

ASTERACEAE

INTRODUCTION TO ASTERACEAE

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Asteraceae, with over 1600 genera and 24,000 species, are the largest family of flowering plants, rivalled only by Orchidaceae. They are almost ubiquitous, being found in all vegetation types, on every continent except Antarctica, although relatively scarce in lowland rainforest communities. They are best represented in grasslands, open grassy woodlands and alpine habitats. The plants are most commonly annual or perennial terrestrial herbs, but some are lianes, aquatic herbs, shrubs or even trees, and some develop bizarre growth forms, like the cushion plants of alpine New Zealand and Tasmania. The characteristic 'daisy' inflorescences of the family ensured that it was one of the earliest natural assemblages to be recognised, but its relationships to other families, and its internal relationships, have taken longer to untangle.

Asteraceae (alt. Compositae) are characterised by florets (often numerous) arranged on a common receptacle in centripetally developing heads surrounded by bracts. The florets typically have petaloid corollas (basically 5-merous, but often reduced), either actinomorphic (tubular, sometimes reduced and filiform) or zygomorphic (ray), usually lobed or toothed, with a calyx represented by a pappus of hairs, bristles, awns or scales, which may be free or variously fused, sometimes absent, an inferior bicarpellate ovary, which develops into a dry single-seeded achene (strictly a cypsela), five stamens with usually free filaments often attached to the corolla wall, and anthers which are usually fused into a tube. There is a single style, usually bilobed, with external hairs, which in the process of elongating sweeps the pollen from the anther tube, before expanding its two linear stylar lobes above the anthers. In such a large family it is to be expected that there will be minor exceptions to the above general plan, but all species have most of the above features.

The family also has a distinctive and varied secondary chemistry, and this feature has not only assisted in confirming the monophyletic status of the family, but has also provided chemical signatures for many of the tribes and other groups. This subject is discussed in detail in Calabria *et al.* (2009).

History of Classification

No attempt will be made here to trace the history of classification in Asteraceae in detail. Excellent and recent comprehensive accounts are available elsewhere, particularly those of Jeffrey (2007), Kadereit (2007), Mauricio Bonifacio *et al.* (2009), Heywood (2009), Lundberg (2009) and Funk *et al.* (2009a).

Mauricio Bonifacio *et al.* (2009) pointed out that even as early as the time of Theophrastus (c. 371–287 BC) there was recognition that the Asteraceae constituted a distinct group of plants, and by the early 16th century the French botanist Ruel had recognised that the head of some Asteraceae was in fact composed of small individual flowers or florets. Adanson (1763) in publishing his *Familles des Plantes*, recognised, among others, the Compositae, although when the starting point for family names was moved to 1789 after the Vienna International Botanical Congress of 2005, the authority for the name shifted to Giseke (1792). The alternative name Asteraceae was formally published by Martynov (1820), and use of either is sanctioned by the International Code of Nomenclature. Tournefort (1700) recognised subdivisions within the Asteraceae, dividing them into three groups, those with tubular florets only, those with ray florets only and those with a mixture of both. The first to recognise and use floret sexuality in his classification was Vaillant (1719–1723), who recognised three subgroups 'familles ou classes' within the Asteraceae.

It was left to Cassini to prepare the first definitive account of the diversity of the family. Over a period of more than 20 years (1813–1834) Cassini published a series of extremely detailed papers, examining the species of Asteraceae and the characteristics of their individual parts (styles, stigmas, anthers, corollas, achenes and pappus). Based on this exhaustive analysis he published a classification of the family embracing the recognition of

20 tribes (Cassini 1819). Most of these tribes are still recognised, and defined in much the same way. Cassini also recognised that Calyceraceae, Campanulaceae and Goodeniaceae were three of the families most closely related to Asteraceae. Cassini's seminal papers, published in a scattered fashion, were brought together by King & Dawson (1975), and King *et al.* (1995a, 1995b).

A second conspectus of the family, incorporating a broader suite of observations on plants from South America, in particular, was published by Lessing (1832). Although based in part on Cassini's work, Lessing's system incorporated many original observations, with elaborate plates illustrating detailed morphology of styles and other organs, and for the first time included some dichotomous keys.

In 1873 Bentham (1873a, 1873b) published two major contributions to understanding of the family, which underpinned work on the family for the next 100 years. These were a discussion of the classification and biogeography of the family (Bentham 1873a), and a detailed description of the genera and family infrastructure in *Genera Plantarum* (Bentham 1873b), written jointly with J.D.Hooker. At almost the same time Bentham was writing the *Flora Australiensis*, and his treatment of Asteraceae, providing the first comprehensive account of the family for Australia, appeared in volume 3 (Bentham 1866). In this work Bentham incorporated the large number of new Australian species described 30 years earlier by Candolle (1836). Candolle had had the benefit of large suites of Australian Asteraceae sent to him by Allan Cunningham, and these had established the outline of the major Australian genera. Bentham built on this with specimens collected by other explorers and collectors, including Labillardière, Brown, Preiss, Baxter, Drummond, Oldfield, Fraser, Huegel, Dietrich and many others, as well as material assembled in the Melbourne Herbarium by Ferdinand Mueller. Bentham's views on the family were very similar to those of Cassini, although arrived at independently.

Hoffmann (1890–1894) published a monumental classification, similar to that of Bentham, which was the last overview of the family at generic level for the next 100 years. The first half of the 20th century yielded a rapid increase in the numbers of species and genera in the family, and for the most part these were placed with the broadly Benthamian framework. During the 1970s advances in anatomy and developmental morphology (particularly as revealed by the electron microscope), phytochemistry, palynology and genetics all contributed additional data towards understanding the infrastructure of the family, and the development of phenetic taxonomy and phylogenetic cladistics provided new tools to manipulate this data.

Bremer (1994) published the first cladistic overview of Asteraceae at the generic level, based on morphological characters. This work recognised three subfamilies and 16 tribes within Asteraceae, divided into 1535 genera and an estimated 23,000 species. The tribes did not differ substantially from those of Cassini, but the three subfamilies, Barnadesioideae, Asteroideae and Cichorioideae were new. Tribe Liabeae (not in Australia) was separated from Senecioneae. More importantly for Australian taxonomists, the formerly monolithic tribe Inuleae was divided into Inuleae *s. str.*, Gnaphalieae and Plucheeae. The widespread and characteristic Australian 'paper daisies' moved to Gnaphalieae from Inuleae.

Following closely on the Bremer book, a conference held at Kew yielded a set of important papers on the taxonomy, biology and economic botany of the family, which were published in two volumes, Hind & Beentje (1995) and Caligari & Hind (1996). This conference contained some of the first results from a new emerging technology, genetic sequencing, and the rapid embracing of this technology, allied to more sophisticated mathematical modelling, has resulted in substantial changes to infrafamilial arrangements of the Asteraceae. The most important of these has been the reversal of previous ideas on the direction of evolutionary change within the family. Previously it had been believed that the original asteraceous condition had been similar to the helianthoid radiate capitulum. In the last 20 years it has been shown that the helianthoid group is placed near the crown of the phylogenetic tree, and that the the mutisioid groups are in fact basal. Publication of a new classification of the family by Panero & Funk (2002) established a new starting point for taxonomic and

phylogenetic studies. It recognised 10 subfamilies and 35 tribes, but many of the latter are still largely as delimited by Cassini.

The cascade of molecular phylogeny papers before and after the Panero & Funk paper has contributed to incremental fine-tuning of the classification of Asteraceae. Two major books have been published on the subject recently, and these have been used as the framework for the classification adopted in this volume, and in *Flora of Australia* vol. 38A & B (still in preparation); they are Kadereit & Jeffrey (2007) and Funk *et al.* (2009b).

In Lundberg (2009) evidence is presented to show that the closest relative to the family Asteraceae is Calyceraceae, and that these two families are sister to Goodeniaceae (including Brunoniaceae). The sister group to these three is the small aquatic family Menyanthaceae. Beyond that relationships are less well defined, but probably include Styliaceae, Alseuosmiaceae, Phellinaceae and Argophyllaceae.

Economic importance of Asteraceae

Despite its size, the family Asteraceae has yielded a comparatively small number of economically important crop plants. None yield timber, fibre or building products. Their main products are oil seeds, leaf, stem and tuber food plants, a small number of medicinal, insecticidal and flavouring compounds, and a large number of ornamental horticultural plants. Some are weeds of agriculture. Much of the information on economic uses below is summarised from Simpson (2009), a paper that should be consulted for primary references and further details.

Edible plants

The principal edible Asteraceous plant is Lettuce, *Lactuca sativa* L., which is a selection from the wild *Lactuca serriola* L., and has a history of cultivation dating back to c. 4500 BC in Egypt, and may originally have been grown for seed oil as well as for its edible leaves. Chicory (*Cichorium intybus* L.), grown as Belgian endive, witloof, raddichio, chioggia and coffee chicory, is also used in salads, as is *Cichorium endivia* L. (endive, escarole, frisée or curly endive). *Launaea sarmentosa* (Willd.) Kuntze, native on the NW Western Australian coast, has been used as a salad vegetable in a number of countries. Minor Asteraceous leaf crops are listed by Simpson (2009).

Artichoke (*Cynara scolymus* L.) is grown for its edible involucre bracts and receptacle, as is its wild relative Cardoon (*Cynara cardunculus* L.), although the latter also yields edible leaf petioles. *Cynara cardunculus* can be invasive, and has become a noxious weed in parts of Australia, and other countries with similar hot dry climates, such as Argentina and the U.S.A.

A small number of species are grown for their edible roots, although as the storage product is not starch, but inulin, which is broken down in the large intestine into fructose and glucose, with production of large quantities of gas, the nutritional value of these foods is not as high as that of potatoes, taro and yams. The most significant tuberous crop is Jerusalem artichoke (*Helianthus tuberosus* L.), a native of North America. Burdock or gobo root (*Arctium lappa* L.) is a native of Asia, and used to a small extent in soups, or pickled, and in sushi where it provides a crunchy texture. Salsify (*Tragopogon porrifolius* L.) has an edible root said to taste like oysters, hence its other common name Oyster plant. The related *Scorzonera hispanica* L. (salsify, scorzonera, black oyster plant) is cultivated to a small extent, mainly in Spain, and has a similar taste. In the Andes Yacon (*Polymnia sonchifolia* Poepp. & Endl.) is grown on a very small scale for its crisp roots which are eaten fresh or cooked. The fleshy roots, 'yams', of *Microseris lanceolata* (Walp.) Sch.Bip. were an important food source for native people in Victoria and New South Wales (Maiden 1889; Low 1991). Virtually no other Australian Asteraceous plants are edible. Notes on a few herbarium sheets record that the fragrant leaves of *Wollastonia biflora* (L.) DC. are used to flavour food in earth ovens in some Torres Straits communities.

The leaves of *Chrysanthemum* spp. are used in Asia as a flavouring for salads, soups, and other dishes, either raw or lightly blanched. The leaves and ray florets of Marigold (*Calendula officinalis* L.) are sometimes used in Australia as an aromatic salad vegetable.

Seed oils

Sunflower (*Helianthus annuus* L.) is a native of Central and southern North America, and has been cultivated for at least 2000 years (perhaps longer) as a food and oilseed crop. It is now grown worldwide as an oilseed crop, valued for its bland unsaturated oils with high smoke point and light colour. The large-headed oilseed varieties were developed in the U.S.S.R., and were crossed with Jerusalem artichoke to improve disease resistance. As well as being used in cooking, sunflower oil is utilised in paints, varnishes and plastics, and to a small extent as a biofuel. The meal left behind after oil extraction from the seeds is used as a stockfeed. The seeds of other selections (grey striped) can be eaten as snacks.

Safflower oil from the Mediterranean species *Carthamus tinctorius* L. has been extracted since Roman times, but enjoyed a period of popularity in the 1980s in the first wave of enthusiasm for unsaturated food oils. Its use declined when research showed that mono-unsaturated fats were healthier than polyunsaturated fats. Varieties with high oleic oils are extensively used for deep frying fast foods because they are non-scum forming. Varieties with high linoleic oil content are used in margarines and salad oils. Like Sunflower oil, Safflower oil is non-yellowing, and finds a use in paints and varnishes.

Niger oil from *Guizotia abyssinica* Cass. is traditionally produced in Ethiopia (where it is probably native, derived from the weedy *G. scabra* Choiv.) and other parts of Africa and India. It will tolerate waterlogged or saline soils. The species was trialled in Australia, but no commercial production seems to have been undertaken (Francis & Campbell 2003). The species is a minor weed in Queensland and New South Wales.

Beverages

The two best-known beverages made from the Asteraceae are *Absinthe* and chamomile tea.

Details of the history and method of production of Absinthe are given in Simpson (2009). The main flavouring species is Wormwood (*Artemisia absinthum* L.), although the green colour comes from Petite wormwood (*Artemisia pontica* L.) and other herbs. *Artemisia absinthum* was also used traditionally to flavour vermouth.

Chamomile teas are made from several species of daisies. English chamomile is *Chamaemelum nobile* (L.) All., German chamomile is *Matricaria recutita* L., and other 'Chamomiles' are Dog fennel (*Anthemis cotula* L.) and Pineapple weed (*Matricaria matricarioides* (Less.) Porter). All were long used as herbal remedies, in some cases by the ancient Egyptians and Anglo Saxons, before being transformed into everyday beverages. Teas were also used to heighten blond highlights in hair, and are still used in some shampoos.

Juice from Chicory root (*Cichorium intybus* var. *sativum* Bisch.), traditionally provided a herbal remedy for intestinal disorders, and the dried, roasted and pulverised root has been used as a coffee substitute or adulterant.

In Sicily Artichoke (*Cynara scolymus* L.) is a major ingredient of Cynar, a bitter aperitif.

Spices

The only substantial use of Asteraceous plants as spices is Tarragon. Distillation of *Artemisia dracunculus* L., a native of southern Russia and western Asia, yields an anise-flavoured oil. The leaves are used as a herb to flavour food, and tarragon oil is also used in perfumery and to flavour vinegars. Russian tarragon (*Artemisia dracunculoides* Pursch.) is sometimes used in a similar way, but is inferior in flavour.

Sweeteners

Stevia rebaudiana (Bertoni) Bertoni from Paraguay has been used as a sweetener for centuries. The leaves contain *ent*-kaurene glycosides, stevioside and several rebaudiosides, which are 100–450 times as sweet as sucrose, but are not metabolised. It is widely used as a sugar substitute in Asia and South America, and has been cultivated in Europe since 1909.

Many Asteraceous species store the fructan inulin in their roots and tubers, and this compound is used in commerce as a sweetener because it can be converted to fructose and glucose by hydrolysis. Inulin can thus potentially be extracted from the roots of such plants as *Taraxacum officinale* L., *Helianthus tuberosus* L., *Microseris lanceolata* (Walp.) Sch.Bip., *Tragopogon porrifolius* L., *Scorzonera hispanica* L. and *Polymnia sonchifolia* Poepp. & Endl. The main commercial source of inulin is from Chicory root (*Cichorium intybus* L.), of which selected commercial strains can yield as much as 30% inulin.

Insecticides

Rythrin insecticides, a mixture of pyrethrin I & II and cinerin I & II, are kerosene-extracted from *Tanacetum cinerariifolium* (Trev.) Sch.Bip. and are very effective against insects such as flies, mosquitoes, fleas and lice. Resistance to the insecticide is low, and it has low toxicity for birds and mammals. Tasmania is a major source for the commercial production of this crop. Other chrysanthemoid species also yield pyrethrins, but are not used commercially.

Medicines

Artemisia annua L. is the source of artemisinin, a compound found to be effective in the treatment of malaria. It apparently works by entering red blood cells and, in contact with iron, releases peroxides which kill the malarial plasmodium. Artemisinin and its derivatives offer the main hope of continued control of malaria, as resistance to traditional treatments grows.

A very large number of species have been used, with varied effectiveness and/or documentation of effectiveness, in herbal remedies. Some of the more commonly used species are listed in Simpson (2009). They include *Arnica* spp. used to relieve bruising and inflammation, Burdock (*Arctium lappa* L.) for intestinal complaints, Echinacea (*Echinacea pallida* (Nutt.) Nutt. for relief of flu-like symptoms, and *E. purpurea* (L.) Moench. and *E. angustifolia* DC. for prevention of colds and urinary infections), Feverfew (*Tanacetum parthenium* (L.) Sch.Bip.) for fevers migraines and rheumatism, and Yarrow (*Achillea millefolium* L.) for baths for cramps.

Rubber

Many Asteraceae produce latex, and its presence or absence can help define major taxonomic groups. Latex also appears sporadically in otherwise latex-free genera. A notable example of this is Guayule rubber (*Parthenium argentatum* A.Gray), native to Mexico and south-western U.S.A. The Olmecs and Aztecs extracted the latex to make rubber, and small scale plantations have been established to produce rubber from the plant commercially. The latex produces isoprene polymers virtually indistinguishable from that of the Rubber tree (*Hevea*), but lacking the proteinaceous compounds that can cause allergenic reactions in *Hevea* rubber. It also has the advantage of being a dryland species requiring little or no supplementary water. Yields, however, are submarginal for commercial purposes. *Taraxacum koksaghyz* Rodin was trialled in Western Australia and Tasmania for rubber production during World War 2.

Dyes

Safflower (*Carthamus tinctorius* L.) yields a red dye, still used in India in some ceremonies and as a colorant for food stuffs and rouge, although it has largely been supplanted by aniline

dyes. Marigold (*Tagetes* sp.) heads are used in India as a dye, and in Mexico they are fed to chickens to improve egg yolk coloration.

Ornamental plants

Exotic daisy species are commonly grown in Australia as ornamental species. *Chrysanthemum indicum* L. and its hybrids have been grown in China for over 2000 years, and it was adopted as the crest of the royal family in Japan. Other commonly cultivated exotics are *Ageratum houstonianum* Mill., *Aster* spp., *Cosmos* spp., *Bellis perennis* L., *Calendula* spp., *Cineraria* spp., *Dahlia* spp., *Gaillardia pulchella* Foug., *Gerbera* spp., *Helianthus* spp., *Tagetes* spp. and *Zinnia* spp. Many of these have escaped from cultivation in Australia, some becoming troublesome (*Ageratum*), others only minor weeds.

In the last 50 years an increasing number of Australian native Asteraceae have entered cultivation as ornamentals. Perhaps the best-known are those of the old 'Helichrysum' and 'Helipterum' groups of the 'paper daisies', now found as species or hybrids of *Chrysocephalum*, *Coronidium*, *Leucochrysum*, *Hyalosperma*, *Rhodanthe* and *Xerochrysum* and other segregate genera. Others are grown to a lesser extent, including *Ammobium alatum* R.Br., *Angianthus* spp., *Brachyscome* spp., *Calomeria amaranthoides* Vent., *Cassinia* spp., *Craspedia* spp., *Leptorhynchus* spp., *Olearia* spp. (particularly *O. phlogopappa* (Labill.) DC. and its allies), and *Ozothamnus* spp.

Weeds

Many Asteraceae listed above as useful plants in commerce have also escaped from cultivation to become minor or major weeds of agriculture, horticulture, of amenity areas or the natural environment. Others have been introduced as seed contaminants or as hitchhikers on clothes or goods. The number of species involved is too large to list all of them here individually. In the descriptive text, introduced species are marked with an asterisk, and those that are particularly troublesome are usually identified in notes. Just a few notable weeds are discussed below. Many are listed as noxious in various States and Territories.

Capeweed (*Arctotheca calendula* (L.) Levyns) is widespread in temperate Australia, particularly in waste ground, footpaths, and playing fields in suburban areas. It can become abundant in pastures, and impart a taint to milk.

Cultivars of *Bellis perennis* L. are grown as an ornamental bedding plant, but its wild form is a common weed of wasteland, grassland, and particularly suburban lawns and street verges. Its rosettes of leaves are closely ground-hugging and escape mowing, and it thrives in damp, intermittently waterlogged lawns and waste ground.

Spiny thistles of the genera *Carduus*, *Silybum*, *Picnoman*, *Cirsium*, *Cynara*, *Onopordum*, *Carthamus*, *Centaurea*, and their allies in tribe Cardueae, are widespread weeds of temperate and dryland habitats, invading grassland, roadsides and open woodland, and degrading pastures. They range from freely seeding annuals to perennial herbs, sometimes rhizomatous. Many are declared noxious weeds.

A common roadside weed is the subglabrous perennial Ox-eye daisy, *Leucanthemum vulgare* Lam. It grows up to 1 m tall, and is found commonly on roadsides in higher rainfall areas of the southern States. Around the margins of lakes and on boggy riverbanks, the introduced *Cotula coronopifolia* L. is frequently common, crowding out smaller plants with its fleshy stems and yellow buttonheaded capitula. The Fleabanes, *Conyza bonariensis* (L.) Cronquist, *C. canadensis* (L.) Cronquist and their relatives, are common in suburban wasteground.

The yellow-flowered Ragwort (*Senecio jacobaea* L.) is one of several herbaceous senecioid weeds found extensively in the southern States. It is particularly invasive of grassland, pastures and woodland, producing prodigious amounts of seed, and has a perennial rootstock from which annual stems to 1.5 m tall are produced. It is poisonous to stock, and a listed noxious weed throughout its range.

Common Sow thistle (*Sonchus oleraceus* L.) and its congeners are familiar to suburban gardeners, and are widespread in cultivated ground and waste ground, in relatively damp temperate regions. Dandelion (*Taraxacum officinale* L. s. lat., see this volume), a group of apomictic microspecies, frequently accompanies Sow thistles. The weedy dandelions should not be confused with a number of native taxa – see this volume for descriptions and keys.

Noogoora burr (*Xanthium occidentale* Bertol.) and Bathurst burr (*X. spinosum* L.) are two troublesome weeds, particularly of agricultural and grazing areas, where their hooked burrs become entangled in wool and animal hair, causing degradation of animal health and value of fleeces. They are particularly common around stock watering points, in stockyards, and in overgrazed paddocks. The taxonomy of *Xanthium* spp. is complex, but is discussed in some detail in this volume.

The shrubby Boneseed (*Chrysanthemoides monilifera* (L.) T.Norl.) is widely adventive in coastal SE Australia and inland in sandy areas of western Victoria. It was originally introduced as a garden plant, but from the 1940s to the 1970s it was planted to stabilise sand drift in coastal and some inland areas. Its fleshy pericarps are attractive to birds, and its spread by seed and by layering of buried stems has led to *Chrysanthemoides* becoming a serious pest, particularly in coastal dune communities, where it smothers other vegetation (Weiss *et al.* 1998; Richardson *et al.* 2006).

One of the most serious weeds of cereal crops in southern Australia is Skeleton weed (*Chondrilla juncea* L.), a parthenogenetic, perennial triploid species, with a rosette of leaves and a characteristic leafless branched inflorescence to a metre tall. Accidentally introduced to Australia before 1918, it has spread throughout the cereal growing areas of SE Australia (with minor infestations in Tasmania and Western Australia subject to eradication programs), and has at times become so prolific as to prevent harvesting of crops. It spreads by seed, adventitious budding from the crown, and vegetative reproduction from root fragments produced by cultivation. It is a proclaimed noxious weed in all States and Territories except the Northern Territory (Panetta & Dodd 1995).

Well known to any Australian who has walked barefoot on lawns is *Soliva sessilis* Ruiz & Pav. and its allies, known as Bindyi, Jo-jo or Onehunga. They are low, mat-forming, inconspicuous herbs with greenish heads, and achenes with terminal sharp spines, native to South America, but introduced in all Australian States and Territories except the Northern Territory. They are common in lawns and damp grasslands, and on roadsides (Hussey *et al.* 2007).

Poisonous plants

A number of introduced and native Asteraceae have been noted, with varying degrees of reliability, as poisonous, usually to stock, rarely to humans. In some cases, poison status has been attributed on the basis that a particular plant is common in an area where poisoning has occurred, but without much other evidence (see, for example *Apowollastonia cylindrica* Orchard, this volume). In other cases poison plants are also unpalatable, so poisoning only occurs when stock lack alternative food, or when the poison plant is a contaminant of hay (for example, *Senecio jacobaea*). Some plants are also only poisonous at some stages of their lifecycle or at particular times of the year (e.g. *Arctotheca calendula*).

Everist (1981) listed 32 species of poisonous Asteraceae for Australia, in the genera *Acanthospermum*, *Arctotheca*, *Baccharis*, *Carduus*, *Centaurea*, *Craspedia*, *Eupatorium*, *Helenium*, *Helichrysum* (now *Argentipallium*), *Inula*, *Ixiolaena*, *Lactuca*, *Osteospermum* (now *Dimorphotheca*), *Senecio*, *Verbesina*, *Wedelia* (now *Apowollastonia* and *Acunniana*) and *Xanthium*. Everist documented for each species the conditions of poisoning, toxicity and symptoms, and treatments. For details, see his work. Occasionally other plants, particularly native species, have been noted anecdotally as poison plants. Where documented, this is mentioned in the notes accompanying the text.

References

- Adanson, M. (1763), *Familles des Plantes*. Vincent: Paris.
- Bentham, G. (1866), *Flora Australiensis*, vol. 3, Myrtaceae to Compositae. Lovell Reeve & Co: London.
- Bentham, G. (1873a), Notes on the classification, history and geographical distribution of Compositae, *J. Linn. Soc., Botany* 13: 335–577.
- Bentham, G. (1873b), Compositae, pp. 163–533, in G.Bentham & J.D.Hooker, *Genera Plantarum* vol. 2(1). Lovell Reeve & Co: London.
- Bremer, K. (1994), *Asteraceae, Cladistics & Classification*. Timber Press; Portland, Oregon.
- Calabria, L.M., Emerenciano, V.P., Scotti, M.T. & Mabry, T.J. (2009), Secondary chemistry of Compositae, pp. 73–88, in V.A.Funk, A.Susanna, T.F.Stuessy & R.J.Bayer (eds), *Systematics, Evolution, and Biogeography of Compositae*. International Association for Plant Taxonomy: Vienna.
- Caligari, P.D.S. & Hind, D.J.N. (1996), *Compositae: Biology and Utilisation, Proceedings of the International Compositae Conference, Kew, 1994*, vol. 2. Royal Botanic Gardens: Kew.
- Candolle, A.P. de (1836), *Prodromus Systematis Naturalis Regni Vegetabilis*, vol. 5. Treuttel & Würtz: Paris.
- Cassini, H. (1819), Sixième mémoire sur la famille des Synanthérées, contenant les caractères des tribus, *J. Phys. Chim. Hist. Nat. Arts* 88: 150–163.
- Everist, S.L. (1981), *Poisonous Plants of Australia*, rev. edn. Angus & Robertson: Sydney.
- Francis, C.M. & Campbell, M.C. (2003), *New high quality oil seed crops for temperate and tropical Australia*. RIRDC Publication No. 03/045. RIRDC: Canberra.
- Funk, V.A., Susanna, A., Stuessy, T.F. & Bayer, R.J. (eds), (2009a), *Systematics, Evolution, and Biogeography of Compositae*. International Association for Plant Taxonomy: Vienna.
- Funk, V.A., Susanna, A., Stuessy, T.F. & Robinson, H. (2009b), Classification of Compositae, pp. 171–189, in V.A.Funk, A.Susanna, T.F.Stuessy & R.J.Bayer (eds), *Systematics, Evolution, and Biogeography of Compositae*. International Association for Plant Taxonomy: Vienna.
- Giseke, P.D. (1792), *Praelectiones in Ordines Naturales Plantarum*. Hoffmann: Hamburg.
- Heywood, V.H. (2009), The recent history of Compositae systematics: from daisies to deep achenes, sister groups and metatrees, pp. 39–44, in V.A.Funk, A.Susanna, T.F.Stuessy & R.J.Bayer (eds), *Systematics, Evolution, and Biogeography of Compositae*. International Association for Plant Taxonomy: Vienna.
- Hind, D.J.N. & Beentje, H.J. (eds) (1995), *Compositae: Systematics, Proceedings of the International Compositae Conference, Kew, 1994*, vol. 1. Royal Botanic Gardens: Kew.
- Hoffmann, O. (1890–1894), Compositae, pp. 87–387, in A.Engler & K.Prantl (eds), *Die natürlichen Pflanzenfamilien*, vol. 4(5). W.Engelmann: Leipzig.
- Hussey, B.M.J., Keighery, G.J., Dodd, J., Lloyd, S.G. & Cousens, R.D. (2007), *Western Weeds. A Guide to the Weeds of Western Australia*, 2nd edn. The Weeds Society of Western Australia: Victoria Park, W.A.
- Jeffrey, C. (2007), Compositae, Introduction with key to tribes, pp. 61–87, in K.Kubitski (Gen. ed.), *The Families and Genera of Vascular Plants, vol. VIII Flowering Plants Eudicots Asterales* (J.W.Kadereit & C.Jeffrey, vol. eds). Springer-Verlag: Berlin, Heidelberg.
- Kadereit, J.W. (2007), Asterales: Introduction and conspectus, pp. 1–6, in K.Kubitski (Gen. ed.), *The Families and Genera of Vascular Plants, vol. VIII Flowering Plants Eudicots Asterales* (J.W.Kadereit & C.Jeffrey, vol. eds). Springer-Verlag: Berlin, Heidelberg.

- Kadereit, J.W. & Jeffrey, C. (eds) (2007), *Vol. VIII Flowering Plants Eudicots Asterales*, in K.Kubitski, (gen. ed.), *The Families and Genera of Vascular Plants*. Springer-Verlag: Berlin, Heidelberg.
- King, R.M. & Dawson, H. (1975), *Cassini on Compositae*. Oriole Editions: New York.
- King, R.M., Janaske, P.C. & Lellinger, D.B. (1995a), *Cassini on Compositae, II*. Monographs in Systematic Botany from the Missouri Botanical Garden 54, Missouri Botanical Garden: St. Louis.
- King, R.M., Janaske, P.C. & Lellinger, D.B. (1995b), *Cassini on Compositae, III*. Monographs in Systematic Botany from the Missouri Botanical Garden 55, Missouri Botanical Garden: St. Louis.
- Lessing, C.F. (1832), *Synopsis generum Compositarum, earumque dispositionis novae tentamen monographus multarum capensium interjectis*. Duncker & Humblot: Berlin.
- Low, T. (1991), *Wild Herbs of Australia and New Zealand*. Angus & Robertson: Sydney.
- Lundberg, J. (2009), Asteraceae and relationships within Asterales, pp. 157–169, in V.A.Funk, A.Susanna, T.F.Stuessy & R.J.Bayer (eds), *Systematics, Evolution, and Biogeography of Compositae*. International Association for Plant Taxonomy: Vienna.
- Maiden, J.H. (1889), *The Useful Native Plants of Australia (including Tasmania)*. Technological Museum of N.S.W.: Sydney.
- Martynov, I.I. (1820), *Tekhno-Botanicheskii Slovat*. Rossilska Akademia: St. Petersburg.
- Mauricio Bonifacino, J., Robinson, H., Funk, V.A., Lack, H.W., Wagenitz, G., Feuillet, C. & Hind, D.J.N. (2009), A history of research in Compositae: early beginnings to the Reading Meeting (1975), pp. 3–38, in V.A.Funk, A.Susanna, T.F.Stuessy & R.J.Bayer (eds), *Systematics, Evolution, and Biogeography of Compositae*. International Association for Plant Taxonomy: Vienna.
- Panero, J.L. & Funk, V.A. (2002), Toward a phylogenetic subfamilial classification for the Compositae (Asteraceae), *Proc. Biol. Soc. Washington* 115: 909–922.
- Panetta, F.D. & Dodd, J. (1995), *Chondrilla juncea* L., pp. 67–86, in R.H.Groves, R.C.H.Shepherd & R.G.Richardson (eds), *The Biology of Australian Weeds*, vol. 1. R.G. & F.J.Richardson: Melbourne.
- Richardson, F.J., Richardson, R.G. & Shepherd, R.C.H. (2006), *Weeds of the South-East, an Identification Guide for Australia*, 2nd edn. R.G. & F.J.Richardson: Meredith, Victoria.
- Simpson, B.B. (2009), Economic importance of Compositae, pp. 45–58, in V.A.Funk, A.Susanna, T.F.Stuessy & R.J.Bayer (eds), *Systematics, Evolution, and Biogeography of Compositae*. International Association for Plant Taxonomy: Vienna.
- Tournefort, J.P. de (1700), *Institutiones Rei Herbariae*. Typographia Regia: Paris.
- Vaillant, S. (1719–1723), Établissement de nouveaux caractères de trois familles ou classes de plantes à fleurs composées; savoir, des Cynarocéphales, des Corymbifères, et des Cichoracées. *Mém. Acad. Roy. Sci. (Paris 4°)* 1718: 143–191, t. 5, 6 (1719); 1719: 277–318, t. 20 (1721); 1720: 277–339, t. 9 (1722); 1721: 174–224, t. 7, 8 (1723).
- Weiss, P.W., Adair, R.J. & Edwards, P.B. (1998), *Chrysanthemoides monilifera* (L.) T.Norl., pp. 49–61, in F.D.Panetta, R.H.Groves & R.C.H.Shepherd (eds), *The Biology of Australian Weeds*, vol. 2. R.G.Richardson & F.J.Richardson: Melbourne.