

## ASTERACEAE (COMPOSITAE)

菊科 ju ke

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Herbs, subshrubs, or shrubs, rarely trees or climbers, bisexual, monoecious, or sometimes dioecious, many with laticiferous cells or canals and/or resinous ducts. Leaves often in a basal rosette; cauline leaves usually alternate, more rarely (in China) opposite or whorled, sessile or petiolate, without stipules; petiole sometimes auriculate at base; leaf blade entire to variously lobed or divided. Florets bisexual (perfect), female (pistillate), or functionally male (functionally staminate), solitary or few to many enclosed in an involucre of 1- to many-seriate phyllaries (involucral bracts) to form a capitulum; calyculus of outer bracts sometimes present and often differing markedly from phyllaries. Capitula solitary or few to many arranged in variously formed synflorescences, homogamous or heterogamous, discoid, disciform, radiate, subradiate, radiant, or ligulate; receptacle usually flattened, sometimes slightly concave or convex, rarely conical, smooth or alveolate, paleate (scaly) or epaleate, with bristles, scales, hairs, or naked. Corolla (3–) 5-merous, gamopetalous, tubular or tubular-filiform, and regular, bilabiate, radiate, or ligulate. Stamens (4 or) 5, inserted within corolla tube; filaments adnate to proximal part of corolla; anthers basifixed or dorsifixed, usually coalescent into a tube, base caudate or not, apex with (rarely without) a sterile, ovate or lanceolate appendage; pollen grains usually tricolporate, echinate or sometimes lophate or spinulate, often caveate. Style apically bifid (rarely entire); style branches variously shaped, with or without an apical appendage, hairs, or papillae. Ovary inferior, 1-loculed; ovule 1, basal, anatropous. Fruit an achene (cypsela). Pappus consisting of 1 to many rows of scales or bristles, or absent. Seed erect; endosperm scanty; embryo straight.

Between 1,600 and 1,700 genera and ca. 24,000 species: cosmopolitan (except Antarctica); 15 tribes (one introduced), 248 genera (18 endemic, 49 introduced), and 2,336 species (1,145 endemic, 109 introduced) in China.

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Taxonomic discussion on the Asteraceae is included under the relevant tribes. The following notes apply to the whole family. Modes of reproduction in the Chinese Asteraceae are known only fragmentarily. As regards the world diversity of the family, only about 12% of genera have been studied using cytoembryology to identify the reproduction system. In 3%, agamospermy was found to occur. Probably the most common reproduction system is allogamy with a sporophytic self-incompatibility; occasional selfing is also possible (stigma ageing or mentor effect). More or less obligate autogamy is relatively rare. Other uncommon reproduction systems include gynodioecy, a very rare dioecy (with heterogametic females). Asexual reproduction is a widespread phenomenon in the Asteraceae, with a wide range of mechanisms. In addition to the rare adventitious embryony, there are common types of autonomous apomixis, agamospermy (apospory, diplospory) associated with various forms of embryogenesis (parthenogenesis, apogamy). All the types of reproduction are to be considered in the evaluation of population variation and for taxonomic conclusions because the prevailing type of reproduction substantially influences the variation limits of taxa.

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### Glossary of botanical terms used in the Asteraceae

Accepted terms are indicated by **boldface**. Within the definitions, *italics* (when not names of genera) indicate terms that are defined in this glossary.

**achene** – the fruit of Asteraceae; a usually dry, indehiscent, 1-locular, 1-seeded fruit derived from a 2-carpellate, inferior ovary. Some authors prefer to use the term cypsel for the fruit of Asteraceae and restrict the term achene to a dry, 1-seeded fruit derived from a 1-carpellate, superior ovary (e.g., in *Ranunculus* in Ranunculaceae).

**alveolate** – honeycombed; usually referring to a  $\pm$  pitted *receptacle*, in which the pits or sockets may be round or  $\pm$  polygonal in cross section, socket margins may be entire, erose, fimbriate, or lacerate; cf. *foveolate*.

**anther appendage** – sterile tissue extending distally beyond pollen sacs as a continuation of an anther connective.

*anther collar* – see *antheropodium*.

**antheropodium** (plural **antheropodia**) – literally “anther foot”; a region of usually thick-walled cells in a staminal filament just proximal to its anther; the collar may be *balusterform* (as in *Senecio*), i.e., proximally with enlarged cells, or straight and (semi)cylindrical and made up of uniformly sized cells (as in *Ligularia* and *Parasenecio*).

**anther tails** – sterile tissue extending from the base of a pollen sac; anther tails may be simple or  $\pm$  branched and often have a characteristic form within taxa; some tribes of Asteraceae characteristically have tailed (also called caudate) anthers.

**anther tube** – in Asteraceae, the five anthers are joined laterally into a tube through which the style emerges.

**antrorse** – directed toward the apex; lateral elements of *barbellate* or *plumose* awns or bristles of a *pappus* may be described as antrorse; cf. *retorse*.

*apical anther appendage* – see *anther appendage*.

**apical plate** – the apical *achene* area on the periphery of which the *pappus* is inserted; sometimes also called pappus disk.

**apical rim** – a  $\pm$  salient ring outside the *pappus* insertion, surrounding the *apical plate* (characteristic of Cardueae).

*aristate scale* – see *pappus*.

**attachment scar** – the area near the base of the *achene* where it was attached to the *receptacle*.

*awn* – see *pappus*.

**balusterform** – referring to an *antheropodium* that is proximally markedly dilated with enlarged cells (as in some Senecioneae).

**barbellate** (diminutive **barbellulate**) – usually refers to a *pappus* awn or bristle with lengths of lateral elements (free cell ends, usually called barbs) less than or subequaling the diameter of the shaft of the awn or bristle; see also *plumose* and *scabrid*.

*basal anther appendages* – see *anther tails*.

*beak* – see *rostrum*.

**bilabiate corolla** – a corolla with 2 lips, usually an outer lip with 3 lobes or teeth and an inner lip with 2 often linear lobes (e.g., in some Mutisieae).

**bisexual floret** (sometimes referred to as hermaphroditic floret or perfect floret) – florets possessing both an anther cylinder and a style, usually both fertile although in some taxa florets may be *functionally male* or *female*.

*bristle* – see *pappus*.

*calathium* or *calathidium* (plural *calathia* or *calathidia*) – see *capitulum*.

**calcarate anthers** – anthers with the filaments inserted  $\pm$  abaxially on the connective, distal to (above) the bases of the paired pollen sacs (e.g., in *Vernonia*).

**calycular bracts** – the individual bracts making up the *calyculus*.

**calyculate** – bearing a *calyculus*.

**calyculus** (plural **calyculi**) – collectively, 1 or more bracts or bracteoles subtending an *involute*, usually readily distinguished from the *phyllaries* (e.g., in *Senecio* and *Taraxacum*).

*capitulescence* – see *synflorescence*.

**capitulum** (plural **capitula**) – the inflorescence in Asteraceae and certain other families; sometimes called a head; a capitulum comprises an *involucre* of *phyllaries* (sometimes subtended by a *calyculus*), a *receptacle*, and (1–)5–100(–1000 or more) *florets*; the florets are borne on the face of the receptacle.

**carpopodium** (plural **carpopodia**) – literally “fruit foot”; the basal, sterile portion of an *achene* at its point of attachment to a *receptacle*; carpopodia are sometimes diagnostic in shape and cellular form (e.g., in some Eupatorieae) and sometimes negligible or essentially absent.

**caudate anthers** – tailed anthers; see *anther tails*.

*chaff* – *paleae*; see *receptacle*.

**compressed achene** – usually, cross sections of *achenes* are  $\pm$  circular or polygonal and isodiametric; sometimes, achenes are compressed or  $\pm$  flattened either (1) laterally with the longer dimension of the cross section of each achene parallel to a radius of the *capitulum* (as in *Helianthus*) or (2) dorsiventrally with the longer dimension of the cross section of each achene perpendicular to a radius of the capitulum (as in *Coreopsis*).

**corolla limb** – in a *disk floret*, the corolla limb is the portion of the corolla distal to the insertion of the staminal filaments (i.e., corolla limb = *corolla throat* + *corolla lobes* of a *disk corolla*); in a *ligulate floret*, the corolla limb is called a *ligule*; in a *ray floret*, it is called a *lamina*.

**corolla lobes** – the lobes of a corolla.

**corolla throat** – usually, throat refers to the portion of a corolla distal to insertion of staminal filaments (i.e., distal to the *corolla tube*) and proximal to the *corolla lobes*; the throat may be gradually or abruptly amplified (enlarged) relative to the tube.

**corolla tube** – usually, the portion of a corolla proximal to insertion of the staminal filaments; also, the  $\pm$  cylindrical portion of a corolla proximal to the  $\pm$  flat *corolla limb* in a *ligulate floret* or a *ray floret*.

**corona** – a crown-shaped *pappus*; or, in Anthemideae (which lack a true pappus), the apex of the *achene* may be produced into an entire to deeply divided, crown-shaped, sometimes pappuslike structure.

*cypsela* (plural *cypselae*) – see *achene*.

**disk corolla** – corolla of a *disk floret*.

**disk florets** – central *florets* of a *disciform capitulum*, *radiant capitulum*, or *radiate capitulum*, or all florets of a *discoïd capitulum*; disk florets usually have actinomorphic corollas; disk florets may be *bisexual* (most common), *functionally male* (moderately common), or *female* (relatively rare, e.g., in *Antennaria*, and in *Cavea* when dioecious).

**disciform capitulum** – a *heterogamous capitulum* with actinomorphic corollas in all *florets*, with *marginal florets* that are *female* or *neuter* (and usually with  $\pm$  attenuate to filiform corollas), and with central florets usually *bisexual*, sometimes *functionally male*. By tradition, both the marginal, female florets and the central, bisexual or functionally male florets in disciform capitula have been referred to as *disk florets*.

**discoïd capitulum** – a *homogamous capitulum* with actinomorphic corollas in all *florets* (similar in *marginal* and central florets) and all florets either *bisexual* or *functionally male* or *female*.

**distant** – in reference to Asteraceae, the opposite of *imbricate*, in an *involucre* where the *phyllaries* do not overlap but are clearly in more than one series.

**ecalcarate anther** – anthers not *calcarate*.

**ecalyculate** – lacking a *calyculus*.

*ecaudate anthers* – anthers not caudate or tailed; see *anther tails*.

**endothecial tissue** – wall structure of pollen sacs with cell thickenings; the endothecium is radial if the wall thickenings are restricted to vertical cell walls (e.g., in *Senecio*), and polarized if restricted to horizontal walls (e.g., in *Ligularia*); intermediate types occur (e.g., in some *Sinosenecio*).

*epaleaceous* – see *epaleate*.

**epaleate** – lacking *paleae*; see *receptacle*.

**epappose** – lacking a *pappus*.

**female floret** (sometimes referred to as pistillate floret) – describes a *floret* with a fertile, functional ovary and style (i.e., capable of producing a viable seed) and lacking stamens.

*filament collar* – see *antheropodium*.

**filiform floret** – a *marginal floret* of a *disciform capitulum* or sometimes a *discoïd capitulum*; filiform florets are *female*, always without staminodes, and have narrowly tubular corollas apically subtruncate, or with 2 or 3 minute teeth or a minute *lamina*.

**floret** – an individual flower in a *capitulum*.

**foveolate** – shallowly pitted; cf. *alveolate*.

**functionally male floret** (sometimes referred to as functionally staminate floret) – a *floret* that has fertile anthers and a sterile ovary, i.e., a floret producing functional pollen and not capable of producing a viable seed; styles of functionally male florets usually are not branched and usually lack stigmatic papillae. Although strictly correct, the word “functionally” is often omitted.

**gland-dotted** – surfaces of Asteraceae, especially leaves and *phyllaries*, sometimes bear subsessile, sessile, or sunken, multicellular glandular hairs; such surfaces have been described as gland-dotted, glandular punctate, punctate, or punctate glandular; here, such surfaces are described as gland-dotted.

*glandular punctate* – see *gland-dotted*.

**glomerule** – a condensed, usually  $\pm$  globose cluster of *capitula* (e.g., in *Eremanthus* Lessing, not in China, and *Gamochaeta*); cf. *pseudocephalium*.

*head* – see *capitulum*.

*hermaphroditic floret* – see *bisexual floret*.

**heterogamous capitulum** – a *capitulum* with *florets* of two or more sexual forms.

**homogamous capitulum** – a *capitulum* with all *florets* of one sexual form, usually all *bisexual*, all *functionally male*, or all *female*.

**imbricate** – partially and  $\pm$  regularly overlapping, as shingles (tiles) of a roof; *phyllaries* of an *involucre* are often imbricate.

*inflorescence* – in Asteraceae, the primary inflorescence is a *capitulum*; in the sense of a compound inflorescence with multiple capitula, see *synflorescence*.

*involucral bracts* – see *phyllaries*.

**involucre** – *phyllaries* collectively; an involucre is the bracts or bracteoles borne at the periphery of a *receptacle*, exterior to the *florets* of a *capitulum*.

**lamina** (plural **laminae**) – in *ray florets*, the  $\pm$  flat,  $\pm$  strap-shaped *corolla limb* of the zygomorphic corolla; a lamina usually has 2 or 3 apical lobes or teeth; it is sometimes referred to as a ray and, incorrectly, as a *ligule*.

**ligulate capitulum** – a *capitulum* with all *florets* *bisexual* and *ligulate*; the *corolla limb* is called a *ligule*, is  $\pm$  flat and  $\pm$  strap-shaped, and is apically 5-lobed or 5-toothed; ligulate capitula are characteristic of Cichorieae.

**ligulate floret** – a floret in which the *corolla limb* is zygomorphic,  $\pm$  flat, and  $\pm$  strap-shaped with 5 apical lobes or teeth; the  $\pm$  flat corolla limb of a *ray floret* has been called a *ligule*, whereas here it is called a *lamina*.

**ligule** – the  $\pm$  flat,  $\pm$  strap-shaped *corolla limb* of a *ligulate floret*.

*male floret* – see *functionally male floret*.

**marginal florets** – the single or multiple series of *florets* around the edge of a *capitulum* and surrounding the central *disk florets*; marginal florets may be (but are not necessarily) *ray florets*.

**neuter floret** – describes a *ray floret* that lacks a style.

**palea** (plural **paleae**) – bracts borne on a *receptacle* of a *capitulum*; usually, each palea subtends an individual *floret*; paleae are usually herbaceous, membranous, or scarious and may be persistent,  $\pm$  caducous, or shed together with *achenes*; paleae have been called receptacular bracts or receptacular paleae; scales of the *pappus* also have been called paleae.

**paleaceous** – *palea*-like; for the sense of bearing paleae, see *paleate*.

**paleate** – bearing paleae; see *receptacle*.

**pappose** – bearing a *pappus*.

**pappus** (plural **pappi**) – collectively, awns and/or bristles and/or scales corresponding to a calyx borne apically on ovaries (ultimately *achenes*) of Asteraceae. A pappus may be  $\pm$  persistent or  $\pm$  caducous; when persistent it is sometimes involved in dispersal of achenes. A pappus may include more than one kind of element (e.g., awns, bristles, and/or scales); the elements may be distinct or  $\pm$  connate and may occur in 1–5 or more series. Scales that are very narrow may be only arbitrarily distinguishable from awns or bristles. The distinction between awns and bristles is also sometimes arbitrary. Generally, cross sections of bristles and awns are  $\pm$  circular or polygonal and have the longer diameter no more than  $3 \times$  the shorter diameter. Pappus elements with  $\pm$  flat cross sections (i.e., longer diameter of cross section more than  $3 \times$  the shorter diameter) are called scales, regardless of relative lengths of the elements. As used here, subulate scale means much the same as flattened bristle. Bristles may be relatively pliable to relatively stiff. Bristles with diameters less than ca. 50  $\mu\text{m}$  are usually called capillary or fine bristles; bristles with diameters greater than ca. 50  $\mu\text{m}$  are usually called coarse bristles. Rigid pappus elements with  $\pm$  circular or polygonal, isodiametric cross sections greater than 100  $\mu\text{m}$  in diameter are usually called awns. Awns and/or bristles may be *barbellate*, *barbellulate*, or *plumose*. A pappus scale may terminate in one or more bristlelike or awnlike appendages; such scales are said to be aristate.

*pappus disk* – see *apical plate*.

**pedicel** – strictly referable to the stalk of an individual *floret*, such as may be found in many species of *Cotula*.

**peduncle** – a stalk (stem) supporting a single *capitulum*.

*perfect floret* – see *bisexual floret*.

*peripheral florets* – see *marginal florets*.

**phyllaries** (singular **phyllary**) – the bracts or bracteoles borne at periphery of a *receptacle*, exterior to the *florets* of a *capitulum*, collectively an  *involucre*; in fruit, phyllaries are sometimes shed together with *achenes* (e.g., in *Acanthospermum*, *Parthenium*, and *Xanthium*).

*pistillate floret* – see *female floret*.

**plumose** – featherlike or bearing feathers; in reference to Asteraceae, plumose usually refers to a *pappus* bristle with lengths of lateral elements 1–3 or more  $\times$  the diameter of the shaft of the bristle; see also *barbellate* and *scabrid*.

**pseudobilabiate corolla** – a corolla with a 4-lobed outer (abaxial) lip and a simple (not lobed) inner (adaxial) lip (e.g., in *Barnadesia Mutis* ex Linnaeus f., not in China).

**pseudocephalium** (plural **pseudocephalia**) – literally “false head”; an aggregation of *capitula* into a secondary, capitulum-like *synflorescence* (e.g., in *Echinops*, *Elephantopus*, and *Sphaeranthus*); cf. *glomerule*.

*punctate* – see *gland-dotted*.

*punctate glandular* – see *gland-dotted*.

**radiant capitulum** – a *heterogamous capitulum* with *marginal florets* usually *neuter* (sometimes *female*) with corollas usually 5-lobed, notably enlarged (relative to corollas of central florets), and actinomorphic to  $\pm$  zygomorphic (e.g., in *Centaurea* s.l.) and with central florets usually *bisexual* with 5-lobed, actinomorphic corollas.

**radiate capitulum** – a *heterogamous capitulum* with marginal *ray florets* and central *disk florets*.

*ray* – see *lamina*.

**ray corolla** – the corolla of a *ray floret*.

**ray florets** – in a *radiate capitulum*, the *marginal florets* that are *neuter*, *female*, or *styliferous and sterile* with zygomorphic corollas. The *corolla limb* of a *ray corolla* is called a *lamina* and is  $\pm$  flat,  $\pm$  strap-shaped, and (0–)2- or 3(or 4)-lobed or -toothed; it has been called a *ligule*, but here *ligule* is used for the corolla limb of a *ligulate floret*.

**receptacle** (adjective **receptacular**) – in reference to Asteraceae, the portion of a *capitulum* that bears *phyllaries* peripherally and *florets* on its face; transition from apex of *peduncle* to receptacle is imperceptible and the distinction is arbitrary; faces of receptacles may be concave, flat, convex, conical, or cylindrical and may be *paleate* or *epaleate* (epaleate receptacles are sometimes described as naked). Paleate receptacles are sometimes said to be chaffy and the *paleae*, collectively, are sometimes called chaff. Epaleate receptacles may bear  $\pm$  subulate enations (e.g., in *Grindelia*) or bristles or subulate to linear scales (e.g., in some Cardueae) or hairs (e.g., in some Anthemideae) among florets, or epaleate receptacles may be  $\pm$  *foveolate* with margins of sockets notably lacerate; such epaleate receptacles may be mistaken for paleate receptacles.

**retorse** – directed toward the base; lateral elements of *barbellate* or *plumose* awns or bristles of a *pappus* may be described as retorse; cf. *antrorse*.

**rostrate** – bearing a *rostrum*.

**rostrum** (plural **rostra**) – a distal, attenuated portion of an *achene* (e.g., in *Taraxacum*).

**scabrid** – used to describe capillary *pappus* bristles with lateral extensions that are shorter than those in *barbellate* bristles; see also *plumose*.

*scale* – see *pappus*.

**scape** – properly, a leafless and simple flowering stem of a plant that has leaves in basal rosettes; the *peduncle* of some Asteraceae (e.g., in *Taraxacum*) is sometimes called a scape.

**scapiform** – resembling a *scape*.

**scrobiculate** – refers to a *receptacle* covered with low mounds of tissue with furrows between, the top of each mound occupied by the remains of the vascular bundle.

**seta** (plural **setae**) – a bristle or bristlelike structure; with reference to Asteraceae, setae are usually elements of a *pappus*.

**setiferous** – bearing *setae*.

**setula** (plural **setulae**) – diminutive of *seta* (*setae*); small hairs usually on an *achene*, including *twin hairs*.

**setuliferous** – bearing *setulae*.

**squamella** (plural **squamellae**) – a relatively small scale; scales of a *pappus* are sometimes called squamellae.

*staminate floret* – see *functionally male floret*.

**sterome** – a central, ± hardened portion of a *phyllary*; individual steromes may be undivided or divided into two lobes (e.g., in Gnaphalieae).

**stigmatic area** – area of a *style branch* covered with stigmatic papillae, present as areas covering the inside of the style branch or separated into two marginal bands that may sometimes fuse toward the apex of the style branch.

*style arm* – see *style branch*.

**style branch** – in reference to Asteraceae, one of the two branches of a style; usually, each style branch bears stigmatic papillae on the inner (adaxial) face, at least proximally; in *functionally male florets*, styles are usually not branched and usually lack stigmatic papillae.

*style branch appendage* – see *style branch tip*.

**style branch tip** – the portion of a *style branch* beyond the *stigmatic area* (sometimes termed style branch appendage); the forms of style branch tips are sometimes characteristic of tribes or subtribes.

**styliferous and sterile** – describes a *ray floret* that has a style but is seed-sterile, i.e., it has an infertile ovary, unable to produce a seed.

**stylopodium** (plural **stylopodia**) – literally “style foot”; usually, a nectary at the base of a style.

**subimbricate** – less than *imbricate*; weakly overlapping.

**subinvolucral bracts** – individual bracts surrounding or below an *involucre*, sometimes subtending individual *peduncles*, e.g., in *Mikania*.

**subplumose** – less than *plumose*.

**subradiate capitulum** – a *heterogamous capitulum* with the *ray florets* not exceeding the *phyllaries*.

**sweeping hairs** – dorsal projections from the abaxial side of the *style branches*. Their function is to collect pollen from the pollen sacs as the style grows up through the *anther tube*; the distribution and shape of sweeping hairs are often taxonomically useful.

*syncalathium* (plural *syncalathia*) – see *synflorescence*.

**synflorescence** – a compound inflorescence; any arrangement of multiple *capitula* on a capitulum-bearing shoot; a synflorescence can be corymbiform, paniculiform, racemiform, spiciform, etc., or capitulum-like; see also *glomerule* and *pseudocephalium*.

**twin hairs** – translation of the German *Zwillingshaare*, sometimes referred to as duplex hairs although usually 3-celled (2 parallel cells plus 1 smaller basal cell); twin hairs are often found on *achenes* of Asteraceae and are sometimes called *setulae*.

**umbo** – a ± conical or polyhedral projection or boss; in some Asteraceae, a usually waxy structure associated with a *pappus* (e.g., in *Jurinea*).

**umbonate** – bearing an *umbo*.

**xylopodium** (plural **xylopodia**) – literally, “wood foot”; a ± woody, subterranean caudex or rootstock that is derived from the hypocotyl and roots.

### Systematic list of tribes, subdivisions of tribes, and genera

● Indicates endemic genus

#### 1. Mutisieae (p. 9)

1. ● *Nouelia*
2. *Leucomeris*
3. *Adenocaulon*
4. *Leibnitzia*
5. *Gerbera*
6. *Piloselloides*
7. *Ainsliaea*
8. *Pertya*
9. ● *Myrriopsis*
2. **Echinopeae (p. 33)**
10. *Echinops*
3. **Carlinae (p. 39)**
11. *Carlina*
12. *Atractylodes*
13. *Tugarinovia*
4. **Cardueae (p. 42)**
1. **Saussurea group**
14. *Jurinea*

15. ● *Diplazoptilon*

16. *Himalaiella*
17. *Dolomiaea*
18. ● *Bolocephalus*
19. *Frolovia*
20. *Aucklandia*
21. *Hemisteptia*
22. *Saussurea*
2. **Arctium group**
23. *Cousinia*
24. *Schmalhausenia*
25. *Arctium*
3. **Onopordum group**
26. *Synurus*
27. *Alfredia*
28. *Olgaea*
29. ● *Xanthopappus*
30. *Syreitschikovia*
31. *Onopordum*

32. *Ancathia*

4. **Carduinae**
33. *Cirsium*
34. *Carduus*
5. **Centaureinae**
35. *Rhaponticum*
36. *Oligochaeta*
37. *Klasea*
38. ● *Archiserratula*
39. *Tricholepis*
40. *Amberboa*
41. *Plagiobasis*
42. *Russowia*
43. *Schischkinia*
44. *Serratula*
45. *Rhaponticoides*
46. *Psephellus*
47. *Crupina*
48. *Carthamus*

49. *Cyanus*

50. *Centaurea*
5. **Cichorieae (p. 195)**
51. *Scorzonera*
52. *Podospermum*
53. *Koelpinia*
54. *Epilasia*
55. *Tragopogon*
56. ● *Fabertia*
57. *Cicerbita*
58. *Melanoseris*
59. *Paraprenanthes*
60. *Notoseris*
61. *Lactuca*
62. *Launaea*
63. *Sonchus*
64. *Chondrilla*
65. *Crepis*
66. *Youngia*

67. *Lapsanastrum*  
 68. *Crepidiastrum*  
 69. *Heteracia*  
 70. *Garhadiolus*  
 71. *Taraxacum*  
 72. *Askellia*  
 73. *Ixeridium*  
 74. *Ixeris*  
 75. *Sonchella*  
 76. *Dubyaea*  
 77. • *Syncalathium*  
 78. *Hololeion*  
 79. *Nabalus*  
 80. *Soroseris*  
 81. *Hypochaeris*  
 82. *Picris*  
 83. *Cichorium*  
 84. *Hieracium*  
 85. *Pilosella*  
**6. Vernonieae (p. 354)**  
 86. *Ethulia*  
 87. *Vernonia*  
 88. *Distephanus*  
 89. *Camchaya*  
 90. *Elephantopus*  
 91. *Pseudelephantopus*  
**7. Senecioneae (p. 371)**  
**1. Tussilaginatae**  
 92. *Doronicum*  
 93. *Farfugium*  
 94. *Ligularia*  
 95. *Cremanthodium*  
 96. • *Sinacalia*  
 97. • *Dicerocoelados*  
 98. *Parasenecio*  
 99. • *Ligulariopsis*  
 100. *Syneilesis*  
 101. *Tussilago*  
 102. *Petasites*  
**2. Tephroseridinae**  
 103. *Sinosenecio*  
 104. *Tephroseris*  
 105. *Nemosenecio*  
**3. Senecioninae**  
 106. *Synotis*  
 107. *Cissampelopsis*  
 108. *Senecio*  
 109. *Crassocephalum*  
 110. *Erechtites*  
 111. *Gymnura*  
 112. *Emilia*  
 113. *Pericallis*  
 114. • *Hainanecio*  
**8. Astereae (p. 545)**  
 115. *Nannoglottis*  
 116. *Dichrocephala*  
 117. *Cyathocline*  
 118. *Grangea*  
 119. *Myriactis*  
 120. *Thespis*  
 121. *Eschenbachia*  
 122. *Microglossa*  
 123. *Bellis*  
 124. *Tripolium*  
 125. *Galatella*  
 126. *Crinolina*  
 127. *Asterothamnus*  
 128. *Arctogeron*  
 129. *Turczaninovia*  
 130. *Lagenophora*  
 131. *Calotis*  
 132. *Callistephus*  
 133. • *Formania*  
 134. • *Heteroplexis*  
 135. *Psychrogeton*  
 136. *Neobrachyactis*  
 137. • *Sheareria*  
 138. *Rhinactinidia*  
 139. *Aster*  
 140. *Solidago*  
 141. *Erigeron*  
 142. *Eurybia*  
 143. *Grindelia*  
 144. *Symphotrichum*  
**9. Anthemideae (p. 653)**  
 145. *Cotula*  
 146. *Soliva*  
 147. *Ajania*  
 148. • *Ajaniopsis*  
 149. *Brachanthemum*  
 150. *Chrysanthemum*  
 151. *Artemisia*  
 152. *Seriphidium*  
 153. *Crossostephium*  
 154. *Filifolium*  
 155. *Neopallasia*  
 156. *Allardia*  
 157. *Cancrinia*  
 158. *Richteria*  
 159. *Handelia*  
 160. *Pseudohandelia*  
 161. *Hippolytia*  
 162. *Kaschgaria*  
 163. *Leucanthemella*  
 164. *Microcephala*  
 165. • *Opisthopappus*  
 166. *Stilpnolepis*  
 167. *Achillea*  
 168. *Anthemis*  
 169. *Tanacetum*  
 170. *Tripleurospermum*  
 171. *Matricaria*  
 172. *Glebionis*  
 173. *Leucanthemum*  
**10. Gnaphalieae (p. 774)**  
 174. *Filago*  
 175. *Phagnalon*  
 176. *Gamochaeta*  
 177. *Leontopodium*  
 178. • *Sinoleontopodium*  
 179. *Antennaria*  
 180. *Gnomophalium*  
 181. *Gnaphalium*  
 182. *Anaphalis*  
 183. *Pseudognaphalium*  
 184. *Xerochrysum*  
 185. *Helichrysum*  
**11. Calenduleae (p. 819)**  
 186. *Calendula*  
**12. Inuleae (p. 820)**  
 187. *Buphthalmum*  
 188. *Carpesium*  
 189. *Pulicaria*  
 190. *Pentanema*  
 191. *Blumea*  
 192. *Inula*  
 193. *Duhaldea*  
 194. *Sphaeranthus*  
 195. *Pterocaulon*  
 196. *Epaltes*  
 197. *Pluchea*  
 198. *Karelinia*  
 199. *Laggera*  
 200. *Pseudoconyza*  
**13. Athroismeae (p. 851)**  
 201. *Anisopappus*  
**14. Heliantheae (p. 852)**  
 202. *Tagetes*  
 203. *Pectis*  
 204. *Flaveria*  
 205. *Glossocardia*  
 206. *Cosmos*  
 207. *Bidens*  
 208. *Coreopsis*  
 209. *Enydra*  
 210. *Acmella*  
 211. *Zinnia*  
 212. *Tridax*  
 213. *Galinsoga*  
 214. *Acanthospermum*  
 215. *Guizotia*  
 216. *Sigesbeckia*  
 217. *Smallanthus*  
 218. *Blainvillea*  
 219. *Synedrella*  
 220. *Calyptocarpus*  
 221. *Eleutheranthera*  
 222. *Eclipta*  
 223. *Clibadium*  
 224. *Sphagnetocola*  
 225. *Melanthera*  
 226. *Wollastonia*  
 227. *Sclerocarpus*  
 228. *Lagascea*  
 229. *Rudbeckia*  
 230. *Tithonia*  
 231. *Helianthus*  
 232. *Xanthium*  
 233. *Ambrosia*  
 234. *Parthenium*  
 235. *Gaillardia*  
**15. Eupatorieae (p. 879)**  
 236. *Ageratina*  
 237. *Mikania*  
 238. *Adenostemma*  
 239. *Gymnocoronis*  
 240. *Ageratum*  
 241. *Eupatorium*  
 242. *Austroeupatorium*  
 243. *Praxelis*  
 244. *Chromolaena*  
 245. *Conoclinium*  
**Genera incertae sedis (p. 892)**  
 246. *Cavea*  
 247. *Centipeda*  
 248. *Symphyllocarpus*

**Key to tribes**

- 1a. Capitula of 2 kinds, either with only functionally male florets or with only female florets; flowering not precocious.
- 2a. Plants monoecious, with male and female capitula on same plant ..... 14. Heliantheae (p. 852)
- 2b. Plants dioecious, with male and female capitula on different plants.
- 3a. Leaves spiny ..... 3. Carlineae (*Tugarinovia*; p. 39)
- 3b. Leaves not spiny.
- 4a. Shrubs ..... 1. Mutisieae (*Myriopsis*, rarely *Pertya*; p. 9)
- 4b. Herbs.
- 5a. Phyllaries papery; female florets filiform ..... 10. Gnaphalieae (*Antennaria*; p. 774)
- 5b. Phyllaries herbaceous; female florets tubular, apically 3- or 4-lobed ..... 246. *Cavea* (p. 892)
- 1b. Capitula all alike, homogamous or heterogamous, rarely plants subdioecious and then flowering precocious.
- 6a. Fertile achenes with conspicuous stipitate glands ..... 1. Mutisieae (*Adenocaulon*; p. 9)
- 6b. Fertile achenes without conspicuous stipitate glands.
- 7a. Capitula homogamous and all florets ligulate, i.e., corollas with an expanded abaxial, apically 5-toothed, 5-lobed, or 5-cleft limb; latex (milky juice) present ..... 5. Cichorieae (p. 195)
- 7b. Capitula heterogamous, or if homogamous then corollas tubular and 5-lobed or zygomorphic and pseudoligulate (5-lobed with one deeper cleft or sinus); plants without or rarely with latex.
- 8a. Capitula homogamous; corollas pseudoligulate, 5-lobed and zygomorphic.
- 9a. Capitula in bracteate glomerules; phyllaries 8, decussate; style branches long ..... 6. Vernonieae (*Elephantopus*, *Pseudelephantopus*; p. 354)
- 9b. Capitula not in bracteate glomerules; phyllaries not decussate; style branches very short or scarcely bilobed ..... 1. Mutisieae (*Ainsliaea*, *Pertya*; p. 9)
- 8b. Capitula heterogamous (marginal florets with a strap-shaped, entire or 2–4-toothed or 2–4-lobed outer limb) or homogamous and corollas 3–5-lobed, actinomorphic.
- 10a. Capitula with all or some florets bilabiate or pseudobilabiate (slightly zygomorphic) ..... 1. Mutisieae (*Gerbera*, *Leibnitzia*, *Nouelia*, *Piloselloides*; p. 9)
- 10b. Capitula lacking bilabiate florets.
- 11a. Capitula each with only 1 floret, aggregated into a terminal globose pseudocephalium; leaves spiny ..... 2. Echinopeae (p. 33)
- 11b. Capitula with more than 1 floret, or if with only 1 floret then leaves not spiny.
- 12a. Leaves at least below synflorescence opposite or mostly so.
- 13a. Style branch tips longer than stigmatic lines, prominent; capitula discoid; corollas never yellow ..... 15. Eupatorieae (p. 879)
- 13b. Style branch tips shorter than stigmatic lines, or absent; capitula radiate, disciform, or discoid; corollas often yellow ..... 14. Heliantheae (p. 852)
- 12b. Leaves all alternate.
- 14a. Style shaft and branches glabrous ..... 1. Mutisieae (*Leucomeris*; p. 9)
- 14b. Style shaft glabrous or with hairs or evident papillae in distal part and/or style branches with hairs or evident papillae abaxially or apically or on an apical appendage.
- 15a. Disk corollas 3- or 4-merous.
- 16a. Receptacle with scales ..... 248. *Symphyllocarpus* (p. 893)
- 16b. Receptacle without scales.
- 17a. Achenes dorsiventrally compressed, elliptic in cross section ..... 9. Anthemideae (p. 653)
- 17b. Achenes subterete, broadly ribbed ..... 247. *Centipeda* (p. 892)
- 15b. Disk corollas or all corollas 5-merous.
- 18a. Style shaft with a papillose-pilose thickening below branches; leaves spiny, at margin finely serrulate-spinulose, or not spiny.
- 19a. Achene densely hairy, capitula homogamous, plants biennial or perennial, and leaves never grasslike; pappus inserted directly on upper edge of achene, not surrounded by a rim ..... 3. Carlineae (p. 39)
- 19b. Achene glabrous or subglabrous, rarely densely hairy but then capitula radiant, plants annual, or leaves grasslike; pappus insertion surrounded by a ± conspicuous rim or crown ..... 4. Cardueae (p. 42)
- 18b. Style shaft without a papillose-pilose thickening below branches; leaves neither spiny nor at margin finely serrulate-spinulose.

- 20a. Achenes large, heteromorphic, outer cymbiform or curved, inner strongly curved to circular; receptacle epaleate; pappus absent ..... 11. Calenduleae (p. 819)
- 20b. Achenes small, columnar or compressed, straight or only slightly curved, homomorphic or only slightly heteromorphic, if large then receptacle paleate; pappus present or absent.
- 21a. Phyllaries rather dry, either with distinct scarious margin or papery, brownish, yellowish, or whitish, never herbaceous and green throughout.
- 22a. Anthers rounded at base; phyllaries with distinct pale or brownish scarious margin ..... 9. Anthemideae (p. 653)
- 22b. Anthers tailed at base; phyllaries papery, whitish, brownish, or yellowish, especially in distal part ..... 10. Gnaphalieae (p. 774)
- 21b. Phyllaries herbaceous, all or at least outer ones green throughout, except at very apex.
- 23a. Style branches long, slender, subulate, without an apical appendage, hairy abaxially and with stigmatic papillae over entire adaxial surface; capitula homogamous ..... 6. Vernonieae (p. 354)
- 23b. Style branches not with above combination of characters; capitula homogamous or heterogamous.
- 24a. Receptacle paleate.
- 25a. Achenes with a carbonized layer in pericarp, thereby black or streaked with black ..... 14. Heliantheae (p. 852)
- 25b. Achenes without a carbonized layer in pericarp, thereby usually not black.
- 26a. Phyllaries linear ..... 12. Inuleae (*Bupthalmum*; p. 820)
- 26b. Phyllaries broadly elliptic to oblanceolate ..... 13. Athroismeae (p. 851)
- 24b. Receptacle epaleate.
- 27a. Style branches terminating in a triangular to subulate appendage distal to stigmatic lines.
- 28a. Phyllaries uniseriate, but sometimes with an outer series of much shorter bracts (calyculus); involucre cylindric ..... 7. Senecioneae (p. 371)
- 28b. Phyllaries 2- to several seriate, if subuniseriate then involucre saucer-shaped to subglobose ..... 8. Astereae (p. 545)
- 27b. Style branches without an apical appendage distal to stigmatic lines, apically rounded or truncate.
- 29a. Phyllaries uniseriate, but sometimes with an outer series of much smaller bracts (calyculus); capitula never aggregated into a compact synflorescence ..... 7. Senecioneae (p. 371)
- 29b. Phyllaries 2- or 3-seriate or imbricate in several series; capitula sometimes aggregated into a compact synflorescence.
- 30a. Corolla bearing numerous robust uniseriate multicellular hairs ..... 246. *Cavea* (p. 892)
- 30b. Corolla without such hairs.
- 31a. Stigmatic papillae confined to 2 submarginal lines often confluent at apex ..... 12. Inuleae (p. 820)
- 31b. Stigmatic papillae covering entire adaxial surface of style branches ..... 7. Senecioneae (*Doronicum*; p. 371)