; hypanthium free from ovaries; fruits indehiscent)

**Colurieae** (shrubs or perennial herbs; leaves pinnately compound or simple; epicalyx usually present; carpels usually many; receptacles often enlarged; ovule 1 per locule; fruit an achene).

- *Fallugia* (shrubs; inflorescences 1-flowered; petals white, sepals imbricate; North America).
- *Geum* (herbs; inflorescences (1–)few-flowered; petals yellow or white; sepals usually valvate; widespread).
- *Sieversia* (shrubs; inflorescences 1-flowered; petals white; sepals valvate; northeast Asia).



*Cercocarpus ledifolius*



*Chamaebatiaria millefolium*



*Dryas octopetala*



*Fallugia paradoxa*



*Geum coccineum*

**Potentilleae (herbs or shrubs; leaves compound and alternate or less often simple; stipules present and fused to petiole; epicalyx usually present; often enlarged receptacle; petals present or absent in *Alchemilla*; carpels with lateral to basal styles, carpels often many; ovule 1 per locule; fruit an achene).**

- *Alchemilla* (herbs to shrubs; epicalyx rarely absent; sepals valvate; petals absent; carpels 1–4(–12); nectariferous disk present; scattered worldwide, particularly northern temperate regions; ca. 300? spp.).
- *Chamaerhodos* (woody herbs; leaves finely pinnatisect; epicalyx absent; petals white or purplish; sepals valvate; stamens 5; carpels 5–10; western North America, central and East Asia).
- *Comarum* (herbs to shrubs; petals purple or white; stamens 20–25; northern temperate regions).
- *Dasiphora* (shrubs; leaves pinnate; styles club-shaped; achenes hairy; cool temperate northern hemisphere).
- *Drymocallis* (woody herbs; petals yellow or white; stamens 20–30; North America).
- *Fragaria* (herbs; leaves 3(–5)-foliate; flowers bisexual or unisexual; petals white or yellowish; sepals valvate; stamens 20–many; carpels many; achene fruits on enlarged and fleshy torus; Eurasia, North America, *E. chiloensis* from Chile).
- *Potaninia* (shrubs; carpel 1; enlarged receptacle absent; 1 sp., *Potaninia mongolica*).
- *Potentilla* (herbs; petals white or purple; sepals valvate; stamens 10–20; anthers 2-thecae; ovules apical; northern temperate and arctic regions; ca. 500 spp.).
- *Sibbaldia* (woody herbs; stamens 5(–10); carpels 5–20, anther with 1-theca; northern temperate and arctic regions).
- *Sibbaldianthe* (woody herbs; leaves pinnate; petals yellow or white, stamens ca. 10; *S. adpressa* from Himalayas to Russian Far East, *S. bifurca* from southeast Europe to Central Russia).
- *Sibbaldiopsis* (shrubs; leaves 3-foliate, leaflets toothed at apex; petals white; achenes hairy; North America; 1 sp., *S. tridentata*).

**Roseae (leaves compound and usually odd-pinnate; stipules attached to petiole; epicalyx absent; carpels many, free to fused; ovule 1 per locule; fruits achenes on fleshy receptacle)**

- *Rosa* (erect or straggling shrubs; usually with prickles; flowers bisexual or rarely unisexual; hypanthium concave, urn-shaped; sepals imbricate; fruits compound achenes; northern temperate regions to tropical montane).

**Rubeeae (leaves simple or compound; stipules free, epicalyx absent; carpels many and usually fused; ovules 2 per locule; fruits compound drupes)**

- *Rubus* (often scrambling shrubs; usually with prickles; flowers bisexual or rarely unisexual; epicalyx absent; receptacle enlarged; petals white, pink, purple or red; sepals imbricate; widespread in temperate regions; ca. 250 spp.).

**Sanguisorbeae (trees, shrubs or herbs; leaves odd-pinnate, 3-foliate or rarely simple and alternate; stipules usually present, often fused; epicalyx present or absent; petals usually absent; hypanthium enlarging in fruit and persistent; carpels 1–5; ovule 1 per locule; fruit an achene)**

- *Acaena* (herbs; inflorescences heads or spikes; epicalyx absent; K(3–)4(–7) C0 A(1–)4(–10) G1(2–4); southern hemisphere).
- *Agrimonia* (herbs; inflorescences racemes; epicalyx absent; petals yellow or white; sepals imbricate; stamens 5–10(–20); carpels 2; Eurasia to Sri Lanka and Java [Indonesia], North America, Mexico, Brazil).
- *Aremonia* (herbs; inflorescences 1–few-flowered; petals yellow; sepals imbricate; stamens 5–10; carpels 2; southeast Europe and west Asia; 1 sp., *A. agrimonoides*).
- *Cliffortia* (shrubs; leaves 2–3-foliate or simple; inflorescences solitary flowers or fascicles; epicalyx absent; flowers unisexual or bisexual; K3(–4) C0 A3–20 G1–2; South Africa up to Kenya and Angola).
- *Hagenia* (trees; inflorescences axillary panicles; flowers unisexual (plants monoecious) or rarely bisexual; K4–5 C reduced A16–20 G2–3; montane tropical Africa; 1 sp., *H. abyssinica*).
- *Leucosidea* (shrubs or trees; inflorescences terminal spikes; sepals valvate; petals green, smaller than sepals; stamens 10; carpels 2(–4); Zimbabwe to South Africa; 1 sp., *L. sericea*).
- *Margyricarpus* (shrubs; inflorescences 1-flowered; epicalyx absent; K(3–)4(–5) C0 A(1–)2(–3) G1; Ecuador to Chile and Argentina, south Brazil).
- *Polylepis* (trees; inflorescences racemes; epicalyx absent; K3–4 C0 A6–many G1(–3); Andean South America).
- *Poteridium* (herbs; inflorescences spikes; epicalyx absent; sepals greenish yellow; petals absent; 2 well-exserted stamens; North America; 1 sp., *P. annua*).
- *Poterium* (herbs; inflorescences spikes or heads; epicalyx absent; flowers unisexual; petals white-green; K4 C0 A2–many G2; styles 2; Eurasia, east Mediterranean, Macaronesia).



*Alchemilla glabra*



*Fragaria vesca*



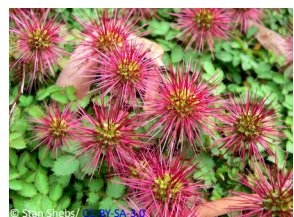
Epicalyx of *Potentilla erecta*



*Rosa canina*



*Rubus fruticosus*



Fruits of *Acaena magellanica*



*Aremonia agrimonoides*

- *Sanguisorba* (herbs; inflorescences spikes or heads; epicalyx absent; flowers bisexual; petals white-green; K4 C0 A2—many G1; style 1; Eurasia, North Africa).
- *Spenceria* (herbs; inflorescences racemes; flowers yellow; stamens 35–40; carpels 2; China; 1 sp., *S. ramalana*).

**Ulmarioideae (herbs; leaves alternate and pinnately compound; stipules present; epicalyx absent; carpels 5–15; ovules 2 per locule; fruit an achene)**

- *Filipendula* (stipules with toothed margins; flowers bisexual or unisexual; petals white, pink or red; receptacles enlarged; sepals reflexed; northern temperate regions).

**Spiraeoideae (mostly shrubs and trees; leaves often simple and alternate; stipules usually present; carpels 1–5 and often free; hypanthium usually free from ovary; fruits various)**

**Amygdaleae (trees or shrubs; leaves simple and alternate; leaf venation pinnate; stipules free or rarely fused, deciduous; epicalyx absent; carpel 1; fruit a drupe)**

- *Prunus* (rarely thorny; petals white or pink; sepals imbricate; widespread; ca. 200 spp.).

**Gillenieae (herbs; leaves 3-foliolate and alternate; stipules present; epicalyx absent; petals present; carpels free; ovules 2–4 per locule; fruits follicles)**

- *Gillenia* (petals white to pink; sepals imbricate; stamens 10–20; eastern North America).

**Kerrieae (leaves simple, opposite or alternate; epicalyx absent; sepals imbricate; petals present or absent; carpels several and free or 1; fruits achenes, usually drupaceous)**

- *Coleogyne* (stems spiny; leaves opposite; sepals 4; petals absent; disk around ovary; carpel 1; southwest USA; 1 sp., *C. ramosissima*).
- *Kerria* (leaves alternate; flowers 5-merous; petals yellow or white; carpels 5–8; China, Japan; 1 sp., *K. japonica*).
- *Neviusia* (leaves alternate; flowers 5-merous, green to white; petals reduced to absent; carpels 2–5; *N. alabamensis* from southeast USA, *N. cliftonii* from California [USA]).
- *Rhodotypos* (leaves opposite; flowers 4-merous; petals white; carpels (2–)4(–6); Japan, central China; 1 sp., *R. scandens*).

**Neillieae (leaves simple alternate; leaf venation palmate; stipules deciduous in *Physocarpus*; epicalyx absent; petals white; ovaries fused; fruit a large follicle)**

- *Neillia* (sepals imbricate; carpels 1(–2); continental Asia).
- *Physocarpus* (sepals valvate; carpels 2–5; North America, *P. amurensis* from northeast Asia).

**Osmaronieae (shrubs or small trees; leaves simple and alternate; stipules present or absent; epicalyx absent; carpels free or fused around the middle; ovules 2 per locule; fruits fleshy or dry)**

- *Exochorda* (shrubs; petals white; sepals imbricate; carpels 5, fused around middle; fruit a follicle; northeastern Asia).
- *Oemleria* (shrubs or small trees; stipules reduced to absent; flowers unisexual (plants dioecious); petals white; sepals valvate; carpels 5, free in female flowers; fruit a drupe; western North America; 1 sp., *O. cerasiformis*).
- *Prinsepia* (shrubs; thorny stems; stipules minute; petals white or yellow; carpel 1; fruit a drupe; Mongolia and Himalayas to Taiwan).

**Pyreae (trees, or shrubs; leaves usually simple and alternate or compound; leaf venation pinnate; stipules usually present; epicalyx absent; flowers 5-merous; carpels fused or free or 1; ovules usually basal; fruit a pome, rarely an achene or capsule)**

**Ovules usually many**

- *Chaenomeles* (thorns on long shoots; inflorescences axillary fascicles or solitary; petals red or white in some cultivars, clawed; sepals unequal; stamens 20–60; carpels 5; East Asia).
- *Cydonia* (leaf margins entire; inflorescences 1-flowered; petals white or pink; sepals imbricate; stamens 15–25; carpels 5; styles free; Caucasus, now widely cultivated).
- *Docynia* (inflorescences umbel-like; hypanthium tubular; sepals valvate; stamens 30–50; carpels 5; ovules 3–10 per locule; eastern Himalayas to southern China).
- *Kageneckia* (flowers unisexual, petals white to yellow; carpels 5, free; Peru to Argentina).
- *Pseudocydonia* (inflorescences 1-flowered; petals pink; sepals slightly imbricate; stamens 20–many; carpels 5; disk around ovary base; styles basally fused; China; 1 sp., *P. sinensis*).



*Filipendula vulgaris*



*Prunus subhirtella*



*Gillenia trifoliata*



*Kerria japonica*



*Neillia tibetica*



*Oemleria cerasiformis*



*Chaenomeles speciosa*



Ovules usually 2

- *Amelanchier* (inflorescences simple racemes; petals white or pinkish; sepals persistent; stamens 15–24; carpels 2–5, apices free; northern temperate regions to Guatemala).
- *Aria* (leaf nerves to margins; petals white or pink; sepals usually persistent stamens about 20; carpels 2–3; ovules 2(–4) per locule; fruit a pome; Europe, North Africa, Asia; ca. 50 spp.).
- *Aronia* (petals white or pink; sepals persistent; stamens 15–25; carpels 2–5; East Asia, North and Central America).
- *Chamaemeles* (petals white to pink, clawed; sepals persistent; stamens 10–18; carpel 1; Madeira [Portugal]; 1 sp., *C. coriacea*).
- *Chamaemespilus* (petals white or pink; sepals persistent; stamens about 20; carpels 2; ovules 2(–4) per locule; southeast Europe; 1 sp., *C. alpina*).
- *Cormus* (leaves compound; petals white or pink; sepals deciduous; hypanthium persistent; stamens about 20; carpels 2–5; ovules 2(–4) per locule; Europe, Asia;
- *Cotoneaster* (petals white or pink; sepals persistent; stamens 6–30; carpels (1–)2–3(–5); Asia, Europe, North Africa).
- *Crataegus* (often thorny; leaves lobed or pinnatifid; petals white, pink or red; sepals persistent or deciduous; stamens 20 or so; carpels 1–5, partly free; northern temperate regions, Central America).
- *Dichotomanthes* (leaf margins entire; petals whitish; sepals persistent; stamens 20 on rim of disk; carpel 1; locule 1; fruit an achene; tropical China; 1 sp., *D. tristanii*carpa).
- *Docyniopsis* (petals white; sepals persistent; stamens many; carpels 5; Asia; 1 sp., *D. laosensis*).
- *Eriobotrya* (leaf nerves to margins; petals white or yellow; sepals persistent; stamens 15–many; carpels 2–5; styles basally fused, hairy; Himalayas to Japan and Malesia).
- *Eriolobus* (leaves 3-parted; inflorescences simple racemes; petals white; sepals reflexed, persistent; stamens 20; carpels 5; southeast Europe to southwest Asia; 1 sp., *E. trilobatus*).
- *Heteromeles* (petals white; sepals persistent; stamens 10; carpels 2, basally fused; western USA to northwest Mexico; 1 sp., *H. salicifolia*).
- *Lindleya* (inflorescences 1-flowered; petals white; sepals imbricate; carpels 5, free; fruit a woody capsule; Mexico; 1 sp., *L. mespiloides*).
- *Malacomeles* (petals white or pinkish; sepals persistent; stamens 20 or so; styles 3–5; ovary inferior; Mexico).
- *Malus* (petals white, pink or red; sepals persistent or deciduous; stamens 15–20; carpels 3–5; ovules 2(–4) per locule; styles basally fused; northern temperate regions; ca. 50 spp.).
- *Mespilus* (sometimes thorny; inflorescences 1-flowered; petals white; sepals persistent; stamens 30–40; carpels (4–)5, fully fused; ovules 2(–3) per locule; southeast Europe to southwest Asia, widely cultivated).
- *Peraphyllum* (leaves sessile, margins entire; petals white or pink; sepals persistent; stamens 15–20; ovary inferior; styles 2(–3); western North America; 1 sp., *P. ramossissimum*).
- *Photinia* (petals white; sepals persistent; stamens usually 20; carpels (1–)2–5; ovules (1–)2–5 per locule; Asia, Mexico).
- *Pyracantha* (often thorny; petals white; sepals persistent; stamens 20; carpels 5, partly free; southern Europe to east Asia).
- *Pyrus* (petals white or pinkish; sepals persistent or deciduous; stamens 15–30; carpels 2–5; styles free; Eurasia).
- *Rhaphiolepis* (petals white to pink; sepals deciduous; stamens 15–20; carpels 2, completely fused to hypanthium; southeast to East Asia).
- *Sorbus* (leaves simple or compound; petals white or pink; sepals persistent; stamens about 20; carpels 2–5, apices free; ovules 2(–4) per locule; Europe, Asia; ca. 100? spp.).
- *Stranvaesia* (petals white; stamens 20 or so; carpels 4–5, free to middle; Himalayas to China and southeast Asia).
- *Torminalis* (leaves deeply-lobed; petals white or pink; sepals deciduous; stamens about 20; carpels 2–3; Mediterranean region to Iran).
- *Vauquelinia* (shrubs or trees; flowers bisexual; petals white; sepals valvate; carpels 5, free; fruits 5-follicles; southern USA to Mexico).

Ovule always 1

- *Hesperomeles* (sometimes thorny; petals white; sepals persistent; stamens 20 or so; carpels 4–6, partly free; Central and South America).
- *Osteomeles* (leaves odd-pinnately compound; petals white; sepals persistent; stamens 20 or so; carpels 5; styles hairy at base; China, Taiwan, Ryukyu Islands [Japan], Hawaii).

*Amelanchier lamarkii**Cotoneaster pannosus**Malus sylvestris**Pyrus calleryana**Rhaphiolepis umbellata**Osteomeles anthyllidifolia*

**Sorbarieae (shrubs; leaves alternate and compound or fascicled to alternate and simple; epicalyx absent; petals present; carpels many and fused or 1; fruit an achene or follicle)**

- *Adenostoma* (evergreen shrubs; leaves simple, whorled to alternate; sepals imbricate; hypanthium funnel-shaped; carpel 1; ovules 2; fruit an achene; western North America).
- *Chamaebatiaria* (usually evergreen shrubs; petals white; sepals valvate; carpels 5; ovules several; fruit a follicle; western USA; 1 sp., *C. millefolium*).
- *Sorbaria* (deciduous shrubs; petals white; sepals valvate; carpels usually 5; ovules several; fruit a follicle; central and East Asia).
- *Spiraeanthus* (leaflets entire; petals pink; carpels 2–5, basally fused; fruit a follicle; Kazakhstan; 1 sp., *S. schrenkianus*).



*Chamaebatiaria millefolium*

**Spiraeae (shrubs or rarely herbs; leaves alternate and simple or compound; leaf venation pinnate; stipules absent; epicalyx absent; sepals valvate; disk usually present; carpels 2–5 and free; fruit a follicle or rarely an achene)**

- *Aruncus* (herbs; leaves compound; flowers usually unisexual; petals white or yellow; carpels 3–5; northern temperate regions).
- *Halodiscus* (petals white; disk inside stamens, rim-like; carpels 4–5; ovules 2; fruit an achene; North America to northern South America).
- *Kelseya* (cushion plants; petals purplish; disk inconspicuous; carpels 3–5; ovules 3–7; northwest USA; 1 sp., *K. uniflora*).
- *Luetkea* (petals white; carpels 4–6; ovules several; northwestern North America; 1 sp., *L. pectinata*).
- *Pentactina* (petals long, linear; Korea; 1 sp., *P. rupicola*).
- *Petrophytum* (low creeping shrubs; leaves 1–3-nerved; petals white; disk well-developed; carpels 3–5; ovules 2–4; western North America).
- *Sibiraea* (flowers unisexual; petals white or pink; disk well-developed; carpels usually 5; ovules 4–8; southeastern Europe to East Asia).
- *Spiraea* (flowers bisexual or rarely unisexual; petals white or rarely yellow or red; disk well-developed; carpels usually 5; ovules 2–few; northern temperate regions; ca. 80 spp.).
- *Xerospiraea* (often thorny; leaves reduced; petals white; carpels 2–5; ovules 2; Mexico; 1 sp., *X. hartwegiana*).



*Aruncus dioicus*



*Spiraea bumalda*

**Unplaced**

- *Lyonothamnus* (trees with flaky bark; leaves simple or compound, opposite; leaf margins entire or deeply divided; stipules deciduous; hypanthium attached to base of carpels; carpels 2, fused; fruit a pair of woody follicles; Santa Catalina Islands, California [USA]; 1 sp., *L. floribundus*).



*Lyonothamnus floribundus*

**148. BARBEYACEAE**

Small **trees**. **Leaves** oblong to lanceolate, simple, opposite; margins entire; dense white hairs below; stipules absent. **Inflorescences** axillary cymes or fascicles. **Flowers** unisexual (plants dioecious), actinomorphic. **Perianth** 1-whorled, basally fused in male flowers or free in females, sepaloid, lobes longer than the tube, persistent, enlarging in fruit. **Stamens** 2–3 whorled, filaments short; anthers basifixed. **Ovary** superior; usually carpel 1 or carpels basally fused; locules 2–3; ovule 1 per locule; placentation apical. **Fruit** a nut, persistent perianth wing-like.

**Genus** 1/species 1; *Barbeya oleoides*.

**Distribution:** Dry forests of Eritrea, Djibouti, Somalia to southwest Arabia.

**Floral formula:** P<sub>3–4</sub> A(6–)9–12  $\overline{\text{G}}$ 1–2(–3)

**Confused with:** Dirachmaceae – perianth 2-whorled and deciduous; stipules present.

**Notes:** The family is closely related ecologically to Dirachmaceae.

**Literature:** Friis 1993a; Thulin *et al.* 1998; WCSP 2014.



**Barbeyaceae characters**

Dense white hairs below and persistent and enlarged sepals surrounding the nut (pale yellow above)

Herbarium specimen *Collenette* 1404 (K)

## MALPIGHIALES

**Notes:** Plants in the order are morphologically diverse ranging from trees, shrubs, woody climbers to herbs, as well as, submerged aquatics (Podostemonaceae), parasites (Rafflesiaceae) and cactus-like succulents (some *Euphorbia* in Euphorbiaceae).

There are few constant macromorphological characters which unite the order, though Malpighiales plants typically have 4–5-merous flowers with free petals, stamens 4–5 (often) to 2-whorled or many, and usually fused carpels with superior ovaries (inferior in Rafflesiaceae and some Rhizophoraceae; part-inferior in some Salicaceae and superior to inferior in Dichapetalaceae). Flowers are usually actinomorphic, though zygomorphic flowers are sometimes present, notably in *Viola* (Violaceae) and Trigonaceae. Stipules are usually present in most families.

Some families have: **petals absent** (Balanopaceae, some Euphorbiaceae, Lacistemataceae, Picrodendraceae, Podostemaceae, Putranjivaceae, Rafflesiaceae, some Salicaceae); **hypanthium present** (Chrysobalanaceae, Dichapetalaceae, Euphroniaceae, Goupiaceae, Passifloraceae, Rhizophoraceae); or are **succulents** (some Euphorbiaceae, some Phyllanthaceae).

Molecular data found the Euphorbiaceae *sensu lato* and Flacourtiaceae were among the few traditionally recognised families not to be found monophyletic. This has resulted in splitting the Euphorbiaceae into several families and the complete breakup of the Flacourtiaceae (see Salicaceae and Achariaceae).

1. Root-holoparasitic herbs without chlorophyll [parasitic on *Tetrastigma*, Vitaceae]  
..... **183. Rafflesiaceae**
1. Non-parasitic plants with chlorophyll present..... **2**
2. Aquatic plants with little differentiation between roots, stems and leaves. **213. Podostemaceae**
2. Plants terrestrial, if aquatic then roots, stems and leaves differentiated..... **3**
3. Woody climbers with leafy tendrils..... **197. Lophopyxidaceae**
3. Trees, shrubs or herbs, if woody climbers then leafy tendrils absent..... **4**
4. Stamens many, filaments basally fused in a ring with small warty structures on filaments;  
leaves 3-foliolate or (rarely) bi-pinnate; petioles long [Costa Rica to Paraguay]  
..... **205. Caryocaraceae**
4. Stamens 1–many, filaments not as above; leaves various, if 3-foliolate then petioles not long..... **5**
5. Ovule 1 per locule; stipules present; ovary  $\geq 1$ -locular; flowers unisexual; perianth 1–2-whorled  
[usually inconspicuous, if conspicuous then exudates often present]..... **6**
5. Ovules  $\geq 2$  per locule, if 1 ovule then flowers bisexual (if unisexual then stipules absent  
with exudates present or perianth conspicuous and exudates absent)..... **7**
6. Plants dioecious; perianth 2-whorled; exudates absent; plants non-succulent; fruits fleshy  
..... **180. Pandaceae**
6. Plants monoecious or dioecious; perianth 1–2-whorled; exudates present or absent; plants  
succulent or non-succulent; fruits non-fleshy or (rarely) fleshy..... **184. Euphorbiaceae**
7. Style (usually) gynobasic; stipules present..... **8**
7. Style terminal or lateral; stipules present or absent..... **9**
8. Anthers dorsifixed..... **196. Chrysobalanaceae**
8. Anthers basifixed..... **187. Ochnaceae**

## 218. COMBRETACEAE

**Trees, shrubs, subshrubs or woody climbers**; sometimes in mangroves; bark often flaking. **Leaves** sometimes gland-dotted, sometimes deciduous, simple, opposite, whorled or alternate; margins entire; petioles present, sometimes with glands; stipules if present reduced or minute. **Inflorescences** racemes, spikes or panicles; bracts often deciduous. **Flowers** usually bisexual, unisexual (plants andromonoecious, rarely dioecious in *Combretum rupicola*, *Conocarpus*, *Laguncularia*), actinomorphic or weakly zygomorphic (some *Combretum*, *Dansiea*, *Lumnitzera littorea*), often nectariferous hypanthium. **Sepals** fused, sometimes reduced. **Petals** free, reduced or absent (e.g. some *Combretum*, *Terminalia*). **Stamens** opposite the sepals, 2-whorled or rarely 1-whorled (some *Combretum* and *Terminalia tetrandra*), filaments attached to hypanthium, often exerted; anthers dorsifixed; staminodes 4–5 in *Combretum gracile* and dioecious species. **Ovary inferior** or part-inferior (*Stephonema*); carpels fused; locule 1; ovules (1–)2–7(–20) per locule; placentation apical. **Fruit** often a samara or drupe.

**Genera** 10/**species** ca. 500.

**Distribution:** Mainly Old World tropical and subtropical regions.

**Floral formula:** K4–5(–8) C0 or 4–5(–8) A(4–5–)8–10(–16)  $\overline{G}2–5(–8)$

**Confused with:** [Chrysobalanaceae](#) – stipules present; ovary superior. [Rhizophoraceae](#) – fruits dry and never winged.

**Notes:** The following generic names are synonymous: *Anogeissus*, *Buchenavia*, *Bucida*, *Finetia*, *Pteleopsis* and *Ramatuela* = *Terminalia*; *Calopyxis*, *Meiostemon*, *Quisqualis* and *Thiloo* = *Combretum*; and *Calycopteris* = *Getonia*.

**Literature:** Keay 1954; Maurin *et al.* 2010; Stace 2007; Tan *et al.* 2002

### Generic synopsis

**Combretoideae** (trees, shrubs or woody climbers; leaves opposite or alternate; ovary inferior)

- *Combretum* (petals usually present; leaves and inflorescences with stalked glands and/or scales; tropical and subtropical regions; ca. 225 spp.).
- *Conocarpus* (fruits cone-like, strongly recurved at the apex; *C. erectus* is a mangrove associate in the Neotropics, *C. lan-cifolius* is in sandy soils of northeastern Africa to Yemen).
- *Dansiea* (inflorescences (1–)2-flowered; ovules 14–20; fruits winged; Australia).
- *Getonia* (scrambling shrubs; flowers sessile; sepals enlarging in fruit; petals absent; fruit dry, achene-like; southeastern Asia; 1 sp., *G. floribunda*).
- *Guiera* (plant covered with small black glands; fruit dry, achene-like; West Africa; 1 sp., *G. senegalensis*).
- *Laguncularia* (mangrove species; leaves opposite; petals <2 mm long; Neotropics, West Africa; 1 sp., *L. racemosa*).
- *Lumnitzera* (mangrove species; leaves alternate; petals >3 mm long; ovules 2–5; East Africa to Australia).
- *Macropteranthes* (leaves alternate or opposite; hypanthium fused to ovary all round; ovules 6–12; fruits winged; Australia).
- *Terminalia* (petals absent; leaves and inflorescences without stalked glands and/or scales; tropical and subtropical regions; ca. 230 spp.).

**Strephonematoideae** (trees; leaves alternate; ovary part-inferior; fruits not winged)

- *Stephonema* (stamens 10; ovules 2; Liberia to Gabon; 3 spp.).



Fruit of *Combretum zeyheri*



*Combretum molle*



*Conocarpus erectus*



*Guiera senegalensis*



*Laguncularia racemosa*



*Lumnitzera racemosa*



*Terminalia mollis*



*Stephonema manni*

Herbarium specimen Cheek 11384 (K)

## UNPLACED BASAL LAMIID FAMILIES

### 345. ONCOTHEACEAE

**Shrubs to trees**, up to 30 m tall. **Leaves** simple, alternate (spiral, crowded at branch tips), leaf base attenuate; margins sometimes with minute glandular teeth or entire; petioles short or absent; stipules absent. **Inflorescences** axillary panicles to thyrses; bracteate. **Flowers** minute (ca. 2 mm in diameter), bisexual, actinomorphic; bracteoles 2. **Sepals** free, imbricate, persistent. **Petals** fused, imbricate, deciduous; greenish to white. **Stamens** alternating with petals; filaments attached to petals; anthers basifixed, extrorse. **Ovary** superior; carpels fused; locules 5; ovules 2 per locule; placentation axile to apical; styles 5. **Fruit** a drupe.

**Genus** 1/**species** 2; *Oncotheca*.

**Distribution:** New Caledonia.

**Floral formula:** K5 C5 A5  $\overline{G}$ 5

**Confused with:** [Phellinaceae](#) – flowers unisexual; perianth free.

**Literature:** Cameron 2002; Carpenter 1975; McPherson *et al.* 1982; Morat & Veillon 1988.

#### Species synopsis

- *O. balansae* (stamens with a prolonged connective and inflexed to cover the ovary).
- *O. humboldtiana* (stamens not as above).



Branch of *Oncotheca macrocarpa*  
Herbarium specimen McPherson 3478 (K)



Fruits of *Oncotheca macrocarpa*  
Herbarium specimen McPherson 3478 (K)

### 346. METTENIUSACEAE

**Trees or shrubs**, rarely **woody climbers** (few *Rhaphiostylis*); young branches often hairy, simple hairs or lepidote and/or stellate in *Dendrobangia* and *Platea*. **Leaves** simple, alternate (spiral); margins entire or toothed (sometimes in *Calatola*), sometimes slightly revolute; venation pinnate; petioles present; stipules absent. **Inflorescences** spikes, cymes, fascicles, panicles or racemes; bracteate. **Flowers** bisexual or less often unisexual, actinomorphic or zygomorphic in female flowers of *Calatola*; bracteolate **Sepals** slightly fused basally to free, imbricate, persistent or deciduous. **Petals** free, basally fused or fused, valvate, sometimes hairy and/or fleshy; often white. **Stamens** alternating with petals, filaments attached to petals or free, sometimes hairy; anthers dorsifixed or basifixed. **Ovary** superior; carpels fused; locule 1 or 2–3 (*Emmotum*); ovule 1–2, if 2 then only 1 often maturing; placentation apical; stigmas capitate, 2–3-lobed, oblique or reduced. **Fruit** a drupe, sometimes appendaged, ribbed and/or asymmetrical, up to 7 cm long.

**Genera** 10/**species** ca. 45.

**Distribution:** Tropical and subtropical regions.

**Floral formula:** K(4–)5 C(4–)5 A(4–)5  $\overline{G}$ 1–4

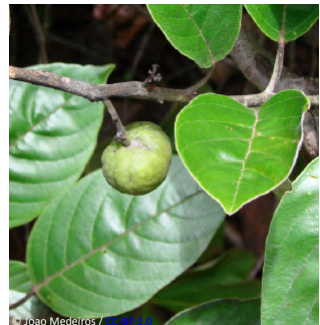
**Confused with:** Metteniusiaceae are very similar to [Icacinaeae](#) but can be identified regionally in the following way: **Africa** – plants with leaves drying dark blackish-brown and sometimes fleshy lateral appendages on the fruit; **Asia** – plants dioecious or polygamous with usually stellate hairs/scales present or plants hermaphroditic with fleshy lateral appendages on the fruit; **New World** – plants erect shrubs or trees, sometimes with lepidote-stellate hairs present and/or leaves without domatia below. See other potentially confused families under Icacinaceae.

**Notes:** Metteniusaceae *sensu* APG III consisted of a single genus *Metteniusa*. Recent molecular work by Byng *et al.* (2014) and Stull *et al.* (2014) expands the family to incorporate several genera from Icacinaceae.

**Literature:** Boutique 1960; Byng *et al.* 2014; Duno de Stefano 2007, 2011; Gonzalez *et al.* 2007; Gonzalez & Rudall 2010; Howard & Duno de Stefano 1999; Kårehed 2001; Klopper *et al.* 2006; Lozano & de Lozano 1988, 1994; Peng & Howard 2008; Sleumer 1942, 1971a; Stull *et al.* 2014; Utteridge 2010.



*Apodytes dimidiata*



Fruit of *Emmotum nitens*

## Generic synopsis

**Apodytes group** (leaves drying dark blackish brown; flowers bisexual; stigmas reduced; fruits often asymmetric)

- *Apodytes* (petals free or basally fused; stigmas small, oblique; lateral appendage on fruits; Africa, Madagascar, tropical Asia; 1–6 spp.).
- *Rhaphiostylis* (petals free; styles persistent; fruits without appendages; tropical Africa; 8–10 spp.).
- *Dendrobangia* (young branches often pubescent with lepidote or stellate hairs; leaf margins slightly revolute; petals fused; Costa Rica to Brazil and Bolivia).



Fruits of *Apodytes*

**Emmotum group** (leaves usually drying dark brown or remaining green; flowers bisexual or rarely functionally unisexual; stigmas capitate, lobed or reduced; fruits symmetric or asymmetric, sometimes ribbed and/or large)

- *Emmotum* (leaf secondary veins conspicuous or not, tertiary venation inconspicuous, margins slightly revolute; petals free, densely hairy; disk present or absent; ovary 2–3-locular; stigmas capitate or 3-lobed; tropical South America; ca. 10 spp.).
- *Metteniusa* (inflorescences cymes; flowers up to 5.5 cm long; petals basally fused to free, reflexed; fruits up to 4.5 cm long; Costa Rica to Peru).
- *Oecopetalum* (inflorescences many-flowered; pedicels absent or reduced; calyx enlarging in fruit; petals free, slightly reflexed; anthers longer than stamen filaments; stigmas capitate or slightly 2-lobed; Mexico to Costa Rica).
- *Ottoschulzia* (leaf margins slightly revolute; inflorescences 1–3-flowered; flowers functionally unisexual or bisexual; calyx not enlarging in fruit; petals basally fused; Central America, Caribbean).
- *Poraqueiba* (leaf secondary and tertiary veins conspicuous; inflorescences panicles; petals free, fleshy; disk absent; tropical South America).



*Metteniusa tessmanniana*  
Herbarium specimen Asplund 19615 (K)

**Platea group** (leaves sometimes turn black when dry; flowers unisexual; sepals ±free, imbricate; stigmas reduced; fruits longitudinally ridged)

- *Calatola* (dioecious; leaves turn black when dry, margins entire or toothed; inflorescences 2–3-flowered; flowers 4-merous; petals basally fused to free, greenish; fruits up to 7 cm long; Central America to Brazil and Bolivia).
- *Platea* (dioecious or polygamous; simple or stellate hairs/scales present; flowers 5-merous; petals basally fused; stamen filaments shorter than anthers; tropical Asia).

## 347. ICACINACEAE

**Woody climbers**, often with **tendrils**, **shrubs** or **trees**; stems rarely spiny (*Cassinopsis*), young branches sometimes hairy, simple, rarely T-shaped or stiff hairs. **Leaves** **simple**, alternate (spiral) or rarely opposite; margins entire to toothed or rarely palmately lobed; venation pinnate, reticulate or sometimes palmate (e.g. *Hoseia*); petioles present; stipules **absent**. **Inflorescences** spikes, fascicles, cymes, umbels, panicles, racemes, heads or solitary flowers; often bracteate. **Flowers** usually small, bisexual or unisexual (plants dioecious) or rarely polygamous, actinomorphic or rarely zygomorphic; bracteolate. **Sepals** fused or free, cup-shaped, usually persistent. **Petals** fused or rarely free, usually **valvate** or imbricate (*Cassinopsis*). **Stamens** alternating with petals, filaments attached or free from petals; anthers dorsifixed; often staminodes in female flowers. **Ovary** **superior**; carpels fused; **locules** 1(–3); ovules 2 per locule and **only 1 often maturing**; placentation **apical**. **Fruit** a 1-seeded **drupe**.

**Genera** 26/species ca. 165.

**Distribution:** Tropical, subtropical and southern temperate regions.

**Floral formula:** K(0–)3–5 C(3–)4–5 A(3–)4–5(–6) G(2–)3(–5)

**Confused with:** **Cardiopteridaceae** – shrubs or trees. **Celastraceae** – stipules present; conspicuous disk present. **Euphorbiaceae** – stipules usually present (vs. absent). **Metteniusaceae** – see treatment for useful characters for identification. **Olaaceae** – stamens opposite the petals. **Stemonuraceae** – hairs on stamens (vs. usually hairs absent).

**Notes:** Icacinaceae as traditionally circumscribed, with about 55 genera, was found to be grossly non-monophyletic by Kårehed (2001) resulting in some genera placed in Cardiopteridaceae and Stemonuraceae (Aquifoliales) and Pennantiaceae (Apiales). The family as circumscribed *sensu* APG III system was still thought to be non-monophyletic and recent and ongoing molecular work by Byng *et al.* (2014) and Stull *et al.* (2014) suggests the genera *Apodytes*, *Calatola*, *Dendrobangia*, *Emmotum*, *Ottoschulzia*, *Oecopetalum*, *Platea*, *Poraqueiba* and *Rhaphiostylis* form a group with *Metteniusa* and are here treated in Metteniusaceae. The following generic names are synonymous: *Chlamydocarya* and *Polyccephalum* = *Pyrenacantha*; and *Polyporandra* = *Iodes*.

**Literature:** Angulo *et al.* 2013; Bailey & Howard 1941a, 1941b, 1941c, 1941d; Boutique 1960; Byng *et al.* 2014; Duno de Stefano 2007, 2011; Duno de Stefano *et al.* 2013; Engler 1893; Howard 1940, 1943, 1992; Howard & Duno de Stefano 1999; Kårehed 2001; Klopper *et al.* 2006; Lens *et al.* 2008; Peng & Howard 2008; Sleumer 1942, 1971a; Stull *et al.* 2014; Utteridge & Schori 2011; Utteridge *et al.* 2005.

## 372. PEDALIACEAE

## SESAME FAMILY

**Shrubs** to **trees** or perennial **herbs**, often xerophytic, rarely annual or aquatic (*Trapella*); stems sometimes swollen. **Leaves** sometimes deciduous, simple, opposite or sometimes alternate (e.g. *Sesamum*); margins entire to lobed or pinnatifid; petioles usually present; stipules absent; conspicuous sticky (**mucilage**) **glandular hairs** (give a slimy clammy feel). **Inflorescences** **axillary** solitary flowers or cymes, rarely raceme-like (*Sesamothamnus*); pedicels with **2(–many) extra-floral nectaries at base** (absent from *Uncarina* and *Trapella*); bracteate. **Flowers** bisexual, **zygomorphic**. **Sepals** fused, blunt-lobed, imbricate, unequal. **Petals** fused, imbricate, spurred (e.g. *Holubia*, *Rogeria longiflora*, some *Sesamothamnus*); white to yellow or rarely red. **Stamens** 4 and unequal or rarely 2 (*Trapella*), opposite the sepals, filaments attached to petals; often staminode 1. **Ovary** superior or inferior (*Trapella*), sometimes a nectar disk below; carpels fused, 2 or rarely 3–4 carpels; locules usually 2; ovules 1–many per locule; placentation **axile**. **Fruit** a capsule, drupe or nut; often **winged, spiny or horned**.

**Genera** 14/species 70.

**Distribution:** Subtropical to tropical regions, mostly in coastal or arid habitats in Old World.

**Floral formula:** K5 C5 A(2–)4+(0–)1\* G2(–3–4)

**Useful species:** *Sesamum indicum* (sesame seeds).

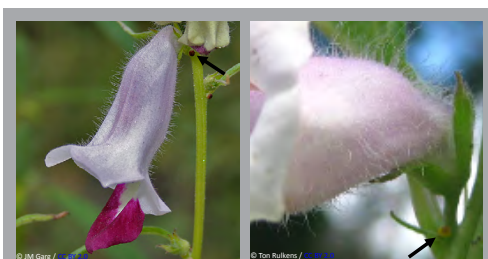
**Confused with:** **Martyniaceae** – inflorescences terminal.

**Notes:** There are rarely 3–4 carpels in *Josephinia imperatricis*, *J. grandiflora* and some *Sesamum orientale*.

**Literature:** Manning 1991; Olmstead *et al.* 2001; Ihlenfeldt 2004b.

### Generic synopsis

- *Ceratothera* (deciduous shrubs or perennial to annual herbs; corolla white, pink or purple; fruits with 2 lateral horns; East to southern Africa).
- *Dicerocaryum* (perennial herbs; flowers longly pedicellate; corolla white, pink, purple or yellow; fruits disc-like with 2 erect conical spines; Madagascar, East to South Africa).
- *Harpagophytum* (perennial herbs; inflorescences 1-flowered; corolla purple, pink or yellow; fruits 4-ridged; southern Africa).
- *Holubia* (annual herbs; inflorescences 1-flowered; corolla yellow-green, with basal sac-like spur; fruits 4-winged, indehiscent; southern Africa; 1 sp., *H. saccata*).
- *Josephinia* (shrubs, subshrubs or annuals; corolla mauve, pink or whitish; carpels 2(3–4); fruits globular with spines; Kenya, Somalia, Malesia, northern Australia).
- *Linariopsis* (perennial herbs or subshrubs; corolla mauve; fruits with tiny warts; tropical Africa).
- *Pedaliodiscus* (perennial herbs; inflorescences 1-flowered; corolla cream; fruits with 4-longitudinal wings; East Africa; 1 sp., *P. macrocarpus*).
- *Pedaliium* (annual herbs; inflorescences 1-flowered; corolla yellow; fruits 4-angled; northeast Africa, widespread pantropical weed; 1 sp., *P. murex*).
- *Pterodiscus* (perennial herbs; inflorescences 1-flowered; corolla yellow, red, orange or purple; fruits with 4-longitudinal wings; Africa).
- *Rogeria* (perennial or annual herbs; inflorescences 2-flowered; corolla white, red or purple; fruits smooth, winged or spiny; southern edge of Sahara, southwest Africa).
- *Sesamothamnus* (trees or shrubs, trunk swollen at base, spines present; corolla white, pink or yellow; fruits smooth; northeast and southern Africa).
- *Sesamum* (deciduous shrubs or perennial to annual herbs; corolla pink, white or purple; fruits smooth; sub-Saharan Africa, India, Sri Lanka; ca. 20 spp.).
- *Trapella* (aquatic perennial herbs; corolla white to pink; stamens 2; staminodes 2; Japan, Russian Far East, Korea, southeast China; 1–2 spp.).
- *Uncarina* (trees or shrubs; inflorescences 1–9-flowered; corolla white, yellow or purple; fruits spiny; Madagascar; ca. 13 spp.).



**Pedaliaceae character**

Extra-floral nectaries (arrowed) are present at the base of the pedicel



*Ceratothera triloba*



Habit of *Harpagophytum procumbens*



*Pterodiscus ngamicus*



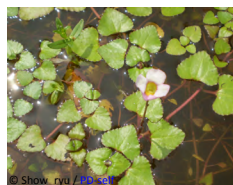
*Pedaliium murex*



*Sesamothamnus rivae*



Fruit of *Uncarina* sp.



Habit of *Trapella sinensis*

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