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# Flora of South Australia

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## CANNABACEAE<sup>1</sup>

C.J. Brodie<sup>2</sup>, J. Kellermann<sup>2</sup> & P.J. Lang<sup>2</sup>

Trees, herbs or lianes, dioecious, rarely monoecious; leaves alternate or opposite, entire to palmately divided, with glandular hairs, cystoliths present; stipulate. **Inflorescence** in compact or lax axillary clusters and panicles; flowers actinomorphic, normally small, imperfect (unisexual), rarely bisexual; male flowers in axillary clusters or cymose panicles, sepals 5, imbricate, petals absent, stamens 4–5, opposite sepals; female flowers axillary, sessile, with membranous bracts, entire calyx fused, closely enveloping the ovary, ovary superior, 1-celled, with 2 centrally attached styles, 1 pendulous ovule. **Fruit** an achene enclosed in the persistent calyx, or a drupe; seed with oily endosperm.

Traditionally Cannabaceae contained only *Humulus* and *Cannabis* (Pearce 1989). In recent phylogenetic analyses these two genera were nested within a group containing Ulmaceae subfam. Celtoideae. Consequently, Ulmaceae has been re-circumscribed by APGIII (2009) and now comprises only the former subfam. Ulmoideae (7 genera). The newly circumscribed family Cannabaceae consists of *Humulus*, *Cannabis* and subfam. Celtoideae (8 genera). Three of the genera transferred from Ulmaceae to Cannabaceae occur in Australia: *Aphananthe* Planch., *Celtis* and *Trema* Lour. The native Australian taxa *Aphananthe* and *Trema* do not occur in S.A., but the introduced taxa *Celtis australis* from Europe, Asia and Africa and *Celtis occidentalis* from North America are both recorded as questionably naturalised here.

Reference: Pearce (1989), Stevens (2001–).

- 1. Tree with woody trunk; stems and twigs hard (woody); all leaves simple; leaf hairs simple; fruit a fleshy drupe..... 2. **Celtis**
- 1: Herb or climber, if woody then only at the base; stems and twigs soft (herbaceous); at least some leaves lobed or palmate; leaf hairs various; fruit a dry achene
  - 2. Stems twining; leaves 3–5 (–7) lobed, occasionally some simple; 2-branched hairs on stems, petioles and main leaf veins; achene surface smooth ..... 3. **Humulus**
  - 2: Stems erect; leaves palmate; 2-branched hairs absent; achene surface rugose ..... 1. **Cannabis**

### 1. CANNABIS L.

*Sp. Pl.* 2: 1027 (1753).

(*Kannabis*, the Greek name for hemp.)

Erect annual herbs, dioecious, rarely monoecious; mostly branching, stems furrowed; leaves basally opposite, then alternate, compound, palmately divided; hairs simple. **Male** inflorescence axillary or terminal, of loose small to medium compound cymes or panicles; female inflorescence axillary, resembling a spike, ± dense. **Fruit** an achene, solitary, ovoid.

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One species, although some authors recognise up to three species with additional subspecies. Native to Asia, now with a worldwide distribution due to its use by humans.

Reference: Clarke & Merlin (2013), UNDOC (2009).

1. \***Cannabis sativa** L., *Sp. Pl.* 2: 1027 (1753). — **Illustr.**: *Pl. W. N.S.W.* 209 (1982).

Annual herb, wind-pollinated, (0.2–) 1–3 (–6) m high, usually dioecious, single-stemmed, more or less branched, emitting a characteristic odour, stems angled, grooved, densely pubescent with antrorse hairs; stipules paired, linear 3–4 mm long; petiole 2–5 (–7) cm long; leaves palmately compound with (3–) 5–7 (–11) leaflets, c. 5–13 (–15) × 0.5–2 (–2.5) cm, leaflets narrowly lanceolate, central leaflet largest, decreasing in size to the outermost leaflets, which are normally 3–4 times smaller, base of leaflets cuneate, margin coarsely serrate with appressed hairs, teeth prominent, 4–8 mm long, apex narrowly acuminate, mid-rib prominent with pinnate veins ± to apex of teeth; ± sessile resinous glandular hairs scattered throughout, especially on abaxial surface, adaxial surface dark green with antrorse cystolithic hairs, abaxial surface with thin simple hairs. **Male** inflorescence of many constricted to elongated compound cymes or panicles, terminating stems or axillary in upper leaf axils on main stem, bracts present, pedicels 2–4 mm long, hairy; flowers 5-merous, ± pendulous, cup-shaped, sepals free, c. 3–3.5 × 1–1.5 mm, hairy to ± glabrous; petals absent; filaments to 0.5 mm long, anthers c. 3 mm long, just shorter than calyx lobes; female inflorescence constricted to dense, resembling a spike, borne in pairs, in apical leaf axils on main stem and secondary branches; bract and bracteoles present, surrounding female flower, covered in stalked glandular hairs; calyx not obvious, adpressed to base of ovary, later enlarging and surrounding fruit, petals absent; style bifid, c. 10 mm long, hairy, warty. **Fruit** surrounded by persistent light green calyx, pale at base; achene compressed, ovoid, c. 2–5 mm long, light brown to grey-white, glabrous, finely reticulate. (**Indian**) **hemp** (when referring to plants cultivated for fibre and seed); **marijuana, grass, weed** (when referring to the plant grown for the drug). **Pl. 1.**

S.A.: <sup>2c</sup>SL; \*W.A.; \*N.T.; <sup>2c</sup>Qld; \*N.S.W.; \*Vic. Grown (under licence) as a fibre crop (hemp), and illegally as a source of narcotics. Naturalised to some extent in most States, mostly sparingly. Flowers: mainly Nov.–Feb., but also at most other times. Can flower within six weeks of germination.

Some authors split *Cannabis sativa* into several subspecies or species (UNDOC 2009, Clarke & Merlin 2013), and much variation is encountered largely as a result of thousands of years of cultivation and human selection for different desirable characteristics (Zhou & Bartholomew 2003, Brown 2005). In Australia it is treated as a single species (Pearce 1989, CHAH 2015).

There are some herbarium records from near Adelaide, in places where it is unlikely to have been deliberately sown or planted. However, no recent collections have been made in S.A., presumably as it is now excluded from most, if not all, bird seed mixes, the suspected source of sporadic wild plants. Consequently, the species is listed as questionably naturalised.

Cultivated in some parts of the world for the fibres and more widely for the drug. Stems are used a source of hemp-fibre for ropes, textiles and paper, and seeds as bird food and a source of oil. Female flowers have high concentrations of tetrahydrocannabinol (THC), and the plant is used as a narcotic around the world for traditional ceremonies, and as a recreational drug in Western societies, including Australia. Medical use of *Cannabis* is approved in some countries and reported to reduce pain in sufferers of chronic pain, or alleviate symptoms of neurological disorders such as multiple sclerosis (Brown 2005).

## 2. **CELTIS** L.

*Sp. Pl.* 2: 1043 (1753).

(*Celtis*, Latin, name used by Caius Plinius Secundus for lotos, *Ziziphus lotus* (L.) Lam. (Rhamnaceae) and probably wrongly applied to this genus by Linnaeus.)

Deciduous trees (semi-evergreen or evergreen trees to shrubs or vines in warmer or tropical areas), monoecious, sometimes bisexual; leaves simple, toothed to entire, generally oblique, 3-nerved at base. **Inflorescence** a raceme or panicle, axillary on new shoots, appearing with leaves on deciduous species; bracts minute (not seen); flowers pedicellate, small, usually green, calyx 4- or 5-lobed, corolla absent; male flowers with 4–5 stamens, pistolode present; female flowers with ovary 1-locular, sessile, style short or absent, stamens reduced to staminodes or absent. **Fruit** a drupe, ovoid or globose, solitary, partially fleshy, on slender stalk. **Hackberries, nettle-trees.**

A genus of about 60 taxa from tropical to warm-temperate areas. Three species are native in Australia, *Celtis philippensis* Blanco, *C. strychnoides* Planch. (W.A., N.T., Qld) and *C. paniculata* Endl. & Planch. (Qld, N.S.W). Some species can be used for timber. A few taxa, most notably *C. australis* and *C. occidentalis* are used as street trees in temperate areas in Australia.

Reference: Hewson (1989), Spencer (1997), Yeo (2011).

1. Leaves more than 2 times longer than wide, lamina pubescent and pale green below, fruiting pedicel to c. 3 cm long ..... 1. **Celtis australis**
1. Leaves less than 2 times longer than wide, lamina glabrous and green below, hairs on veins only, fruiting pedicels normally < 2 cm long ..... 2. **Celtis occidentalis**

1. \***Celtis australis** L., *Sp. Pl.* 2: 1043 (1753). — *Celtis occidentalis auct. non* L.: *SA Census online* (July 2009). — **Illustr.:** R.D.Spencer, *Hort. Fl. S.E. Austral.* 2: 102 (1997).

Tree to 15 (–20) m, deciduous, widely rounded with dense foliage; bark grey-brown, older trunks fluted to slightly buttressed, twigs mostly drooping, young twigs ± pubescent, new growth ± tomentose; stipules minute, caducous (not seen); petiole to 1–2 cm long, tomentose to pubescent; leaves narrowly lanceolate to ovate-lanceolate, (5–) 7–12 (–13) × 1–5.5 cm, more than twice as long than wide, (seedling leaves normally smaller, 1.8–6 cm long, elongate; vegetative growth normally larger), base somewhat oblique and asymmetrical, resulting in a ± falcate leaf shape, margin serrate or double serrate, mostly to the base or almost so, adaxial surface deep green with few short hairs sometimes giving a rough feel, abaxial surface light green-grey, pubescent on veins and lamina. **Inflorescence** small, 1–3 flowered, in leaf axils; bract minute, caducous (not seen); pedicel 1–2 cm long, pubescent; male flowers c. 3 mm long, mostly glabrous, but densely pubescent basally, where sepals and stamens attach; sepals 2–3 mm long glabrous, stamens 5; female flowers to 7 mm long, sepals 2–3 mm long, glabrous, stigma bifid, to 4 mm, pubescent, ovary glabrous, but densely pubescent basally, where sepals attach; bisexual flowers as female flowers, with 5 stamens. **Fruit** a globular drupe, c. 1 cm diam., glabrous; pedicel to 2–3 (–3.5) cm long, calyx absent; orange when ripe, eventually purple. **European hackberry. Pl. 2A–C.**

S.A.: <sup>2c</sup>SL, <sup>2c</sup>NL; \*N.S.W.; \*Vic. The native range extends from south-eastern to south-western Europe, to north Africa and western Asia (Turkey). It has naturalised in Western Asia, parts of Europe, the U.S.A. (California) and in temperate Australia. Flowers: spring, when leaves appear. Fruits: Feb.–Apr.

Widely cultivated as a street tree in Adelaide, as it matures to an ideal compact size and provides dense shade in summer. Many seedlings germinate in gardens, parks, roadsides, verges and wasteland. Occasionally found in areas of natural vegetation with parent trees in the vicinity.

2. \***Celtis occidentalis** L., *Sp. Pl.* 2: 1044 (1753). — **Illustr.:** R.D.Spencer, *Hort. Fl. S.E. Austral.* 2: 102 (1997).

Tree to c. 20 m, deciduous, bark grey-brown, developing flanges when older; young twigs sparsely pubescent; stipules minute, caducous (not seen); petiole 0.5–2 cm long, pubescent, becoming less so when older; leaves ovate, (4–) 6–13 × (2.5–) 4–5 cm, less than twice as long than wide, base obviously oblique, margin serrate to c. half to two thirds to leaf base, occasionally more, adaxial surface green, normally glabrous and smooth to touch, abaxial surface light green, glabrous with some hairs on major veins, and in tufts in main vein axils. **Inflorescence** mostly 3-flowered on new growth and along new stems; single-flowered in leaf axils; pedicel 0.4–1 cm long; male flowers on new growth and along new stem, glabrous, c. 2 mm long, densely pubescent at base where sepals attach; sepals 2–3 mm long, glabrous; stamens 5; female flowers solitary in leaf axil, to 6 mm long, sepals 2–3 mm long, glabrous, stigma bifid, to 3 mm, pubescent, ovary mostly glabrous, but densely pubescent at base where sepals attach; bisexual flowers as female flowers, with 5 stamens. **Fruit** a globular drupe, c. 0.6–0.9 cm diam., glabrous; pedicel c. 1–2 cm long, calyx absent, dark orange to purple- or blue-black when ripe. **American hackberry. Pl. 2D–G.**

S.A.: <sup>2c</sup>SL, <sup>2c</sup>SE; \*N.S.W.; \*Vic. Native to North America, naturalised in Australia. In S.A., sparingly naturalised in Belair N.P. and near Myora Forest in the SE region. Flowers: in spring when leaves appear. Fruits: in autumn (Feb.–Mar.), retaining at least some fruit throughout winter, sometimes until Sep.

Superficially similar to *C. australis*.

Cultivated in temperate areas of the world and used sparingly as a street tree in Adelaide.

### 3. HUMULUS L.

*Sp. Pl.* 2: 1028 (1753).

(Origin unclear, possibly from the Latinised form of old German word *humela*, hops, or from the Latin word *humus*, ground, because the plants often grow along the ground if not supported.)

Twining perennial or annual vine, petioles sometimes twining, dioecious; stems, branchlets and petioles with rigid 2-branched hairs; leaves opposite, simple or lobed. **Male** inflorescence in loose cyme or panicle; female inflorescence cone-like at maturity (infructescence), in short bracteate spikes, the conspicuous bracts each with one or two flowers.

**Fruit** an achene, covered by bracts. **Hop.**

Three species native to the northern hemisphere.

Reference: Spencer (1997).

#### 1. \**Humulus lupulus* L., *Sp. Pl.* 2: 1028 (1753).

Perennial rhizomatous twining herbaceous vine, dioecious,  $\pm$  scabrid, single-stemmed or branched, emitting a characteristic odour; stems 6–10 m long, 6-angled; stems, petioles and major veins on abaxial leaf surface armed with small 2-branched, short-stalked, stout hairs; stipules present, with 2 linear-lanceolate lobes, glabrous, 0.6–1.6 mm long; petiole 2–12 (–17) cm long, as long or shorter than the leaf blade; leaves opposite, simple, cordate to usually deeply palmately 3–5 (–7) lobed, broadly ovate in outline, 5–17  $\times$  5–20 cm, base cordate to auriculate, margins serrate, teeth to c. 4–10 mm wide, acute and normally minutely aristate, apex and lobe apices acuminate, adaxial surface with stout retrorse hairs, minor veins on abaxial surface with stiff simple hairs. **Male** inflorescence (not seen in S.A. material) a much-branched cymose panicle; flowers pedicellate, sepals c. 2 mm long, filaments 0.4–0.5 mm long, hair-thin, anthers c. 2 mm long; female inflorescence a cone-like spike, borne singly or forming panicles in leaf axils or at apex of lateral branches, flowers on rachis in bracts, (1–) 2 flowers per bract, stigmas 2 per flower; inflorescence enlarging into a cone-like infructescence, to 20–25  $\times$  30–40 mm, conspicuous bracts enlarging to c. 8–10  $\times$  15–20 mm in fertilized flowers, infructescences covered with numerous glands, unfertilized infructescence also enlarging, but smaller than fertilized infructescences and not producing fruits. **Fruit** an achene, enclosed in a bracteole within a bract, achene c. 6 mm long. **Hop. Pl. 2H–J, 3.**

S.A.: \*SL; \*W.A.; \*Qld; \*N.S.W.; \*Tas. Native to Europe, Asia and North America. Flowers: in S.A. recorded in Feb.

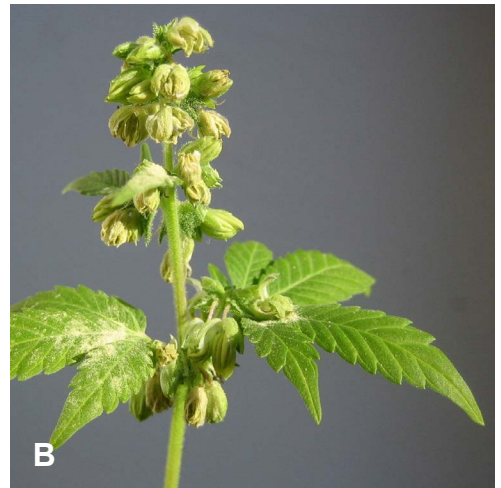
There are 3–4 varieties recognised in Europe, which occupy different geographical regions. The S.A. material is most likely the European variety *H. lupulus* var. *lupulus*. It appears to be sparingly established at two localities in the Adelaide Hills, where plants are known to have persisted for 23 and 28 years. No longer found at Waterfall Gully, following creekline restoration.

*Humulus lupulus* has been transported around the world and is widely cultivated as the female infructescence (hops) contains lupulin and is used as bittering agent and preservative in the brewing of beer. Many different cultivars have been developed around the world with the majority coming from Europe and North America, and have also been bred in Australia to suit local conditions. Plants and their parts can differ in size and the amount of lupulin produced. The brewing industry in Australia uses hops, and plantations are found in Tas. and southern Vic. where climate and day length are most suitable. No major commercial plantations are currently known in S.A., although historical plantations from the 19th century are documented.

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*Cannabis sativa* (A, B, C, D, E & F)



**Pl. 1.** **A**, inflorescence and flower from male plant 'A', and female plant 'B' with flower and fruit below. **B**, male inflorescence. **C**, hemp stalk with sheathing bast fibres pulled apart. **D**, hemp plant in fibre crop, France. **E**, female inflorescence showing whitish glandular hairs. **F**, seeds (graduations 1 mm). Illustration: A, Otto Wilhelm Thomé, *Flora von Deutschland, Österreich und der Schweiz* 1885, Gera, Germany. Photos: B & F, Erik Fenderson; C, Natrij; D, C.J. Brodie; E, from: Bokské, CC BY-SA 3.0.



*Celtis australis* (A, B & C)

*C. occidentalis* (D, E, F & G)



*Humulus lupulus* (H, I & J)

Pl. 2. **A-F**, cult., Myrtlebank, Adelaide, SL. **G**, P.J. Lang 2831, self-seeded trees, Belair NP, SL. **H-J**, C.J. Brodie 6833, Woodhouse, Adelaide Hills, SL. Photos: A-G, P.J. Lang, DEWNR; H-J, C.J. Brodie, DEWNR.





*Humulus lupulus* (A, B, C & D)

**Pl. 3.** **A**, inflorescences from male plant 'A' and female plant 'B'; infructescences 'C', and details of flowers and seed. **B**, young vines regenerating from rhizomes after slashing, C.J.Brodie 6833, Woodhouse, Adelaide Hills, SL. **C**, infructescence, in cultivated crop, Hallertau, Germany. **D**, female inflorescence. *Illustration: A, Otto Wilhelm Thomé, Flora von Deutschland, Österreich und der Schweiz 1885, Gera, Germany. Photos: B, C.J. Brodie DEWNR; C, Lucky Starr, CC BY-SA 3.0; D, Bernd Haynold, CC BY-SA 2.5.*

