Honey sources satellites: Drought-tolerant and salt-tolerant honey sources

SOURCE: IBRA
[with P. Walker]

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HONEY SOURCES SATELLITE 6.

DROUGHT-TOLERANT AND SALT-TOLERANT HONEY SOURCES

by Eva Crane and Penelope Walker

London 1986

International Bee Research Association
The "Directory of important world honey sources" by Eva Crane, Penelope Walker and Rosemary Day was published by the International Bee Research Association in 1984, with financial support from the International Development Research Centre, Ottawa. This Directory, and the database from which it was produced, contain much concentrated information which will be of value to certain specialists. IBRA is therefore publishing a series of Honey Sources Satellites on topics of special interest, giving information extracted from the database.

Satellites 1 and 2 are relevant to the whole database. Satellite 1 will be especially useful to readers using Satellites 3-6 who do not have access to the 1984 Directory, and Satellite 2 also to botanists and others concerned with the plant origins of honeys.

Titles of the Honey Sources Satellites are:

1. Bibliography (with author reference codes); country codes; other abbreviations
2. Plants listed alphabetically and by family; common name index; pollen grain information
3. Chemical composition of some honeys
4. Physical properties, flavour and aroma of some honeys
5. Honeydew sources and their honeys

Eva Crane
Woodside House
Gerrards Cross
SL9 9TE, UK
1. INTRODUCTION

In view of the lively and increasing interest in plants that can produce a useful crop in dry areas or on saline soils, Satellite 6 is devoted to honey sources in the 1984 Directory that are drought- or salt-tolerant. Of the 98 plants covered, 77 are drought-tolerant, 37 are salt-tolerant, and 16 tolerate both drought and salt.

Sections 2 and 3 give separate lists of honey sources in the Directory that were reported in at least one region to be drought-tolerant or salt-tolerant, respectively, and Section 4 gives the complete printout of information from the Directory, for each of the plants. For the convenience of users, aspects of the printouts that may not be self-evident are explained in Section 5.

While IBRA was preparing the 1984 Directory, Dr G. E. Wickens at the Royal Botanic Gardens, Kew, was setting up the SEPASAT database (Survey of Economic Plants for Arid and Semi-Arid Tropics). Mutual co-operation between the two organizations led to useful additions to both databases.

In 1984 Eva Crane read a paper "Bees and honey in the exploitation of arid land resources" at an international meeting (KICEPAL) at Kew, which was published as pages 163-175 in "Plants for arid lands" edited by G.E. Wickens, J.R. Goodin and D.V. Field (London, George Allen & Unwin, 1985).
2. LIST OF IMPORTANT HONEY SOURCES RECORDED AS DROUGHT-TOLERANT

Plants marked * are reported to be very drought-tolerant.

001 Acacia berlandieri Benth.; Leguminosae
002* Acacia caffra (Thunb.) Willd.; Leguminosae
004 Acacia greggii A. Grey; Leguminosae
005 Acacia mellifera (Vahl) Benth.; Leguminosae
008* Acacia senegal (L.) Willd.; Leguminosae
009 Acacia seyal Del.; Leguminosae
010 Acacia tortilis (Forssk.) Hayne; Leguminosae
022 Agave americana L.; Agavaceae
024 Aloe dichotoma Masson; Liliaceae
026 Aloysia gratissima (Gill. & Hook.) Troncoso; Verbenaceae
030 Anacardium occidentale L.; Anacardiaceae
039 Azadirachta indica A. Juss.; Meliaceae
066 Caesalpinia coriaria (Jacq.) Willd.; Leguminosae
067 Cajanus cajan (L.) Millsp.; Leguminosae
070 Calliandra calothyrsus Meissn.; Leguminosae
076* Carnegiea gigantea (Engelm.) Britton & Rose; Cactaceae
078 Cassia siamea Lam.; Leguminosae
084 Centaurea solstitialis L.; Compositae
085 Cercidium floridum Benth.; Leguminosae
086 Cicer arietinum L.; Leguminosae
093 Citrus limon (L.) Burm. f.; Rutaceae
106 Combretum celastroides Laws.; Combretaceae
122 Dalbergia sissoo DC.; Leguminosae
126 Dialium engleranum Henriques; Leguminosae
139 Echium lycopsis L.; Boraginaceae
149 Eriobotrya japonica (Thunb.) Lindl.; Rosaceae
153 Eucalyptus aniceps (Maiden) Blakely; Myrtaceae
154 Eucalyptus caleyi Maiden; Myrtaceae
156 Eucalyptus camaldulensis Dehn.; Myrtaceae
158 Eucalyptus cladocalyx F. Muell.; Myrtaceae
160 Eucalyptus crebra F. Muell.; Myrtaceae
167 Eucalyptus gomphocephala DC.; Myrtaceae
168 Eucalyptus gracilis F. Muell.; Myrtaceae
170 Eucalyptus incrassata Labill.; Myrtaceae
172 Eucalyptus leucoxylon F. Muell.; Myrtaceae
176* Eucalyptus melliodora A. Cunn. ex Schauer; Myrtaceae
178* Eucalyptus oleosa F. Muell. ex Miq.; Myrtaceae
180 Eucalyptus paniculata Smith; Myrtaceae
181 Eucalyptus platypus Hook.; Myrtaceae
182 Eucalyptus polyanthemos Schauer; Myrtaceae
185 Eucalyptus rubida Deane & Maiden; Myrtaceae
187 Eucalyptus sideroxylon A. Cunn. ex Woolls; Myrtaceae
191 Eucalyptus wandoo Blakely; Myrtaceae
205 Gleditsia triacanthos L.; Leguminosae
207 Glycine max (L.) Merr.; Leguminosae
208 Gmelina arborea Roxb.; Verbenaceae
217 Gymnopodium antigonoides (Robinson) Blake; Polygonaceae
220 Hedysarum coronarium L.; Leguminosae
221 Helianthus annuus L.; Compositae
237 Ipomoea batatas (L.) Lam.; Convolvulaceae
244 Jacquemontia nodiflora G. Don; Convolvulaceae
246 Julbernardia paniculata (Benth.) Troupin; Leguminosae
272 Lotus corniculatus L.; Leguminosae
280 Mahonia trifoliata (Moric.) Fedde; Berberidaceae
290 Medicago sativa L.; Leguminosae
296 Melilotus alba Desr.; Leguminosae
297 Melilotus officinalis (L.) Pall.; Leguminosae
313 Olea africana Mill.; Oleaceae
314 Onobrychis viciifolia Scop.; Leguminosae
315 Opuntia engelmanii Salm-Dyck; Cactaceae
317 Paliurus spina-christi Mill.; Rhamnaceae
319 Parkinsonia aculeata L.; Leguminosae
330 Pithecellobium dulce (Roxb.) Benth.; Leguminosae
335 Pongamia pinnata (L.) Pierre; Leguminosae
336* Prosopis cineraria (L.) Druce; Leguminosae
338* Prosopis glandulosa Torrey; Leguminosae
339* Prosopis juliflora (Sw.) DC.; Leguminosae
340* Prosopis pallida (Humboldt & Bonpl. ex Willd.) Kunth; Leguminosae
349 Rhigozum trichotomum Burch.; Bignoniaceae
354 Robinia pseudoacacia L.; Leguminosae
397 Tamarindus indica L.; Leguminosae
405 Thymus capitatus (L.) Hoffm. & Link; Labiatae
426 Trifolium alexandrinum L.; Leguminosae
441 Viguiera helianthoides Kunth; Compositae
448* Ziziphus mauritania Lam.; Rhamnaceae
450 Ziziphus nummularia (Burm. f.) Wight & Arn.; Rhamnaceae
452* Ziziphus spina-christi (L.) Desf.; Rhamnaceae
3. LIST OF IMPORTANT HONEY SOURCES RECORDED AS SALT-TOLERANT

This list includes plants reported to show any degree of salt-tolerance.

003 Acacia decurrens (Wendl.) Willd.; Leguminosae
019 Aegiceras corniculatum (L.) Blanco; Myrsinaceae
022 Agave americana L.; Agavaceae
037 Avicennia germinans (L.) L.; Avicenniaceae
038 Avicennia marina (Forssk.) Vierh. var. resinifera (Forst.) Bakh.; Avicenniaceae
063 Bucida buceras L.; Combretaceae
067 Cajanus cajan (L.) Millsp.; Leguminosae
071 Callistemon citrinus (Curt) Skeels; Myrtaceae
101 Coccoloba uvifera L.; Polygonaceae
104 Cocos nucifera L.; Palmae
122 Dalbergia sissoo DC.; Leguminosae
156 Eucalyptus camaldulensis Dehn.; Myrtaceae
159 Eucalyptus cornuta Labill.; Myrtaceae
167 Eucalyptus gomphocephala DC.; Myrtaceae
180 Eucalyptus paniculata Smith; Myrtaceae
184 Eucalyptus robusta Smith; Myrtaceae
205 Gleditsia triacanthos L.; Leguminosae
221 Helianthus annuus L.; Compositae
272 Lotus corniculatus L.; Leguminosae
291 Melaleuca leucadendron (L.) L.; Myrtaceae
297 Melilotus officinalis (L.) Pall.; Leguminosae
298 Metrosideros excelsa Sol. ex Gaertn.; Myrtaceae
319 Parkinsonia aculeata L.; Leguminosae
330 Pithecellobium dulce (Roxb.) Benth.; Leguminosae
335 Pongamia pinnata (L.) Pierre; Leguminosae
336 Prosopis cineraria (L.) Druce; Leguminosae
337 Prosopis farcta (Sol. ex Russell) J.F. Macbride; Leguminosae
340 Prosopis pallida (Humboldt & Bonpl. ex Willd.) Kunth; Leguminosae
350 Rhizophora mangle L.; Rhizophoraceae
361 Sabal palmetto (Walt.) Lodd. ex Schultes; Palmae
377 Scaevola frutescens (Mill.) Krause; Goodeniaceae
379 Schinus terebinthifolius Raddi; Anacardiaceae
382 Serenoa repens (Bartr.) Small; Palmae
422 Tournefortia argentea L.f.; Boraginaceae
426 Trifolium alexandrinum L.; Leguminosae
427 Trifolium fragiferum L.; Leguminosae
438 Vicia faba L.; Leguminosae
4. PRINTOUTS FOR HONEY SOURCES RECORDED AS DROUGHT-TOLERANT AND/OR SALT-TOLERANT

001 Acacia berlandieri Benth.; Leguminosae

DROUGHT

guajilla, huajilla (Es/MEX); guajillo, huajillo (USA)
Shrub, 1-4 m, spiny; fls white

Distribution subtropical N and C America; native to southern USA and north MEX. Habitat desert plant growing with Prosopis and Cactus spp (USA, Pel/76; Usa/79); forms impenetrable thickets in semi-arid steppes of north MEX (Ord/83)

Soil some moisture needed. Rainfall drought tolerant (Pel/76; Usa/79)

Economic and other uses
Yields gum (Usa/79)

Nectar rating; blooms, nectar flow
N1 USA/TEX (Lov/56; Pel/76)
N2 MEX (Ord/72)

Blooms iii-v (MEX, Ord/83); ii-iv (USA/TX). Nectar flow - rain during flowering stops flow (Lov/56; Pel/76)

Honey flow
Honey yield [medium] 27.0 kg/colony/season (Lov/56)

Honey: physical and other properties

Pfund white (Lov/56; Pel/76); almost water white (Ord/83)
Flavour and aroma mild (Dou/79; Lov/56; Pel/76)

002 Acacia caffra (Thunb.) Willd.; Leguminosae

DROUGHT

common hook-thorn (En/SOU); gewone haakdoring (Af)
Shrub/tree, <12 m, one of the least prickly acacias; fls creamy-white

Distribution tropical and subtropical Africa. Habitat veld (BOT, Cra/73); woodland, wooded grassland, and by rivers and streams (Pag/77); coastal scrub

Temperature frost resistant (Pag/77). Rainfall v drought tolerant (Pag/77)

Economic and other uses
Fodder - lvs, pods; ?toxic (Pag/77). Fuel. Timber. Other uses medicinal
Warning
Lvs and pods ?toxic to animals (Pag/77)

Nectar rating + honeybee species; blooms, nectar flow
N1 BOT[tm](Cra/73)
N WRA[tm](Bau/66)
Blooms ix-xi (southern Africa, Pag/77)

Pollen
P RWA

Honey no data

003 Acacia decurrens (Wendl.) Willd.; Leguminosae  
black wattle; acácia-da-Australia, acácia negra (Pt/BRA)
Tree, <12 m, evergreen; fls yellow, slightly fragrant; similar
to and often confused with Acacia mearnsii De Wild.
Distribution tropical and subtropical Africa, Oceania, S America;
 native to Australia. Habitat naturalized in parts of southern
Africa
Soil wide range, but growth indifferent on poor soil (AUS/NSW,
And/56); salt tolerant (Kwe/78)

Economic and other uses
Fuel. Land use windbreak, shade, amenity. Soil benefit
stabilization. Other uses tannin

Nectar rating + honeybee species; blooms, nectar flow; composition
N1 RWA[tm](Bau/66)
Blooms iv-ix (BRA, Caa/72); ix-x (BRA/RG, Jul/72). Nectar sugar
concentration [medium] 23% (Jul/72)

Honey no data

004 Acacia greggii A. Grey; Leguminosae  
catsclaw, devil's claws, paradise flower (En/USA); uña de gato
(Es/MEX)
Tree/shrub, <5 m, spiny; fls pale yellow
Distribution subtropical N and C America; native to USA.
Habitat desert of USA/AZ (Pel/76); desert/dry steppes of north
MEX (Ord/72); torrent beds and along small streams
Soil poor dry soil preferred (Ord/83). Rainfall drought tolerant
Nectar rating; blooms, nectar flow; composition

N1 USA/AZ, TX (Pel/76)
N2 MEX (Ord/72; Ord/83); USA/NM (Pel/76)
N USA/AZ (Mof/81); USA/UT (Van/49)

Blooms iii-v and again in summer (USA, Lov/56; Pel/76). Nectar flow heaviest in dry season after rainy autumn/winter (Ord/83); fails in extreme heat (Pel/76). Potassium content and fluorescence (AA491/80)

Honey flow
Honey yield (kg/colony/season) [high] 72 (USA, Lov/56); [moderate] 10 (USA/TX, Pel/76)

Pollen
P1 USA/UT

Honey: chemical composition
Water [low] 14-17% (Lov/59d)

Honey: physical properties
Pfund white or extra light amber (Lov/59d); light amber (Ord/83)

005 Acacia mellifera (Vahl) Benth.; Leguminosae

blackthorn, hook-thorn (En/SOU); swarthook (Af)
Shrub/tree, 5-8 m, v spiny; fls cream/white; nectary in fl, also ?extrafloral nectaries on fl buds

Distribution tropical Africa; native to Africa. Habitat dry bushveld (Joh/73); colonizes overgrazed areas (NAM, Cla/73); on dunes in Kalahari desert (NAM, Joh/73)

Temperature -7 to 38° (BOT/Kalahari, Cla/73). Rainfall drought tolerant

Economic and other uses

Warning
Spreads rapidly by seed/vegetatively, forming spiny impenetrable thickets (Pag/77; Usa/79)

Nectar rating + honeybee species; blooms, nectar flow
N1 BOT [tm] (Cra/73)
N2 NAM [tm] (Joh/73); SOU, tm (And/73; Joh/73)

Blooms ix (NAM), viii-x (SOU). Nectar flow 2-3 wks (SOU); rain in ii-iv ensures good flow the following spring (NAM); bees forage late morning to mid afternoon when hot and dry (BOT, Cla/73)
Honey: physical properties

Colour water coloured (And/73)
Granulation slow

008 Acacia senegal (L.) Willd.; Leguminosae
syn Acacia verek Guill. & Perr.

gum acacia, gum arabic tree; gommier (Fr/SEN)
Tree/shrub, 5-15 m, spiny; fls whitish spikes
Distribution tropical and subtropical Africa and Asia; native to
Africa and Asia. Habitat arid areas; survives hot dry winds and
sandstorms; altitudes 100-1700m in E Africa
Soil poor; rocky sand/clay; no waterlogging; pH 5-8 (Usa/80).
Temperature -4 to 48°C (INI, Usa/80); frost tolerant. Rainfall
200-800 mm, 300-450 mm optimum; max dry period 8-11 mths (Nap/-
83); drought tolerant (Usa/80)

Economic and other uses
hedges, shade. Soil benefit N-fixation, erosion control, reclama-
tion of refractory sites. Other uses yields gum arabic; rope
from root fibres; medicinal; tannin

Warning
Forms spiny thickets, can become a pest. Noxious weed in AUS and
SOU (Usa/80). Susceptible to browse damage

Nectar rating + honeybee species
NI SEN, tm(Dou/70)

Pollen
Pollen grain illustrated and described (Smt/56a)

Honey: physical and other properties
Pfund amber (Dou/70)
Granulation rapid
Aroma v mild

009 Acacia seyal Del.; Leguminosae
mimosa épineux, (Fr/SEN)
Tree/shrub, <12 m, spiny, deciduous; fls yellow, fragrant
Distribution tropical Asia, Africa; subtropical Africa; native
to Africa, W Asia. **Habitat** drier woodland and grassland savanna; may occur on river banks (Usa/80)

**Soil** wide range, even heavy clay (Usa/79); free lime ?not tolerated (Hor/81); inundation tolerated better than by other acacias (Usa/80). **Rainfall >350 mm; drought tolerant (Usa/80)**

### Economic and other uses

**Fodder** - lvs, pods, fls (Usa/80). **Fuel. Timber.** **Land use shade.** **Other uses** yields gum arabic

### Nectar rating + honeybee species

N1 SEN[tm](Dou/70; Ndi/74)

### Pollen

Pollen grain illustrated and described (Smt/56a)

### Honey: physical and other properties

Pfund white (Dou/70)

Aroma v mild

---

010 **Acacia tortillls (Forssk.) Hayne; Leguminosae**

umbrella thorn (En/SOU); haak-en-steek (Af); mos'arwa, musa (BOT); semra (OMA)

Tree, 5-20 m, thorny; fls white/cream/pale yellow, fragrant

**Distribution** tropical Africa, Asia. **Habitat** low altitude dry areas in variety of woodland (Pag/77); veld (BOT, Cra/73)

**Soil** sandy loam, dunes and rocky soil if well drained; alkaline soil preferred (Usa/80). **Temperature <50°; hardy (Pag/77); protect young plants from frost (Usa/80). Rainfall 100-1000 mm with 10-12 mths dry period (Nap/83); drought resistant (Pag/77; Usa/80)

### Economic and other uses

**Fodder** - lvs and pods (Pag/77); but ?toxic to animals (Usa/79).

**Fuel. Timber.** **Land use** windbreak, shade, afforesting dry rocky areas, amenity. **Soil benefit** sand stabilization, N-fixation

### Warning

?Toxic to animals (Usa/79). Thorny, can become a nuisance in humid/sub-humid areas; lateral roots cause difficulties in shallow soil (Usa/79)

### Nectar rating + honeybee species; blooms, nectar flow

N1 BOT[tm](Cra/73); OMA,[af+am?](Dut/79); OMA[af+am?](Fil/80)

N2 YEA,am(Fie/80)

N OMA, af(Dut/77)

**Blooms** xi-i (SOU, Pag/77); iv-vi (OMA)
Honey flow
Honey yield [moderate] 2-3 kg/colony/season (af, Dut/79)

Pollen
Pollen grain illustrated and described (Smt/56a)

Honey no data

019 Aegiceras corniculatum (L.) Blanco; Myrsinaceae
river mangrove, small black mangrove (En/AUS)
Shrub/tree; fls pure white, fragrant
Distribution tropical Asia, Oceania. Habitat landward side of mangrove swamps and up rivers to tidal limits (AUS/QD, Bla/72); tidal swampy forest (INI/WBE, Chk/72)
Soil mangrove swamps; salt tolerant

Economic and other uses
Sticks used in oyster culture

Nectar rating + honeybee species; blooms, nectar flow
N1 AUS/QD(Bla/72)
N INI/WBE,ad(Chk/72)
Blooms x-xi (AUS/QD); iii-iv (INI/WBE)

Honey flow
Honey yield [high] 54 kg/colony/season (AUS/QD, Bla/72)

Pollen
P1 AUS/QD. Pollen value [high]. Colour greyish (Bla/72).
Pollen grain described (Ert/69)

Honey: physical and other properties
Pfund extra white (Bla/72)
Granulation rapid in cool weather
Flavour distinctive

022 Agave americana L.; Agavaceae
American agave; American aloe (En/SOU); century plant, mescal (En/USA); maguey (Es/HOD); agave (It)
Herb, 1-2 m, spiny, rosette of tough rigid lvs; fls yellowish-green, many on 8-9 m stalk of plants of approx 10 yrs; plant dies after flowering
**Distribution** subtropical N America, tropical and subtropical C America, (Med) Europe; native to MEX. **Habitat** arid and semi-arid areas of W hemisphere; when cultivated for ornament full sun is required.

**Soil** limestone; ?salt tolerant. **Rainfall** drought tolerant but irrigation improves growth.

**Economic and other uses**

**Food** - sap fermented in MEX to produce alcoholic drinks. **Land use** hedges, amenity. **Other uses** fibres from lvs

**Alert to beekeepers**

Bees "cross" on this flow (USA, Pel/76)

**Nectar rating + honeybee species; blooms, nectar flow**

<table>
<thead>
<tr>
<th>N1</th>
<th>USA/Arizona (Pel/76)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N3</td>
<td>ITA (Ric/78); SOU, tm (And/73); USA/Arizona (Lov/56)</td>
</tr>
<tr>
<td>N</td>
<td>HOD (Ord/63)</td>
</tr>
</tbody>
</table>

**Blooms** xi-iii (SOU); vi-viii in Med area. **Alert to beekeepers** bees "cross" on this flow (USA, Pel/76)

**Honey flow**

**Honey yield** [high] 41 kg/colony/season (MEX, Pel/76)

**Pollen**

P3 SOU. **Chemical analysis** (Sta/74). **Pollen grain** illustrated and described (Heu/71); extremely under-represented because of large grain size (Ric/78). **Reference slide**

**Honey: physical and other properties**

**Colour** dark (And/73; Lov/56); v dark (Pel/76)

**Flavour** strong, "poor" (Lov/56). **Aroma** of sour grain mash (Lov/57a)

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**024 Aloe dichotoma Masson; Liliaceae**

**DROUGHT**

quiver tree (En/SOU); keetmanshoop, kokerboom (Af)

Tree/shrub, 3-5 m, exceptionally 7 m

**Distribution** subtropical and tropical Africa; native to Africa.

**Habitat** dry desert and semi-desert areas, on and among rocky hills (Pag/77)

**Soil** not too damp (Pag/77). **Temperature** not cold areas (Pag/77).

**Rainfall** drought tolerant

**Nectar rating + honeybee species; blooms, nectar flow**

| N1  | SOU, tm (Joh/73) |

**Nectar flow** abundant after good rainy season (Joh/73)
Pollen
P NAM

Honey no data

026 Aloysia gratissima (Gill. & Hook.) Troncoso;
Verbenaceae
syn Aloysia ligustrina Small

beebrush, whitebrush (En/USA); huele de noche, jozmín cillo, vera dulce (Es/MEX)
Shrub; fls white
Distribution subtropical N America. Habitat semi-desert
Rainfall drought tolerant but plant dies back during dry spell

Economic and other uses
Land use hedges, amenity

Nectar rating; blooms, nectar flow
N1 USA/TX(Lov/56)
N2 MEX(Ord/83)
Blooms vi-xii. Nectar flow heaviest following rain (USA/TX, Lov/56d)

Honey flow
Honey yield [moderate] 2-3 kg/colony/season (MEX, Ord/83)

Honey: chemical composition
Water [low] can be 12-13% in dry deserts (Lov/56d)

Honey: physical and other properties
Pfund white (Lov/56)
Viscosity "heavy body"
Granulation rapid (Lov/56d)
Flavour mild (Lov/56). Aroma delicate

030 Anacardium occidentale L.; Anacardiaceae
DROUGHT

cashew nut; marañón (Es/COL); jambu mété, monyet (In)
Tree, <10 m, evergreen, straggly; fls pink, may be striped yellow, small, fragrant
Distribution tropical and subtropical regions; native to BRA.
Habitat low country, altitudes <1200 m
Soil wide range including sandy soil, eroded or other poor sites; not low waterlogged sites or rock. Rainfall 500-700 mm; drought tolerant
### Economic and other uses

**Food** - roasted nuts.  **Fuel.**  **Timber.**  **Soil benefit** cover and conservation.  **Other uses** ink from bark; insect-repellent oil from nut shell; liquid in husk for insulating medium; tannin

### Warning

Husk toxic to man

### Nectar rating + honeybee species; blooms, nectar flow

<table>
<thead>
<tr>
<th>Rating</th>
<th>Species</th>
<th>Blooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>COL(Cor/76); GUY(tm)(Cra/73); INI/KER(ac)(Dev/71; Hol/65)</td>
<td>ii-iii, also v-vi (tropical America, Ord/83)</td>
</tr>
<tr>
<td>N2</td>
<td>INO(ac)(Bee/77)</td>
<td></td>
</tr>
</tbody>
</table>

### Pollen

P3 INO.  **Pollen grain** illustrated and described (Smt/56a).

### Reference slide

**Honey** no data

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**037 Avicennia germinans (L.) L.; Avicenniaceae**  
**SALT**  
syn Avicennia nitida Jacq.

- black mangrove; blacktree, blackwood (En/USA); mangrove (Fr/MAT); mangle (Es/HOD, NIA); mangle prieto (Es/CUB, DOR, MEX); courida (Es/GUY)
- Tree/shrub, <18 m, evergreen; fls whitish, small

**Distribution** tropical Africa, S and C America, Caribbean; subtropical N America.  **Habitat** low marshy sea coasts of USA/FL, Gulf coast to TX and tropical America; often forms thick groves around bays and river mouths (Ord/83)

**Soil** salt tolerant (Pel/76).  **Temperature** plant damaged or killed by frost (USA, Lov/62d; Pel/76)

### Economic and other uses

**Fuel.**  **Timber**

**Nectar rating + honeybee species; blooms, nectar flow; composition**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Species</th>
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</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>CUB(Ord/44); DOR(Ord/64); GUY(Bee/76; Cra/73; Cra/79); HOD(Ord/63); MEX(Ord/72); NIA(Ord/63a); SUR(Bee/76); SEN(tm)(Dou/70)</td>
<td>vi-vii.  <strong>Nectar flow</strong> 6-8 weeks USA/FL; trees can become salt-coated in dry weather, which discourages bees; v sensitive to weather (Pel/76)</td>
</tr>
<tr>
<td>N2</td>
<td>CUB(Ord/83); USA/FL,TX(Mor/56)</td>
<td></td>
</tr>
<tr>
<td>N3</td>
<td>USA/FL,TX(Pel/76)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>GUS(tm)(Sve/80); MAT(Bal/76); SUR(Cra/79); TRI(Lau/76)</td>
<td></td>
</tr>
</tbody>
</table>

**Sugar analysis** (Vah/72)
Honey flow
Honey yield [high] mean 23-27, max 90 kg/colony/season (USA/FL, Lov/62d)

Pollen
P DOR. Reference slide

Honey: chemical composition
Water [high] 24% (Lov/58a)
Glucose [high] (Lov/61)
Fermentation on storage likely (Cra/75)

Honey: physical and other properties
Colour light (Cra/75; Pel/76); dark but light if not unifloral (Mot/64); usually dark but light in Cuba (Ord/83). Pfund white to light amber (Lov/56); water white or extra light amber (Lov/62d)
Viscosity "thin bodied" (Lov/56)
Granulation rapid (Mot/64; Ord/83); fine grain (Lov/61)
Flavour mild (Cra/75; Pel/76); slightly salty or brackish (Lov/56; Mot/64); can be sweet (Lov/61). Aroma sometimes "swampy" (Lov/61)

038 Avicennia marina (Forssk.) Vierh. var. resinifera) SALT (Forst.) Bakh.; Avicenniaceae
grey mangrove, white mangrove
Tree/shrub, <12 m, peg-like root branches project above mud; fls deep yellow/orange
Distribution tropical, subtropical Oceania. Habitat coastal; muddy estuaries/backwaters/banks of tidal streams (AUS/QD, Bla/72)
Soil mud/silt; salt tolerant

Economic and other uses
Food - fruit can be eaten. Fodder lvs palatable to stock. Timber

Nectar rating; blooms, nectar flow
N1 AUS/SA(Boo/72)
N3 AUS/QD(Bla/72)
Blooms ii (Aus/QD, Bla/72)

Honey flow
Honey yield [moderate] max 18 kg/colony/season (AUS/QD, Bla/72); good every 2 yrs (AUS/SOU, Boo/72)

Pollen
P2 AUS/QD. P3 AUS/SA. Yield low to moderate (Boo/79). Pollen value good (Boo/79)
Honey: physical and other properties

Pfund extra light amber to light amber (Bla/72; Boo/72); light amber (Wal/78)

Viscosity "light bodied" (Wal/78)

Granulation slow (Bla/72); soft grain (Wal/78)

Flavour strong

039 Azadirachta indica A. Juss.; Meliaceae

nim

Tree, <11 m, evergreen except in extreme drought; fls white, fragrant

Distribution subtropical and tropical Africa, Asia. Habitat dry areas

Soil dry stony, clay, shallow or nutrient-deficient soils; optimum pH 6.2; not laterite outcrops; not on waterlogged/saline soil (Usa/80). Temperature range 0° (occasional) to 44° (shade); seedlings killed by frost (Usa/80). Rainfall 130-1150 mm, >450 mm preferred; drought tolerant

Economic and other uses


Timber termite resistant. Land use windbreak, shade, afforestation, amenity. Soil benefit lvs for mulch; reclamation of arid waste land. Other uses medicinal; insecticide; oil for lamps/lubrication/soap; gas generation (Usa/80)

Warning

Tree may be "aggressively" invasive (Usa/80)

Nectar rating + honeybee species; blooms, nectar flow

N1 INI/UTT,ac(Kap/57; Koh/58)
N2 INI/MAH[ac](Chu/80)
N INI/TAM[ac](Ram/37)

Blooms iii-iv (INI/UTT); iii-v (W Africa, Pam/77)

Pollen

P3 INI/MAH. Pollen grain illustrated and described (Nak/65)

Recommended for planting to increase honey production

INI/MAH (Sub/62). Propagate by fresh seed (Usa/80); seed production starts at 5 yrs; grows rapidly. See Warning

Honey: chemical composition

Water [high] 22.88% (Sig/62)
Sucrose [high] ?7.46%
Ash [low] 0.06%
Free acid [medium] 20.8 meq/kg
**Honey: physical and other properties**

**Colour** light golden (Koh/58)

**Viscosity** "thin"

**Flavour** slightly bitter

---

**063 Bucida buceras L.; Combretaceae**

júcaro negro (Es/CUB); guaragauao (Es/DOR); cacho de toro (Es/HOD); pucté (Es/MEX)

Tree; fls white, small

**Distribution** subtropical N America, tropical C America and Caribbean. **Habitat** shores/marshes/river mouths

**Economic and other uses**

**Timber** hard, resistant. **Land use** amenity

**Nectar rating; blooms, nectar flow**

N1 BEL(Mul/79)

N3 DOR(Ord/64)

N CUB(Ord/83); DOR(Ord/83); HOD(Ord/63); MEX(Ord/83)

**Blooms** i-iv (tropical America, Ord/83). **Nectar flow** cannot be relied on every yr (Ord/83)

**Pollen**

P DOR

**Honey** no data

---

**066 Caesalpinia coriaria (Jacq.) Willd.; Leguminosae**

dividivi (Es); guatapana (Es/DOR)

Tree, small to medium size, deciduous; fls yellow/whitish

**Distribution** tropical S America, C America, Caribbean; subtropical C America. **Habitat** deciduous forest (Ord/83)

**Soil** dry preferred (Ord/83). **Rainfall** drought tolerant (Ord/83)

**Economic and other uses**

**Timber. Other uses** - tannin from pods

**Nectar rating; blooms, nectar flow**

N1 DOR(Ord/66; Ord/72)

N2 DOR(Ord/64; Ord/83)

**Blooms** ix-ii (C America, Ord/83)
Honey flow
Honey yield "much dividivi honey in hives in October" (Caribbean area, Ord/83)

Pollen
P DOR

Honey: physical properties
Pfund light amber (Ord/83)

067 Cajanus cajan (L.) Millsp.; Leguminosae

pigeon pea, red gram; feijão boere (Pt MOZ); cajan, arthar (INI)
Shrub, <3 m, annual/biennial/perennial; fls yellow spotted red
Distribution tropical Oceania, Africa, Asia, Caribbean, S America, C America; subtropical Africa, Asia; native to NE Africa and Asia. Habitat cultivated crop plant; wide range from arid to humid areas; grows well on "difficult" sites; some cvs do not crop in shade or salt spray; some cvs for altitudes >3000 m
Soil infertile/arid; light sand or deep loam preferred; water-logging not tolerated; some cvs salt tolerant. Temperature mean <35°, optimum 18-29°; killed by frost. Rainfall 400-2500 mm with 5-6 mths max dry period; drought tolerant; not suited to wetter areas of tropics

Economic and other uses
Food - pods; seeds for dhal (INI). Fodder - pods/husks/lvs for cattle; lvs for silkworms/lac insects. Fuel. Land use hedges, windbreaks, temporary shade. Soil benefit erosion control; N-fixation. Other uses gunpowder from charcoal; thatching; basketry; gum

Nectar rating + honeybee species; blooms, nectar flow
NI INI/BIH,ac(Nai/76); MOZ,tm(Cra/73)
N TRI(Lau/76)
Blooms xii (INI/BIH); winter (tropical America, Ord/83)

Pollen
Pollen grain illustrated and described (Sao/61)

Honey: physical and other properties
Colour distinctive greenish hue in the comb (Lau/76)
070 Calliandra calothyrsus Meissn.; Leguminosae

red calliandra
Shrub, 5-10 m; fls red

Distribution tropical C America, Asia; native to C America.
Habitat humid/sub-humid zones; altitudes 150-1500 m
Soil wide range; good tolerance to flooding. Rainfall 1000-2000 m with 3-4 mths max dry period

Economic and other uses
Fodder lvs. Fuel "excellent fast-growing source" (USA/80).
Land use hedges, afforestation, amenity, firebreak, weed suppression. Soil benefit erosion control; N-fixation; organic manure; mulch

Warning
?Invasive, spreads rapidly by seed (USA/80)

Nectar rating + honeybee species; blooms, nectar flow
N1 INO/JAV, ac(PEU/80)
Blooms all yr (INO/JAV)

Honey flow
Honey yield [moderate] 1.3 kg/colony/mth (INO/JAV, PEU/80)

Pollen
Pl INO/JAV

Recommended for planting to increase honey production
INO/JAV, PEU/80. Propagate by seed/large cuttings; grows rapidly, 2.5-3.5 m in 6-9 mths (USA/80). See Warning

Honey: physical and other properties
Flavour bitter-sweet (USA/80)

071 Callistemon citrinus (Curt) Skeels; Myrtaceae

crimson bottle brush (En/AUS)
Shrub/tree, 4-9 m; fl stamens bright red, resembling a bottle-brush
Distribution temperate and subtropical Oceania; native to Australia
Soil damp soil; also poor dry soil; some salt tolerance

Economic and other uses
Land use amenity
Nectar rating + honeybee species; blooms, nectar flow

N1 PAK, ac(Pak/77)
N2 AUS/VIC(Gom/73)
Blooms xi-xii (AUS/VIC)

Pollen
P2 AUS/VIC. P PAK

Honey no data

076 Carnegiea gigantea (Engelm.) Britton & Rose; Cactaceae  DROUGHT

pitahaya, saguaro (Es/MEX)
Shrub (columnar cactus), post-like, 6-18 m high, <0.6 m diameter; fls white, open at night and lasting into the day
Distribution subtropical N America, C America; native to N America and C America. Habitat desert zones in Sonora (MEX), adjacent areas of USA
Rainfall very drought tolerant

Economic and other uses
Food - fruit; seeds; alcoholic drink from fruits. Land use amenity check carefully

Nectar rating; blooms, nectar flow; composition
N1 MEX(Ord/83)
N2 MEX(Ord/72)
Blooms iv-vi (MEX). Nectar secretion 5 ml or more/fl (Mcg/59).
Sugar concentration [medium] 25% (Mcg/59). Juice from ripe fruit also collected and stored by bees, resulting in red patches in combs (Ord/83).

Pollen
P1 USA/AZ. Yield 12 or more bee loads/fl (Mcg/59). Pollen value good (Mcg/59). Colour of load cream (Mcg/59)

Honey: physical properties
Viscosity "very thick" (Ord/83)

078 Cassia siamea Lam.; Leguminosae  DROUGHT

yellow cassia; casia de Siam (Es/VEN)
Tree, 15-20 m, evergreen; fls yellow
Distribution tropical Asia, Caribbean, C America, Africa; subtropical N America; native to SE Asia from INO to SRI. Habitat wide
range from arid to humid areas; plantations, river banks, irrigated land, etc; lowlands <1200 m

**Soil** deep, relatively rich soil preferred; laterite and limestone tolerated; poor tolerance to waterlogging. **Temperature** tropical heat tolerated; frost not tolerated. **Rainfall** monsoon areas preferred; in dry areas, roots need access to deep soil moisture; 500-1000 mm/yr with max dry period 4-5 mths

**Economic and other uses**

**Fodder** for cattle/sheep; seeds/pods/lvs highly toxic to pigs (Usa/80). **Fuel. Timber. Land use** windbreak, afforestation, amenity. **Soil benefit** soil conservation; organic manure.

**Other uses** host plant for sandalwood (Santalum album)

**Warning**

Wood may contain irritant yellow powder (Usa/80). Seeds/pods/lvs highly toxic to pigs (Usa/80)

**Nectar rating; blooms, nectar flow**

N1 VEN(Cra/73; Ste/71)

**Blooms** vi-x (VEN)

**Pollen**

**Pollen grain** illustrated and described (Smt/54a)

**Honey** no data

084 *Centaurea solstitialis* L.; Compositae

**DROUGHT**

cockspur, St Barnaby's thistle, yellow Jack (En/AUS); Barnaby's thistle, star-thistle, yellow star thistle (En/USA)

Herb, 30-100 cm, annual/biennial; fls pale yellow

**Distribution** temperate Europe, Oceania; subtropical N America; native to Europe. **Habitat** cultivated or waste ground; troublesome weed in grain fields USA/CA

**Soil** dry. **Temperature** - plant cut back by frost. **Rainfall** drought tolerant (Pel/76)

**Economic and other uses**

**Food** - as vegetable. **Fodder** - hay, which needs moistening before use. **Other uses** medicinal

**Warning**

Troublesome weed in grain fields (USA/CA)
Nectar rating; blooms, nectar flow; composition

**N1** USA/CA (Jay/54; Pel/76; Van/41)

**N2** ARG (Kat/68); AUS/NSW (Goo/47); USA/CA (Lov/56)

**N3** AUS/VIC (Gom/73)

**Blooms** late spring to summer (AUS/NSW); vi-ix (EUR, Maz/82); vii-frost (USA/CA). **Nectar flow** stops in drought but restarts after rain (Pel/76). **Nectar secretion** 0.123 mg/fl/day (Sim/80); slow but continuous (Pel/76). **Sugar concentration** [medium] 51.2% (Sim/80); 38% (Van/41). **Sugar value** (mg/fl/day) [medium] 0.107 (Sim/75); 0.164 (Sim/80)

Honey flow

**Honey yield** [moderate] <27 kg/colony/season (USA/CA, Van/41)

Pollen

**P1** AUS/VIC; USA/CA. **P2** AUS/NSW. **Pollen value** important source in Sacramento Valley (USA/CA) vii-x, pollen produced throughout the day (Van/41). **Chemical composition** (Maz/82; Shp/80).

**Colour** yellow (Van/41); dull purple (Wal/78). **Reference slide**

Honey: physical and other properties

**Colour** greenish (Lov/56; Van/41); greenish with yellow tinge like olive oil (Pel/76). **Pfund** white or extra light amber (Lov/56; Van/41); white (Pel/76; Wal/78)

**Viscosity** "heavy body" (Pel/76)

**Granulation** rapid (Van/41); v fine grained (Goo/47)

**Flavour** v sweet, almost cloying (Pel/76); delicate (Wal/78)

085 **Cercidium floridum** Benth.; Leguminosae

*syn* Cercidium torreyanum (S. Wats.) Sarg.

green bark acacia (En/USA); palo brea, palo verde (Es/MEX); palo verde (USA)

Tree, <9 m, deciduous, lvs borne for short period only, bright green bark (Pel/76); fls yellow

**Distribution** subtropical N America, C America. **Habitat** desert areas of USA/CA, AZ and MEX

**Rainfall** drought tolerant (Pel/76)

Economic and other uses

**Fuel.** **Land use** shade

Nectar rating; blooms, nectar flow

**N1** MEX (Ord/83)

**N2** MEX (Ord/72); USA/AZ (Lov/56; Pel/76)

**Blooms** spring (tropical America, Ord/83). **Nectar flow** more reliable on low ground with higher soil moisture (Pel/76)
Honey flow
Honey yield [moderate] 9-13 kg/colony/season (USA, Lov/56)

Pollen
P MEX

Honey: physical and other properties
Colour light yellow (Pel/76). Pfund light amber (Ord/83)
Viscosity "good body" (Pel/76)
Flavour distinctive, like bark of this tree (Ord/83; Pel/76)

086 Cicer arietinum L.; Leguminosae
chick pea, Bengal gram, gram; harbara (INI)
Herb, 50-60 cm, annual, shrubby
Distribution temperate (Med) Europe; tropical Asia, Africa, C America, S America; native to W Asia. Habitat cultivated crop plant especially in dry regions; basins/river banks (SUD)
Soil heavy but not waterlogged. Temperature moderate. Rainfall needs little rain and is not much affected by drought (Why/53); sometimes grown under irrigation

Economic and other uses
Food - pods, young shoots, seeds used in dahl (INI). Fodder - hay. Soil benefit soil renovation, green manure. Other uses - liquid from glandular hairs (94% malic acid, 6% oxalic acid) used medicinally and as vinegar (Pus/68)

Nectar rating + honeybee species; blooms, nectar flow
N1 INI/UTT(Cht/69)
N3 INI/MAH[ac](Chu/80)
Blooms xii-i (INI/UTT). Nectar flow not reliable (Sig/62)

Honey flow
Honey yield [moderate] 2.0-2.5 kg/colony/season, migration to crop recommended (INI/UTT, Cht/69)

Pollen
P3 INI/MAH. Reference slide

Honey no data

093 Citrus limon (L.) Burm. f.; Rutaceae
lemon; limón (Es/VEN); citronnier (Fr)
Tree, 3-6 m, evergreen, stout stiff thorns; fls white, petals pinkish outside, v fragrant
**Distribution** temperate (Med) Europe, Oceania; tropical Africa; subtropical Asia, Africa, N America; native to Asia. **Habitat** cultivated crop plant; open forests in high rainfall areas (ZIM, Wil/72); semi-arid areas. **Temperature** mild/warm; tree damaged by frost.

**Economic and other uses**

**Food** - fruit; flavourings, juice, essential oil, liqueurs. **Land use** hedges. **Other uses** as rootstock for grafting other Citrus spp; oil for perfumery, cosmetics.

**Nectar rating + honeybee species; blooms, nectar flow; composition**

| N1 | ISR(Chi/65); Moa/55; PAK,ac(Pak/77); VEN(Cra/73) |
| N2 | AUS/VIC(Gom/73); USA/CA(Pel/76) |
| N3 | USA(Ord/83) |

**Blooms** viii–ix (BRA/SC, SP, Caa/72); ii–iii (PAK); ii–iv (VEN, Ske/71). **Nectar secretion** considered to be the lowest of Citrus spp; trees near coast of USA secreted more than those inland (Ord/83). **Sugar concentration** [medium] 24.9–28.7% (Fah/49); also [low] 15–18% (Frj/70); nectar from honey sacs of bees: 63.0% in dry area, 28.2% in humid area (Mof/74).

**Honey flow**

**Honey yield** (kg/colony/season) [high or moderate] 30–60 or 15–20, mixed with other Citrus spp (ISR, Chi/65).

**Pollen**

| P2 | AUS/VIC. P PAK. |

**Chemical analysis** (Gil/80)

**Honey: physical and other properties**

**Colour** clear (Erb/83). **Pfund** light amber (Ord/83).

**Flavour** delicate, "aromatic" (Erb/83); strong, sour (Ord/83).

**Aroma** delicate, "aromatic" (Erb/83); characteristic, and like the plant (Ord/83).

**101 Coccoloba uvifera L.; Polygonaceae**

sea grape; seaside plum (En/USA); uva caleta, uvero (Es/CUB); uva de mar (Es/DOR); uvero de playa (Es/DOR, NIA); uva (Es/HOD). Shrub/tree, evergreen; fls greenish yellow, small. **Distribution** subtropical N America, tropical C America, Caribbean, S America. **Habitat** coastal regions; also inland CUB but trees much smaller and more crooked; sandy slopes behind coastal vegetation (USA). **Soil** sandy; salt tolerant.

**Economic and other uses**

**Food** - fruit for jelly.
Nectar rating; blooms, nectar flow

| N1   | CHG/Diego Garcia (Sil/69); MEX (Brs/82); OMA (Bea/79); TAN/ZAN (tm) (Cra/73) |
| N2   | DOR (Ord/64); Ord/83); JAM (Ord/83); PUE (Phl/14); USA/FL (Ord/83) |
| N3   | SRI,ac (Kud/81); USA/FL (Pel/76) |

N2 DOR (Ord/64); HOD (Ord/63); NIA (Ord/63a)

N3 USA/FL (Lov/56; Pel/76)

Blooms all yr (tropical America, Pel/76); iv-v and again later (CUB). Nectar flow prolonged but less intense than Avicennia germinans (Ord/44); wind can cause first fls to fall (Ord/83).

Nectar secretion copious until well past noon, often till 17.00 h

Honey: chemical composition

Water high (Mot/64)

Honey: physical and other properties

Pfund amber (Lov/56; Pel/76); v light amber (Mot/64); light amber (Ord/83)

Flavour spicy (Mot/64); sharp (Ord/83)

104 Cocos nucifera L.; Palmae

coconut, coconut palm; cocotero (Es/DOR); cocotier (Fr); coqueiro (Pt/ MOZ); thengu (INI)

Tree, 30-40 m, evergreen; fls cream, small, monoecious, both male and female fls have nectaries, male fls fragrant

Distribution tropical Asia, Oceania, Africa, C America, Caribbean; subtropical N America; native to ?Indo-Malaysian region.

Habitat cultivated crop plant; irrigated plains, OMA; sea shores, inland lowlands

Soil salty, sandy soil tolerated; must be well drained. Temperature light frost tolerated

Economic and other uses

Food - fruit, shoots, toddy from fermented sap. Fodder - pressed cake. Timber. Land use amenity. Other uses oils/fats from copra; lvs for thatching; fibres for ropes/mats

Alert to beekeepers

Where sap is tapped from unopened inflorescences for toddy-making, many bees drown in the collecting pots (Kan/40)

Nectar rating + honeybee species; blooms, nectar flow; composition

| N1   | CHG/Diego Garcia (Sil/69); MEX (Brs/82); OMA (Bea/79); TAN/ZAN (tm) (Cra/73) |
| N2   | DOR (Ord/64); Ord/83); JAM (Ord/83); PUE (Phl/14); USA/FL (Ord/83) |
| N3   | SRI,ac (Kud/81); USA/FL (Pel/76) |
| N    | BUM (Zma/80); INI/KAR, KER [ac] (Kha/59); MOZ [tm] (Cra/73); SEN [tm] (Dou/70); SEY (Sil/70); THA (Smt/83) |
**Blooms** i-iii (BUM); most of yr (tropical America, Ord/83); peak in early spring (MEX). **Nectar flow** heaviest before rainy season in May (MEX, Brs/82); major source on Samui island (THA, Smt/83); production falls as distance from coast and as altitude increase (Ord/83); unreliable (SEY, Sil/70). **Sugar concentration** [medium] 24% (Zma/80). **Sugar analysis** (Row/76; AA657/70). Bees also forage on young (2.5-cm) coconuts which are coated with nectar for about a week (Mot/64); where sap is tapped from unopened inflorescences for toddy-making, bees collect sap (SRI, Kud/81). **Alert to beekeepers** many bees drown in the collecting pots (Kan/40)

**Honey flow**

**Honey yield** (kg/colony/season) [high] 70-80 (MEX, Brs/82); [moderate] estimated 1-3 (SRI, Kud/81)

**Pollen**

PI DOR; INI/KAR, KER; JAM; OMA; USA/FL. P CHG; SEY; USA/FL. **Yield** 6.1 g/inflorescence (Mcg/76). **Pollen value** "a useful perpetual source" (SEY, Sil/70); major source (Kha/59).

**Colour** white/yellowish-white (Ord/83). **Pollen grain** illustrated (Bls/80)

**Honey: physical and other properties**

**Colour** may be greenish-yellow like motor oil (Mot/64); crystal clear if monofloral (Ord/83). **Pfund** amber, but ?water white if monofloral (Cra/75; Mot/64)

**Granulation** [medium] 3 mths (Mot/64)

106 Combretum celastroides Laws.; Combretaceae

DROUGHT

syn Combretum trothae Engl. & Diets

savanna bushwillow (En/SOU); Jesse-bush combretum (En/ZIM)

Shrub/tree, 4 m, often forms impenetrable thickets, "Jesse bush"; fls greenish to yellow

**Distribution** tropical Africa. **Habitat** deciduous thickets in Itigi and Manyoni areas (TAN, Smi/57); dry woodland on hillsides

**Soil** Kalahari sand; also rocky soil. **Rainfall** drought resistant

**Nectar rating + honeybee species; blooms, nectar flow**

N1 ?KEN,tm(Smt/57); TAN,tm(Smt/57)

Blooms "throughout the season" (TAN). **Nectar flow** xii-iii with peak in ii (TAN)

**Pollen**

**Pollen grain** illustrated and described (Smt/54a)

**Honey: physical and other properties**

**Pfund** extra light to light amber (Smt/57)
**Dalbergia sissoo DC.; Leguminosae**

**sissoo; shisham (INI)**

Tree, 18-21 m, deciduous; fls yellowish, small

**Distribution** tropical, subtropical Asia; native to foothills of Himalayas. **Habitat** tropical highlands; dry savannah woodlands; coastal sand dunes and wasteland; canal banks in plains and lower hills

**Soil** salt tolerant. **Temperature** <0 to 50° (Usa/79). **Rainfall** 700-2000 mm with 3-4 mths drought (Usa/79)

**Economic and other uses**

**Fodder** - young branches/lvs. **Fuel. Timber. Land use** wind-break, shade, afforestation, amenity. **Soil benefit** erosion control

**Warning**

Even light winds blow fls from branches reducing the nectar available in windy seasons/areas (Sig/48)

**Nectar rating + honeybee species; blooms, nectar flow**

<table>
<thead>
<tr>
<th>Country</th>
<th>Code</th>
<th>Species</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>NL INI/HIM</td>
<td>ac</td>
<td>(Rah/41)</td>
<td></td>
</tr>
<tr>
<td>INI/PUN</td>
<td>ac</td>
<td>(Rah/41)</td>
<td></td>
</tr>
<tr>
<td>INI/UTT</td>
<td>ad</td>
<td>(Rae/80)</td>
<td></td>
</tr>
<tr>
<td>PAK</td>
<td>ac, ad</td>
<td>(Pak/77; Shi/77; Shr/48)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>INI/HIM</td>
<td>ac</td>
<td>(Sig/48)</td>
</tr>
</tbody>
</table>

**Blooms** iii–iv (INI); iv–v (PAK). **Nectar flow** 2 wks (INI, Sig/62)

**Honey flow**

**Honey yield** (kg/colony/season) [moderate] 4–9 (INI, Sig/62); 27, mixed with honey from clovers (PAK, Shr/48)

**Pollen**

P PAK

**Recommended for planting to increase honey production**

INI/MAH (Sub/79). Propagate by suckers, root and shoot cuttings; grows rapidly; suitable for dry zones. See **Warning**

**Honey: chemical composition**

<table>
<thead>
<tr>
<th>Component</th>
<th>Measurement</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>[medium] 18.75%</td>
<td>(Sig/48)</td>
</tr>
<tr>
<td>Glucose</td>
<td>[medium] 34.6%</td>
<td></td>
</tr>
<tr>
<td>Fructose</td>
<td>[medium] 39.1%</td>
<td></td>
</tr>
<tr>
<td>Sucrose</td>
<td>[medium] 1.04%</td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>[medium] 0.18%</td>
<td></td>
</tr>
</tbody>
</table>

**Honey: physical and other properties**

**Pfund** amber to dark amber (Sig/62)

**Flavour** strong
126 Dialium engleranum Henriques; Leguminosae  
DROUGHT  
syn Dialium simii Phillips  
Kalahari podberry (En/SOU, ZAM); mussala (ANA)  
Tree, 7-20 m, much branched; fls small, petals absent, sepals creamy-white, golden brown and hairy outside  
Distribution tropical Africa; native to BOT, NAM, ZAM.  
Habitat mixed forest/woodland; savannah  
Soil deep white sand; Kalahari sand.  
Rainfall 600-800 mm (ZAM, Smt/59); drought tolerant  

Economic and other uses  
Food - fruit.  
Other uses medicinal  

Nectar rating + honeybee species; blooms, nectar flow  
Nl ANA,tm(Ros/60); ZAM,tm(Smt/59)  
N ZAI,tm(Dub/50)  
Blooms iv-v (ANA); vii-viii (southern Africa, PAG/77).  
Nectar secretion "one of the best nectar producers - south of Lunda" (ANA, Ros/60)  

Honey: physical and other properties  
Colour light (Dou/50)  

139 Echium lycopsis L.; Boraginaceae  
DROUGHT  
syn Echium plantagineum L.  
blue weed, Patterson's curse, salvation Jane, viper's bugloss (En/AUS); flor morada, flor morena (Es/ARG)  
Herb, 20-60 cm, annual/biennial; fls blue, becoming pink to purple  
Distribution temperate Europe, Oceania; subtropical Oceania, S America; native to S and W Europe.  
Habitat roadsides, fields, sandy areas near the sea; humid pampas of ARG; noxious introduced weed in some wetter parts of AUS where it is widespread and often dominant in pastures  
Soil siliceous preferred.  
Rainfall drought tolerant  

Economic and other uses  
Fodder (Pig/77)  

Warning; alert to beekeepers  
Warning can be highly invasive weed in wetter parts of AUS (Cra/81).  
Alert to beekeepers appearance of "bee paralysis" may be associated with this pollen (AUS, Dol/61)  

Nectar rating; blooms, nectar flow  
N1 ARG(Cos/63; Per/80; Vit/65); AUS/SA(Pur/68)  
N2 AUS/VIC(Gom/73); AUS/WA(Col/62)
N3 AUS/NSW (Goo/47)
Blooms viii-x (AUS/WA); viii extending to xii (AUS/VIC)

Pollen
P2 AUS/SA, VIC, WA. Yield heavy (Pur/68). Pollen value good quality (Col/62); doubtful quality (Pur/68); appearance of bee "paralysis" may be associated with this pollen (AUS, Dol/61)

Honey: chemical composition
Sucrose [high] 9% (Smt/65)
pH 3.1 (Woo/78)
Other components several pyrrolizidine alkaloids identified (Cul/81)

Honey: physical and other properties
Colour white to light golden (Cra/75); light (Pur/68). Pfund light amber (Gom/73)
Granulation rapid
Flavour delicate (Cra/75); peculiar but not objectionable (Gom/73)

149 Eriobotrya japonica (Thunb.) Lindl.; Rosaceae

Loquat; néflier du Japon (Fr)
Tree, <10 m, evergreen; fls white, woolly
Distribution temperate (Med) Europe, N Africa, Asia; subtropical Asia; native to China. Habitat cultivated crop plant; altitudes <1800 m, optimum 900-1200 m
Soil well drained, light loam. Temperature - tree hardy but fruit damaged by frost. Rainfall drought tolerant

Economic and other uses
Food - fruit; liqueur from fruit in BER. Land use amenity

Nectar rating + honeybee species; blooms, nectar flow; composition
N1 AFG (Cra/73; Hof/72); CHN/N, central (Tse/54); LEB (Yaz/53);
PAK [ac] (Cra/73); PAK, ac (Pak/77); PAK/NWFP (Shi/77)
N2 JAP (Sak/82)
N3 IN0 [ac] (Bee/77); JAP (Inu/57); LEB (Fli/62)
N INI/UTT, ac (Koh/58)
Blooms viii-i in 3 flushes (INI/north, Koh/58); autumn (tropical America, Ord/83). Nectar flow during dearth period (INI/north); reduced by covering of dust during droughts (Pak/77). Sugar concentration [high] 30.5-65.0% (Shr/58)

Honey flow
Honey yield (kg/colony/season) [moderate] 3.6 (PAK, Pak/77); >1 (ac, Pak/77); 20 (LEB, Yaz/53); every 2 yrs (JAP, Inu/57)
Pollen
P1 INO. P PAK. Pollen grain illustrated and described (Nak/65). Reference slide

Honey: physical properties
Pfund amber (Cra/75; Mot/64)

153 Eucalyptus aniceps (Maiden) Blakely; Myrtaceae

Kangaroo Island mallee, peaked crown top mallee, sand mallee, white mallee
Tree, 6 m, small mallee
Distribution subtropical Oceania; native to Australia
Soil sandy; sandy-loam. Rainfall areas with <1000 mm AUS/SA; semi-arid/arid AUS

Economic and other uses
Fuel. Timber

Nectar rating; blooms, nectar flow
N1 AUS/SA(Boo/72); AUS/WA(Lei/72)
N2 AUS/SA(Lei/72); AUS/WA(Col/62)
Blooms i-ii AUS (Pen/61); i-iv, buds 2-3 yrs before flowering (AUS/WA, Lei/72)

Honey flow
Honey yield good every 5 yrs, otherwise poor to medium (AUS/SA, Boo/72); occasional moderate yields (AUS/SA)

Pollen
P2 AUS/WA. P3 AUS/SA. Yield high every 2 yrs (Boo/72); poor (Lei/72). Pollen value good (Boo/72); average (Lei/72)

Honey: physical properties
Pfund light amber (Boo/72); medium/amber (Lei/72; Pur/68)

154 Eucalyptus caleyi Maiden; Myrtaceae

Caley's ironbark, drooping ironbark (En/AUS)
Tree, <12 m; fl stamens creamy-white/pinkish
Distribution subtropical and temperate Oceania; native to AUS.
Habitat hilly country above 450 m (AUS)
Soil sandy/stony. Rainfall arid, semi-arid (AUS/QD)
Economic and other uses
Timber. Land use amenity

Alert to beekeepers
No pollen (AUS, Lei/72); pollen inadequate for brood rearing (AUS, Pen/61)

Nectar rating; blooms, nectar flow
N1 AUS/NSW(Cok/63); AUS/QD(Bla/72)
N3 AUS/NSW(Goo/47)
Blooms iv-viii (AUS, Pen/61); vi-x (AUS/QD)

Pollen
Alert to beekeepers no pollen (Lei/72); pollen inadequate for brood rearing (Pen/61)

Honey: physical and other properties
Colour bright, exceptionally clear (Bla/72). Pfund 2.0-15.5 mm, extra white (Bla/72; Lei/72; Pur/68; Roc/68)
Granulation rapid, smooth, transparent grain (Bla/72)
Flavour sweet

156 Eucalyptus camaldulensis Dehn.; Myrtaceae
syn Eucalyptus rostrata Schlechtd.

DROUGHT/SALT
Murray red gum, river red gum (En/AUS)
Tree, <40 m depending on soil moisture
Distribution temperate (Med) Europe, Africa; subtropical S America, Africa, Oceania, Asia; tropical Africa, Asia; native to AUS. Habitat most widely planted eucalypt; banks of inland rivers/alluvial flats subject to periodic flooding; cold tablelands; sub-humid SOU; some provenances will grow at >1200 m
Soil deep silt with clay subsoil preferred; salt tolerance varies with provenance; free lime not usually tolerated. Temperature high temperatures and hot dry winds tolerated; some provenances frost hardy. Rainfall 200-1250 mm, commercial plantations >400 mm; arid and semi-arid areas, some provenances more drought tolerant than others

Economic and other uses
Fodder - lvs, but not always favoured. Fuel - charcoal particularly important. Timber termite resistant. Land use windbreak, shade, afforestation, amenity. Other uses medicinal; paper-pulp; rayon; tannin from bark

Warning; alert to beekeepers
Warning young trees susceptible to fire (Usa/80). Other plants will not grow around this sp (Usa/80). Alert to beekeepers when
the bug Nysius vinitor Berg. infests fls in some areas, there is no flow (AUS, Pen/61)

Nectar rating + honeybee species; blooms, nectar flow; composition

N1 AUS/NSW(Goo/47); AUS/QD(Bla/72); AUS/SA(Boo/72); AUS/VIC(Gom/73); BRA/NG-tm(Cor/70); MOR(Cra/73); SOU,tm(Mou/72); URS(Glu/55)
N2 AUS/WA(Col/62); ITA(Ric/78); PAK,ac(PAK/77); SOU,tm(And/73)

N1 ALG(Ske/72); ZIM,tm(Pap/69)

Blooms all yr, heavily every 2 yrs (AUS, Pen/61); buds 9-12 mths before flowering (AUS, Gom/73); vii-ix (BRA).

Nectar flow ix-ii (ISR, Eis/80); too short for appreciable colony gains (SOU, And/73).

Alert to beekeepers when Nysius vinitor infests fls in some areas, there is no flow (AUS, Pen/61).

Nectar secretion 4.1-15.4 mg/fl/day (Eis/80); very profuse, one of the heaviest yielders (Gom/73).

Sugar concentration [high] 61-81% (10 fls, Sao/54; Wie/80); [medium] 16.5-24.8% (various dates, Eis/80); 30% (Pel/76); >50% (Zma/80).

Sugar value [medium] 0.56-2.90 mg/fl/day (Eis/80)

Honey flow
Honey yield (kg/colony/season) [high] 60 (AUS, Pen/61); 55 (AUS/QD, Bla/72); 100-120, mixed with honey from E. cladocalyx (MOR, Cra/73)

Pollen
Pl AUS/QD, SA, VIC; ITA.
P2 AUS/WA; SOU.
P PAK; ZIM.

Yield prolific (Gom/73); high in alternate yrs (Boo/72).

Pollen value good (Boo/72; Pen/61).

Chemical analysis 25.8% crude protein (AA1244/78).

Colour of load greyish-brown (Ric/78).

Pollen grain illustrated and described (Smt/56a)

Recommended for planting to increase honey production

AUS (Aus/83); BRA (Wie/80); FRA (Sab/82); SOU, sub-humid zone (Loo/83).

Propagate by seed which is freely produced; choice of provenance v important (Usa/80). V valuable for both brood rearing and honey production, and especially to beekeepers wanting colonies to store pollen before working pollen-deficient flow (Gom/73).

See Warning; alert to beekeepers

Honey: chemical composition

Water - refractive index 1.4935 (Moh/82)

Glucose [medium] 32.70%. Fructose [medium] 38.20%. Sucrose [medium] 1.79-2.30%. Reducing sugars 68.82%. Maltose 6.60%.

Raffinose 1.60%. Contents of sugars as % of total sugars (Peo/72)

Ash [medium] 0.12% (Moh/82); K 0.148%, Na 0.0079%, Ca 0.001% pH 4.2 (Lan/66); 5.3 (Moh/82). Free acid [medium] 20.70 meq/kg (Moh/82)

Amylase 29.4 (Lan/66)

Nitrogen 0.035% dry wt (Bos/78). Amino acids, free 0.157,
Honey: physical and other properties

Colour clear golden (And/73; Sou/63); grey with chestnut tint (Erb/83); straw coloured (Gom/73); v variable, generally light grey, may be darker (Ric/78); v clear (Ske/72). Pfund 32-63 mm, white to light amber (Bla/58; Lei/72; Roc/68); light amber (Boo/72; Pur/68); medium amber (Cra/75); 34.1 mm (also 3 "bulk honeys" 37.7-51.3 mm), extra light amber (Lan/66); 51 mm, light amber (Peo/72)

Viscosity 103.20 poise (Moh/82). Optical rotation -8.55 deg.

Other physical properties - may froth on extraction (Bla/58)

Granulation rapid (And/73; Sou/63); slow, large brown crystals (Bla/58; Cra/75); rapid, hard (Gom/73); medium (Moh/82); fine-grained and compact (Ric/78)

Flavour mild, woody (Bla/58; Cra/75; Lei/72). Aroma characteristic (Ric/78)

158 Eucalyptus cladocalyx F. Muell.; Myrtaceae

sugar gum (En/AUS)

Tree, <30 m (6-12 m in poor conditions); fls v fragrant

Distribution subtropical Africa, Oceania; temperate (Med) Africa; native to AUS/SA, VIC. Habitat mixed woodland AUS; sub-humid Cape coastal belt (SOU) but not where there are salt-laden sea-breezes

Soil wide range especially quartzite ridges, acid soil (AUS); poor soil, infertile wasteland (SOU). Temperature hot dry conditions (AUS); susceptible to frost damage only when young.

Rainfall 500 mm but higher rainfall areas preferred (AUS); winter rainfall zone, but not heavy rains, drier districts of western SOU

Economic and other uses

Fodder - lvs, but can be toxic to sheep/cattle/horses (Pen/61).

Fuel. Timber. Land use windbreak, shade, amenity

Warning Lvs can be toxic to animals (Pen/61; Boo/72); other plants will not grow around this sp (Anr/74)

Nectar rating + honeybee species; blooms, nectar flow

N1 MOR(Cra/73); SOU/CAPE,tm(And/73; Mou/72)
N2 AUS/NSW(Goo/47); AUS/SA(Boo/72)
N3 AUS/VIC(Gom/73)

Blooms i-ii, may be every 2 yrs; buds 13 mths before flowering (AUS, Pen/61). Nectar flow annual (SOU, Anr/74); lengthy (SOU,
Loo/82); few days (AUS/VIC). Nectar secretion heavy, especially on warm slightly humid days; hot dry winds reduce flow

Honey flow
Honey yield (kg/colony/season) [high] 100-120, often with E. camaldulensis (MOR, Cra/73); 15-25, max 90 (SOU/Cape, Anr/74); "indifferent yields" outside winter rainfall area (SOU, And/73)

Pollen
P2 AUS/WA. P3 AUS/SA, WA; SOU/CAPE. Yield moderate, every 2 yrs (Boo/72); small (Anr/74). Pollen value disagreement as to value (Pen/61; Sou/65); bees prefer pollen from other sources (Gom/73); poor quality (Boo/72); little collected (And/73)

Recommended for planting to increase honey production
AUS (Aus/83); SOU (Anr/74; Loo/82; Sou/65); sub-humid zone. Propagate by seed; grows rapidly; first fls at 4-5 yrs but initial nectar yield low (Anr/74). See Warning

Honey: chemical composition
Water [low] 14.6% (by gravimetry), 15.4% (by refractometry) (Anr/74)
Glucose [low] 25.2%. Fructose [medium] 41.9%. Maltose 12.2%
Ash [medium] 0.3%
Nitrogen 0.02%

Honey: physical and other properties
Colour pale straw (And/73 Gom/73); light (Mou/72). Pfund 41 mm, extra light amber (Anr/74); light amber (Boo/72; Pur/68)
Relative density 1.438 (Anr/74). Viscosity 21.36 poise. Other properties froths on heating (Sou/65)
Granulation slow, none if monofloral (And/73; Mou/72)

159 Eucalyptus cornuta Labill.; Myrtaceae  SALT
yate (En/AUS, SOU)
Tree, <21 m but can form stunted thickets
Distribution subtropical Oceania, Africa; native to AUS.
Habitat <300 m altitude (Pen/61)
Soil moist gravelly loam; also alkaline and saline soil.
Temperature thrives under hot wet conditions; frost resistant.
Rainfall low rainfall areas

Economic and other uses
Timber. Land use windbreak, shade, amenity

Nectar rating + honeybee species; blooms, nectar flow
N1 AUS/WA(Col/62)
N2 SOU/CAPE, tm(And/73; Mou/72)
Blooms i–ii (AUS, Pen/61); xii–i (SOU/CAPE); usually every 2 yrs (Pen/61). **Nectar flow** fair (Pen/61)

**Pollen**
P2 AUS/WA. P3 SOU/CAPE. **Yield** fair (Pen/61). **Pollen value** good (Pen/61)

**Honey: physical and other properties**
**Colour** light medium (And/73)
**Granulation** rapid, fine
**Flavour** fairly strong

160 **Eucalyptus crebra** F. Muell.; Myrtaceae

*narrowed-leaved red ironbark* (En/AUS)

**Tree**, <30 m

**Distribution** subtropical Oceania, Africa; native to AUS.

**Habitat** undulating/hilly country <600 m (AUS)

**Soil** deep, moderately good acid soil; also sandy soil with hard clay subsoil. **Temperature** seedlings frost hardy. **Rainfall** minimum 25 mm in driest mths; seedlings drought tolerant (AUS); summer rainfall area, sub-humid interior (SOU)

**Economic and other uses**

**Timber**

**Nectar rating + honeybee species; blooms, nectar flow**

**N1** AUS/QD(Bla/72)

**N3** AUS/NSW(Goo/47); SOU,tm(And/73)

**Blooms** v–i (AUS, Pen/61); vii–xii, main period ix–xi (SOU).

**Nectar flow** "reasonable", enhanced by heavy rains prior to blooming (Pen/61)

**Honey flow**

**Honey yield** [high] 82 kg/colony/season; good yield once every 3 yrs, when many trees flower together (AUS/QD, Bla/72)

**Pollen**
P1 AUS/QD. P3 AUS/NSW; SOU. **Yield** minor to medium (Bla/72); deficient (Cok/63); fair (Goo/47); major producer (Pen/61)

**Recommended for planting to increase honey production**

SOU, sub-humid zone (And/73; Dai/70). Propagate by seed; grows rapidly at first, slowing down at pole-size (AUS, Pen/61)
Honey: physical and other properties
Pfund light amber (And/73); extra white to extra light amber (Bla/72); 14-35 mm, white (Lei/72; Roc/68)
Viscosity "heavy body" (Bla/72)
Granulation slow, coarse whitish grain
Flavour mild, sweet

167 Eucalyptus gomphocephala DC.; Myrtaceae

DROUGHT/SALT
tuart (En/AUS, SOU)
Tree, <42 m, occurs as forest in AUS/WA
Distribution subtropical Oceania, Africa, Asia; temperate (Med) Europe; native to AUS/WA. Habitat coastal (AUS; SOU), semi-arid/sub-humid zones (Usa/80)
Soil sandy loam overlying limestone (AUS); limestone areas (AUS/WA); calcareous sand; slightly saline soil tolerated (Usa/80); waterlogging not tolerated. Temperature absolute minimum -4°; poor frost tolerance. Rainfall absolute minimum 300 mm; range in AUS/WA 700-1000 mm with 6 dry summer mths (Usa/80)

Economic and other uses
Fuel. Timber. Land use windbreak, shade, amenity. Soil benefit stabilizes dunes; soil protection

Warning; alert to beekeepers
Warning young plantations susceptible to fire (Usa/80). Alert to beekeepers flow reduced if the weevil Haplonyx tibialis has caused severe bud drop (AUS, Pen/61)

Nectar rating + honeybee species; blooms, nectar flow
N1 AUS/WA(Col/62); URS(Glu/55)
N3 SOU/CAPE,NATAL,tm(And/73)
N AUS/WA(Smt/69)
Blooms every 4-7 yrs; i-iii, buds 2 yrs before flowering (AUS, Pen/61); autumn (SOU, Dai/70). Nectar flow iii-iv (AUS/WA). Alert to beekeepers flow reduced if the weevil Haplonyx tibialis has caused severe bud drop (AUS, Pen/61). Nectar secretion rain during blooming stops flow (Pen/61), but nectar may be produced again later (Col/62)

Pollen
P2 SOU/CAPE, NATAL. P3 AUS/WA. Yield abundant (Pen/61).
Pollen value poor (Col/62; Pen/61)

Recommended for planting to increase honey production
SOU (Dai/70); good for calcareous areas in sub-humid zones. Propagate by seeds, which are produced infrequently (Pen/61). See Warning; alert to beekeepers
Honey: physical and other properties
Colour light (And/73; Smt/69)
Granulation rapid, fine (Smt/69)
Flavour of caramel (And/73; Dai/70). Aroma strong (Dai/70)

168 Eucalyptus gracilis F. Muell.; Myrtaceae
DROUGHT
small-budded mallee, snap and rattle, white mallee, yorrell (En/AUS)
Shrub/tree, <18 m, mallee-like, forms clumps/thickets
Distribution subtropical Oceania; native to AUS. Habitat widespread in southern AUS
Soil sandy soil (AUS). Rainfall dry areas (AUS)

Economic and other uses
Fuel. Timber

Alert to beekeepers
Heavy bee losses have occurred, pollen probably inadequate for brood rearing (AUS/VIC, Gom/73); little/no pollen collected (AUS/SA, Boo/72)

Nectar rating; blooms, nectar flow; composition
N1 AUS/VIC(Gom/73)
N2 AUS/SA(Boo/72); AUS/WA(Col/62; Lei/72)
Blooms iv-viii (AUS, Pen/61); iii-xi, best viii-x, rarely iv-v (AUS/WA); main flowering ix-x, buds 3-6 mths before flowering (AUS/VIC, Gom/73). Nectar flow good every 4-15 yrs (AUS/NSW, Boo/72). Sugar concentration probably high, since a colony working this flow uses up to 1 litre of water per day (AUS, Col/62)

Honey flow
Honey yield (kg/colony/season) [high] mean 27-36, max 113 (AUS/VIC, Gom/73)

Pollen
P3 AUS/VIC, WA. Alert to beekeepers heavy bee losses have occurred, pollen probably inadequate for brood rearing (AUS/VIC, Gom/73); little/no pollen collected (AUS/SA, Boo/72). Colour grey to dirty white (Gom/73)

Honey: chemical composition
Amino acids 373.23 ug/g (contents of 13 individual acids given, Peo/72a; Peo/74)

Honey: physical and other properties
Pfund light amber (Boo/72; Gom/73; Lei/72; Pur/68); 55.4 mm, light amber ("bulk honey", Lan/66)
Flavour mild (Gom/73; Lei/72)
**170 Eucalyptus incrassata Labill.; Myrtaceae**

syn *Eucalyptus incrassata var. costata* N.T. Burbridge

angulosa mallee, giant angular mallee, lerp mallee, ridge-fruit mallee, yellow mallee (En/AUS)

Tree, 2–5 m

**Distribution** subtropical and temperate Oceania; native to AUS

**Soil** sandy. **Rainfall** low rainfall areas in AUS

**Economic and other uses**

**Timber. Land use** windbreak

**Nectar rating; blooms, nectar flow**

N1 AUS/VIC (Gom/73); AUS/WA (Col/62)

N3 AUS/SA (Boo/72)

**Blooms** iii–iv, buds 10–15 mths before flowering (AUS, Pen/61); conflicting reports but generally x–iv (AUS/VIC)

**Honey flow**

**Honey yield** "heavy (AUS, Aus/83)

**Pollen**

P1 AUS/VIC, WA. P2 AUS/SA, VIC, WA. **Yield** quite reasonable (Pen/61); average (Gom/73)

**Recommended for planting to increase honey production**

AUS (Aus/83)

**Honey: chemical composition**

**Amino acids** 507.99 µg/g, also contents of 14 individual acids (Peo/72a; Peo/74)

**Honey: physical properties**

**Pfund** medium amber (Boo/72; Gom/73; Lei/72; Pur/68)

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**172 Eucalyptus leucoxylon F. Muell.; Myrtaceae**

South Australian blue gum, yellow gum (En/AUS); leucoxylon gum (En/SOU); white ironbark (En/USA)

Tree, <27 m; fls with pink/crimson/white filaments

**Distribution** subtropical Africa, N America, Oceania; tropical Africa; temperate (Med) Africa, Oceania; native to AUS.

**Habitat** undulating country/valleys; also open woodland/forests in moist valleys (AUS)

**Soil** heavy alluvium, stiff clay, sandy loam. **Temperature** hot dry winds tolerated; some frost tolerated but seedlings need protection.

**Rainfall** 500 mm (AUS/SA); drought tolerant (AUS); drier areas more suitable (SOU)
Economic and other uses

Timber. Land use windbreak, shade, amenity. Other uses medicinal oil from lvs

Alert to beekeepers

Sometimes bees will not collect nectar (Pen/61); no pollen (AUS, Pen/61); pollen inadequate for brood rearing (AUS/VIC, Gom/73)

Nectar rating + honeybee species; blooms, nectar flow

<table>
<thead>
<tr>
<th>Rating</th>
<th>Species</th>
<th>Blooms</th>
<th>Nectar flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>AUS/SA(Boo/72); AUS/VIC(Gom/73)</td>
<td>iv-xii, best v-ix (SOU); v-xii, buds 6-10 mths before flowering (AUS, Pen/61)</td>
<td>heavy every 2 yrs.</td>
</tr>
<tr>
<td>N2</td>
<td>SOU,tm(And/73); USA/CA(Pel/76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>NEZ(Wal/76); URS(Glu/55)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Alert to beekeepers sometimes bees will not collect nectar (Pen/61). Nectar secretion generally yielded freely (Gom/73)

Pollen

P3 SOU. Alert to beekeepers no pollen (AUS, Pen/61); pollen inadequate for brood rearing (AUS/VIC, Gom/73)

Recommended for planting to increase honey production

AUS (Aus/83). Propagate by seed; regenerates fairly well (Pen/61). Useful shelter tree; cv Rosea for amenity planting. See Alert to beekeepers

Honey: chemical composition

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>15.4, 16.8% (Che/74)</td>
</tr>
<tr>
<td>Glucose</td>
<td>27.7, 30.6%</td>
</tr>
<tr>
<td>Fructose</td>
<td>43.7, 40.7%</td>
</tr>
<tr>
<td>Sucrose</td>
<td>1.0, 4.8%</td>
</tr>
<tr>
<td>Ash</td>
<td>0.24, 0.11%</td>
</tr>
<tr>
<td>pH</td>
<td>5.19, 3.88 (Che/74); 4.3 (Lan/66)</td>
</tr>
<tr>
<td>Total acid</td>
<td>10.6, 32.2 meq/kg</td>
</tr>
<tr>
<td>Free acid</td>
<td>8.6, 22.8 meq/kg</td>
</tr>
<tr>
<td>Amylase</td>
<td>28 (Che/74); 13.9 (Lan/66)</td>
</tr>
<tr>
<td>HMF</td>
<td>2.0, 1.4 ppm</td>
</tr>
</tbody>
</table>

Honey: physical and other properties

Colour clear, pale straw (And/73; Cra/75; Gom/73). Pfund light amber (Boo/72); 20 mm, white; also 68 mm, light amber (Che/74); white (Glu/55); 62.4 mm (67.4 mm after 16 h at 66°), light amber (Lan/66; Lei/72; Pur/68); 23.3-55.0 mm, white to light amber (4 bulk honeys, Lan/66); medium amber (Lei/72)

Viscosity "good body" (Cra/75)

Granulation rapid (And/73; Cra/75); fine (Gom/73)

Flavour mild (And/73; Cra/75; Gom/73); like vanilla (Glu/55; Pel/76)
Eucalyptus melliodora A. Cunn. ex Schauer; Myrtaceae

Drought tolerant

**Distribution** subtropical Oceania, Africa, Asia; tropical Africa; native to AUS. **Habitat** gentle slopes/foothills in well watered E AUS; river flats in drier W AUS; always <900 m altitude; high veld SOU

**Soil** wide range; heavy alluvial soil preferred, but also sandy loam, granites; not poor sand. **Temperature** fairly frost resistant. **Rainfall** mostly within 380-760 mm; very drought resistant

**Economic and other uses**
- Fodder
- Fuel
- Timber
- Land use windbreak, shade, amenity

**Alert to beekeepers**

Pollen inadequate for brood rearing (Gom/73; Loo/83; Pen/61)

**Nectar rating + honeybee species; blooms, nectar flow**

<table>
<thead>
<tr>
<th>Country</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUS/NSW(Cok/63; Goo/47)</td>
<td>AUS/QD(Bla/72)</td>
</tr>
<tr>
<td>KEN<a href="Tow/69">tm</a></td>
<td>SOU,tm(And/73; Bey/68; Loo/70; Mou/72)</td>
</tr>
<tr>
<td>N URS(Glu/55)</td>
<td>ZIM<a href="Pap/69">tm</a></td>
</tr>
</tbody>
</table>

**Blossoms** x-xii (SOU); ix-ii (sometimes vi), heavily every 2 yrs, buds 10-12 mths before flowering (AUS, Pen/61). **Nectar flow** maintained in dry periods, often copious (Pen/61); heaviest in warm moist conditions, 6 wks duration (SOU, Mou/75)

**Honey flow**

**Honey yield** [high] 25, max 75 kg/colony/season (AUS, Mou/75)

**Pollen**

**Alert to beekeepers** pollen inadequate for brood rearing (Gom/73; Loo/83; Pen/61))

**Recommended for planting to increase honey production**

AUS (Aus/83); SOU (Mou/75). Propagate by seed; blooms when little other nectar is available. See **Alert to beekeepers**

**Honey: chemical composition**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>[low] 14.0% (Che/74; also gives data for 2 samples age 5-12 mths); 17.2% (Woo/76; Woo/76a)</td>
</tr>
<tr>
<td>Sugars, total</td>
<td>79.5% (77.6% after 44 days at 50°, Woo/76a).</td>
</tr>
<tr>
<td>Glucose</td>
<td>[medium] 30.4% (Che/74); 33.3% (28.0%, Woo/76a).</td>
</tr>
<tr>
<td>Fructose</td>
<td>[medium] 42.9% (Che/74); 36.1% (38.2%, Woo/76a).</td>
</tr>
<tr>
<td>Sucrose</td>
<td>[medium] 5.1% (Che/74); 1.2% (0.7%, Woo/76a).</td>
</tr>
<tr>
<td>Ash</td>
<td>[low] 0.06%</td>
</tr>
<tr>
<td>pH</td>
<td>4.10 (Che/74); 4.18 (4.05, Woo/76); 4.4 (Woo/78).</td>
</tr>
</tbody>
</table>
acid meq/kg 17.2 (Che/74); 22.3 (21.5, Woo/76). Free acid
(meq/kg) [medium] 12.2 (Che/74); 17.8 (16.5, Woo/76). Lactone
(meq/kg) 5.0 (Che/74); 4.5 (5.0, Woo/76)
Amylase 30 (Che/74); 26.1 (Edw/75). HMF 1.9 ppm
Nitrogen 0.025-0.043% (Che/74); 0.020% (Woo/76). Amino acids,
free 579.8 μM/100g (237.9, Woo/76); contents of individual acids
(proline 80% of total, Woo/76a)
Volatile compounds, major: acetoin and ?hexenyl butyrate; also 6
other compounds (Grd/79); 48 present, 13 named (Woo/78a)

Honey: physical and other properties
Colour pale straw if monofloral (And/73; Gom/73; Joh/75;
Sou/63); usually extra light (Cra/75). Pfund 12-45 mm, extra
white to extra light amber (Bla/72; Lei/72; Roc/68); 21 mm,
white (26 mm in sample age 5-12 mths, Che/74); 26.9 mm, white
(115.2 mm, dark amber after 44 days at 50°, Woo/76)
Granulation slow, none if monofloral (Bla/72; Joh/75; Mou/75)
Flavour sweet, cloying, pronounced (And/73; Bla/72; Cra/75;
Mou/75). Aroma characteristic (And/73); v aromatic (Sau/63)

178 Eucalyptus oleosa F. Muell ex Miq.; Myrtaceae
DROUGHT
acorn mallee, giant mallee, oil mallee, red mallee (En/AUS)
Tree/mallee, <10 m
Distribution subtropical Oceania; native to southern AUS
Soil grey and brown calcareous soils; sometimes on sand (AUS).
Temperature frost resistant. Rainfall 300-500 mm average (AUS);
v drought tolerant

Economic and other uses
Fuel. Timber. Land use windbreaks in low rainfall areas;
shade. Other uses essential oils

Nectar rating; blooms, nectar flow
N1 AUS/VIC(Gom/73)
N2 AUS/NSW(Goo/47)
N3 AUS/SA(Boo/72)
Blooms v-vii every 2 yrs, buds 12 mths before flowering (AUS,
Pen/61); xii-v usually each year (AUS/VIC)

Honey flow
Honey yield [high] 54 kg/colony/season (AUS/VIC, Gom/73); usually
good every 5 or more yrs, smaller yields between (AUS/SA, Boo 72)

Pollen
P2 AUS/NSW. P3 AUS/SA, VIC. Yield low to moderate, annual
(Boo/72); average (Gom/73). Pollen value average (Boo/72);
?poor (Gom/73). Colour cream
Honey: physical and other properties

**Pfund**
light amber (Boo/72; Pur/68); medium amber, sometimes
darker (Gom/73; Lei/72)

**Flavour**
mild (Gom/73; Lei/72)

180 *Eucalyptus paniculata* Smith; Myrtaceae

drought/salt
grey ironbark (En/AUS)
Tree, <42 m; fl stamens white/creamy-yellow

**Distribution**
subtropical Oceania, Africa, S America; tropical
Africa; native to AUS/NSW, QD. **Habitat** moist valleys preferred,
also ironstone ridges (AUS); coastal areas and humid interior SOU

**Soil**
good sandy loam; best in deep well drained soil but will
adapt to poor, dry sites (SOU); not poor sand; salt tolerant.

**Temperature**
frost tender.

**Rainfall**
somewhat drought resistant
but growth more rapid in rain-fed areas; >750 mm preferred (SOU)

**Economic and other uses**
Timber termite resistant. **Land use** windbreak, amenity

**Alert to beekeepers**
Pollen can be inadequate for brood rearing (AUS, Pen/61; SOU,
Sou/63); honey granulates in hive if cold (Coe/71)

**Nectar rating**
**honeybee species; blooms, nectar flow; composition**

**N1**
AUS/NSW (Cok/63; Goo/47); KEN,tm (Smt/60; Tow/69); SOU,tm (Mou/72)

**N2**
SOU/CAPE, NATAL, TVL, tm (And/73)

**Blooms**
v-xii usually every 3 yrs (AUS, Pen/61); iii-iv (BRA/RS,
Jul/72); iv-vi, regular (SOU, Sou/63); during dearth period
(SOU, Coe/67). **Nectar flow** irregular and difficult to predict
(SOU, Coe/67). **Nectar secretion** most copious in dry periods
after good rains during bud development (SOU, Guy/71). **Sugar
concentration** [medium] 28-30% (Jul/72)

**Honey flow**
**Honey yield** (kg/colony/season) [high] 100 (AUS, Pen/61); 50 (SOU,
Guy/71)

**Pollen**
P3 SOU/CAPE, NATAL, TVL. **Alert to beekeepers** pollen can be
inadequate for brood rearing (AUS, Pen/61; SOU, Sou/63)

**Recommended for planting to increase honey production**
SOU (Dai/70). **See Alert to beekeepers**

**Honey: physical and other properties**

**Colour**
light (And/73; Cra/75); pale straw (Coe/71; Guy/71)

**Granulation**
slow or medium (And/73); slow, fine (Coe/71; Cra/75; Guy/71); **(alert to beekeepers)** granulates in hive if cold (Coe/71)
181 Eucalyptus platypus Hook.; Myrtaceae DROUGHT

moort (En/AUS)
Tree, <9 m; fl stamens yellow
**Distribution** subtropical Oceania; native to AUS/WA. **Habitat** moist depressions on low hills and flats (AUS); southern mallee areas
**Soil** sandy loam; heavy, grey, clayey soil; moist loam. **Temperature** moderately frost resistant. **Rainfall** 350 mm, but 400-700 mm with predominance in winter preferred; drought resistant

**Economic and other uses**
**Timber.** **Land use** windbreak (low shelter), amenity. **Other uses** tannin from bark

**Nectar rating; blooms, nectar flow**
\[ N1 \] AUS/WA(Col/62; Lei/72)
**Blooms** vi-x every 4 yrs, varies with climatic conditions; fl period rarely >2 mths (Pen/61). **Nectar flow** starts and finishes abruptly (Col/62)

**Pollen**
\[ Pl \] AUS/WA. **Yield** heavy (Pen/61). **Pollen value** excellent (Pen/61)

**Recommended for planting to increase honey production**
AUS (Aus/83). Excellent low shelter

**Honey** no data

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182 Eucalyptus polyanthemos Schauer; Myrtaceae DROUGHT

red box (En/AUS, SOU)
Tree, <23-30 m; poor form
**Distribution** subtropical Africa; temperate Oceania, (Med) Africa; native to AUS/NSW, VIC. **Habitat** in mountainous areas, only in sheltered valleys <600 m (AUS); woodland; drier areas of SOU
**Soil** poor, dry, stony/gravelly and poor-class heavy soils (AUS).
**Temperature** moderately frost tolerant. **Rainfall** moderately drought tolerant

**Economic and other uses**
**Fuel.** **Timber.** **Land use** windbreak, shade

**Alert to beekeepers**
Pollen inadequate for brood rearing (Gom/73; Loo/83); honey "difficult to extract" (Gom/73)
Nectar rating + honeybee species; blooms, nectar flow; composition
N1 SOU/TVL[tm] (Bey/68)
N2 ?SOU/TVL[tm] (Loo/70)
N3 AUS/NSW (Goo/47); AUS/VIC (Gom/73); SOU/TVL,tm (And/73)

Blooms ix-xii (AUS, Pen/61); usually every 2 yrs, buds 10-12 mths before flowering (Gom/73). Nectar flow xii, ii (ISR, Eis/80); unreliable (AUS, Gom/73). Nectar secretion 0.4 mg/fl/day (Eis/80).
Sugar concentration [low] 18.7% (Eis/80). Sugar value [low] 0.08 mg/fl/day (Eis/80)

Pollen
P3 SOU/TVL. Alert to beekeepers pollen inadequate for brood rearing (Gom/73; Loo/83)

Recommended for planting to increase honey production
SOU (Loo/83; Sou/63). Grows rather slowly (Pen/61). See Alert to beekeepers

Honey: physical and other properties
Colour pale, dull (And/73; Gom/73; Lei/72)
Viscosity (alert to beekeepers) honey "difficult to extract" (Gom/73)
Granulation slow, none if monofloral (And/73; Gom/73; Sou/63)
Flavour usually slightly oily or like tallow, but this disappears after 12 mths (Gom/73); oily (Lei/72; Loo/70)

184 Eucalyptus robusta Smith; Myrtaceae
swamp mahogany, swamp messmate (En/AUS); robusta gum (En/SOU); eucalyptus rouge (Fr/MAE, MAY); eucalipto (Pt/BRA)
Tree, <27 m; fl stamens white
Distribution subtropical Africa, S America, Oceania, Asia; tropical Africa, Asia, S America; temperate Europe; native to coastal AUS/NSW, QD. Habitat cultivated in warmer Americas; coast, saltwater flats/edges of saltwater lagoons, low-lying forest country (AUS); thrives in coastal/inland districts (SOU); mist belt of midlands to coast (SOU/NATAL)
Soil wide range; sandy soil; waterlogged soil; salt tolerant; swampy ground in subsaline areas (EUR); some flooding tolerated (AUS). Temperature frost-tender. Rainfall high rainfall areas (AUS); summer rainfall areas (SOU)

Economic and other uses
Timber. Land use windbreak, shade, afforestation, amenity

Nectar rating + honeybee species; blooms, nectar flow; composition
N1 BRA[tm] (Smt/60; Wie/80); MAE (Chl/75); MAY (Bro/82; Cra/73); URS (Glu/55)
N3 AUS/NSW(Goo/47); AUS/QD(Bla/72); SOU/CAPE,NATAL,TVL,tm(And/73)

Blooms ix-xi (subtropical AUS, v temperate AUS, Pen/61); vi-vii (AUS/QD); iii-vii (BRA). Nectar flow reliable (SOU, Dai/70).

Sugar concentration [medium] 51% (Caa/72); 32-37% (Jul/72); 38-45% (Wie/80). Sugar analysis (Maz/59)

Pollen
P3 AUS/QD; SOU/CAPE, NATAL, TVL. P BRA. Yield small, but reliable in winter (AUS, Pen/61); fair (SOU, Loo/83); good (AUS/83). Pollen grain described (Bah/73). Reference slide

Recommended for planting to increase honey production
AUS (Aus/83); BRA (Wie/80); SOU (Dai/70; Sou/63)

Honey: chemical composition
Water [medium] 17.0, 17.5% (Fle/63)
Ash [medium] 0.211, 0.201%
pH 4.2, 4.3

Honey: physical properties
Pfund medium amber (Bla/72); dark amber (Cra/75); 85.1, 80.1 mm, amber (Fle/63)

185 Eucalyptus rubida Deane & Maiden; Myrtaceae

candle bark gum (En/AUS, SOU)
Tree, <30 m

Distribution subtropical Africa, Oceania; native to AUS/NSW, TAS. Habitat <1200 m altitude (AUS); sheltered valleys or occasionally on slopes/ridges

Soil moist alluvial flats; slate, igneous soils; sandy and black turf soil (SOU); deeper dry soils. Temperature warm moist situations preferred; frost and cold wind tolerated. Rainfall 750-1000 mm (AUS/SA); summer rainfall area, sub-humid interior (SOU); only moderately drought tolerant

Economic and other uses
Fuel. Timber, but not durable. Land use windbreaks (useful for cold areas); amenity. Other uses pulp for paper

Warning
Frequently attacked by leaf-eating beetles (AUS, Key/77)

Nectar rating + honeybee species; blooms, nectar flow
N1 SOU/TVL[tm](Bey/68)
N2 AUS/SA(Boo/72)
N3 AUS/VIC(Gom/73); SOU/NATAL, OFS, TVL, tm(And/73)
Blooms i-ii; buds 12-15 mths before flowering (AUS, Pen/61); summer (SOU, Dai/70). **Nectar flow** heavy every 2 yrs (AUS/SOU, Boo/72)

**Pollen**
P2 AUS/SA. P3 AUS/VIC; SOU/NATAL, OFS, TVL. P SOU/TVL. 
**Yield** moderate, annual (Boo/72). **Pollen value** fair (Pen/61); moderate (Boo/72)

**Recommended for planting to increase honey production**
SOU (Dai/70; Loo/82; Sou/63). See **Warning**

**Honey: physical properties**
**Colour** dark (And/73); clear (Gom/73). **Pfund** amber (Gom/73)

**187 Eucalyptus sideroxylon A. Cunn. ex Woolls; Myrtaceae**

black ironbark (En/AUS, SOU); mugga, red ironbark (En/AUS) 
**Tree**, <30 m, only 18 m in dry areas; **fl stamens** pink/white

**Distribution** subtropical Africa, Asia, Oceania, S America; temperate (Med) Africa, Oceania; tropical Africa; native to AUS/NSW, QD, VIC. **Habitat** high rainfall coastal areas; also on ridges, plains and undulating hill country (AUS); open forest hillsides (AUS/QD); sub-humid zone (SOU) 

**Soil** poor shallow soils including clay, gravel and sand (AUS). 

**Temperature** fairly frost tolerant; high summer max >100°. 

**Rainfall** low to medium (AUS); drought tolerant (SOU) 

**Economic and other uses**
**Fuel. Timber.** **Land use** windbreak, shade, amenity. **Other uses** oil; tannin

**Alert to beekeepers**
Pollen inadequate for brood rearing; colony populations decrease especially after heavy flow (AUS, Pen/61)

**Nectar rating + honeybee species; blooms, nectar flow**

**N1** AUS/NSW(Cok/63); AUS/QD(Bla/72); AUS/VIC(Gom/73); SOU/TVL,tm (And/73) 

**N2** AUS/NSW(Goo/47); PAK,ac(Pak/77) 

**Blooms** v-vii (AUS, Pen/61); buds 5-6 mths before flowering; 
**winter** (Gom/73); vii-x (AUS/QD); autumn-spring, profuse (SOU, Dai/70). **Nectar secretion** plentiful (Gom/73); so profuse that nectar can be shaken out by hand (Loo/83)
Pollen
P3 AUS/QD; PAK. Alert to beekeepers pollen inadequate for brood rearing; colony populations decrease especially after heavy flow (AUS, Pen/61)

Recommended for planting to increase honey production
AUS (Aus/83); SOU, sub-humid zone (Dai/70). Propagate by seed, which is freely produced but often of low viability (Pen/61). Seed provenance important (Pen/61). See Alert to beekeepers

Honey: chemical composition
pH 4.6 (Lan/66)

Honey: physical and other properties
Colour light straw (And/73); pale (Gom/73). Pfund 41 mm, extra light amber (Bla/72; Lei/72; Roc/68); 47.4 mm, extra light amber (bulk honey, Lan/66)
Viscosity "good body" (Bla/72)
Granulation rapid, fine (And/73; Bla/72; Gom/73)
Flavour mild (Gom/73)

191 Eucalyptus wandoo Blakely; Myrtaceae

Drought syn Eucalyptus redunca Schauer var. elata Benth.

wandoo, white gum (En/AUS)
Tree, 20-30 m

Distribution subtropical Oceania; temperate (Med) Africa; native to AUS/WA. Habitat <300 m altitude (AUS)

Soil granite soil with clay (AUS); brown/sandy loam, gravelly soil (AUS). Rainfall drought tolerant

Economic and other uses
Fuel. Timber. Land use shade, amenity. Other uses tannin from bark and wood

Nectar rating; blooms, nectar flow
N1 AUS/WA(Col/62)
N AUS/WA(Smt/69)
Blooms winter in N of range and summer in S, buds 2-3 yrs before flowering, but flowers annually (AUS, Pen/61)

Honey flow
Honey yield [high] 90 kg/colony/season (AUS, Pen/61)

Pollen
P3 AUS/WA. Yield abundant (Pen/61). Pollen value poor (Pen/61)
Honey: physical and other properties

Pfund light amber to amber (Cra/75); extra light to light amber (Lei/72; Smt/69); 36 mm, extra light amber (Smt/67)

Granulation medium grain, and colour then light cream (Cra/75; Pen/61)

Flavour mild (Cra/75; Lei/72; Smt/69)

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205 Gleditsia triacanthos L.; Leguminosae

DROUGHT/SALT

Honey locust, thorny locust (En/USA)

Tree, <45 m, deciduous, spreading, thorny; thornless cvs available; fls greenish, honey-scented

Distribution subtropical Oceania, Asia, Africa; temperate N America; tropical Africa; native to N America. Habitat tropical highlands; rich bottom land USA; steppes URS; veld SOU; outback AUS

Soil wide range; acid and alkaline; sand to clay; deep sandy loam best; slightly saline soil tolerated. Temperature v frost tolerant. Rainfall 500-2500 mm with 6-8 mths max dry period; drought tolerant where deep soil moisture available; semi-arid conditions

Economic and other uses


Warning

Forms dense thickets and has become a nuisance in AUS/QD (Usa/79)

Nectar rating + honeybee species; blooms, nectar flow

N1 PAK,ac(Pak/77)
N2 URS(Glu/55)
N3 SOU,tm(And/73); USA/LA(Pel/76)

Blooms iii-iv (PAK); xi-iii (SOU); v-vi (USA). Nectar flow too short for large yield (Pel/76). Nectar secretion 0.154 mg/fl/day (Sim/80). Sugar concentration [medium] 45.5% (Sim/80). Sugar value (mg/fl/day) [medium] 0.156 (Sim/75); 0.189 (Sim/80)

Honey flow

Honey potential [moderate] 250 kg/ha (Rom, Apc/68; Cir/80)

Pollen

P3 SOU. P PAK. Yield 0.004 mg/10 fls (Sim/75). Chemical analysis (Sta/74). Pollen grain illustrated (Lie/72); illustrated and described (Ada/76). Reference slide

Honey no data ("pure honey not known", And/73)
207 Glycine max (L.) Merr.; Leguminosae

DROUGHT

soya bean; soja (Es)
Herb, annual, 45-120 cm depending on cv; fls white/purple

Distribution subtropical N and S America, Asia, Africa; temperate Asia, N America; tropical S America, Caribbean, Asia, Africa; native to SE Asia. Habitat cultivated crop plant

Soil wide range, even poor; loose soil preferred, moist but not waterlogged; some acidity tolerated, but plant may be v sensitive to acidity. Temperature optimum 20-25°; warm but not too hot in summer; damaged by frost. Rainfall drought tolerant after germination and early development; wet seasons tolerated

Economic and other uses
Food - seed; oil and meal from seed; bean sprouts; green vegetable. Fodder - hay/pasture/silage/concentrates; meal from oil extraction. Soil benefit cover, green manure, N-fixation.

Other uses linoleum, printing ink, glycerine, insecticides, rubber substitutes, paints, soaps

Nectar rating; blooms, nectar flow; composition
N1 CHN(Tse/54); USA/?AR(War/65); USA/MS(Tat/56)
N2 ?USA/AL(Bas/67); USA/LA(Lie/72); USA/TN(Lit/54)
N3 USA/NC, TN(Pel/76)

Blooms xii-iii (BRA, Jul/72); late vi-early viii (USA/IL, Jay/70); mid vii-viii (USA/WI, Eri/75). Nectar flow starts 4 days after first flowers open, thereafter only at air temp above 21-24° (Eri/75). Nectar secretion highest with hot days and warm nights, reduced by low humidity and cool weather (Lov/77); v dependent on soil fertility (Frj/70); none on clay soil (Lov/57b); nectar volume may be small and its attractiveness varies greatly; sometimes bees ignore it (Frj/70). Sugar concentration [medium] 31-38% (Jul/72); the following results are for nectar from honey sacs of bees: 33-36% (several cvs, Eri/75); 43% (mean, 55 samples, Jay/70); 28.5% (mean, 2 yrs, Lid/81); 18-55% (AA694/77); 33.0-39.7% (Hark cv, AA1242/77)

Honey flow
Honey yield (kg/colony/season) [high] 14-45 (Frj/70); up to 45 (USA/AR, IL, Jay/70); 36 (USA/AR, Lov/77)

Pollen
P ?USA/NC, TN. Colour of load grey to brown, small (Eri/75; Jay/70). Pollen grain illustrated (Lie/72). Reference slide

Honey: physical and other properties
Colour v light (Lov/58). Pfund white to extra light amber (Eri/75); light amber (Lov/56); water white (Lov/57b); 47-49 mm, extra light amber (Pel/76, Roc/68)
Viscosity "rather thin" (Cra/75; Pel/76); "medium body" (Lov/56)
Granulation rapid (Pel/76)
Flavour characteristic (Eri/75); distinctive (Lov/56); unusual (Pel/76)

208 Gmelina arborea Roxb.; Verbenaceae

DROUGHT

melina; malayna (GAM); kumil (INI)
Tree, 15-80 m, deciduous; fls yellow and brown, fragrant, produced when tree is leafless
Distribution tropical Africa, Asia; native to Asia. Habitat tropical forests and plantations; humid lowlands
Soil good, well drained but moist alluvium; plant stunted by dry sand, leached acid soil and v thin impermeable soil. Temperature <52°; severely damaged by frost. Rainfall 750-4500 mm; where <1000 mm, grows along water courses or irrigated areas; some provenances drought tolerant

Economic and other uses
Fuel. Timber. Other uses paper from pulp

Warning
Produces heavy shade limiting other growth; dead lvs create a mild fire hazard; trees may die young (10 yrs); cattle eat lvs/bark and may cause damage

Nectar rating + honeybee species; blooms, nectar flow
N1 GAM[tm](Sve/80); INI/TAM,ac(Chn/74)
N GAM[tm](Mea/76)
Blooms ?ii (GAM)

Honey flow
Honey yield [high] mean 20, max <100 kg/colony/hive

Pollen
P1 INI/TAM

Honey no data

217 Gymnopodium antigonoides (Robinson) Blake;
Polygonaceae

DROUGHT
dzidzilché (Es/MEX)
Shrub/tree, 5-8 m, deciduous, branching near base; forms pure stands, "aguanales" (MEX); fls pale yellow-green, fragrant
Distribution tropical C America. Habitat dry rocky areas, often on slopes (MEX/Yucatan); grows again after felling and burning; lowland rainforest (MEX)
Soil shallow, rocky. Rainfall drought resistant

Economic and other uses
Fuel

Warning
Difficult to eradicate from soil; nuisance in agave-growing areas (Ord/83)

Nectar rating; blooms, nectar flow
NI MEX(Ord/63; Ord/66; Ord/72; Ord/83; Saf/73; Smt/60; Wis/53)
Blooms iii-iv (MEX/YUC). Nectar secretion heavy (MEX, Saf/73)

Honey flow
Honey yield [high] 136 kg/colony/season, mixed with that of Viguieria helianthoides (MEX, Smt/60); "most valuable plant for commercial apiculture" in Yucatan peninsula (MEX, Ord/83); several crops/yr, after good rains (MEX, Saf/73)

Honey: chemical composition
Water [medium] 18.0% (Rob/56)
Amylase 24. HMF <1 ppm

Honey: physical and other properties
Colour light (Ord/83). Pfund 64 mm, light amber (Cra/75; Rob/56)
Relative density 1.4171 (Rob/56)
Flavour delicate (Ord/83); characteristic (Rob/56). Aroma characteristic (Rob/56)

220 Hedysarum coronarium L.; Leguminosae DROUGHT

French honeysuckle, Spanish sainfoin, sweetvetch; sulla (It)
Herb, 1-2 m, deep rooted, erect/prostrate, biennial/perennial; fls deep red/purple, fragrant
Distribution temperate (warm) Europe, Africa, Oceania
Soil deep, rich, calcareous; also poor compact soil if it contains lime; not acid, saline or stagnant soil. Temperature not winter-hardy to N of Alps (Maz/82). Rainfall winter rain or irrigation preferred; drought resistant

Economic and other uses
Fodder - hay/green fodder. Soil benefit - green manure
Nectar rating; blooms, nectar flow; composition

NI ITA (Ric/78); MAQ (Far/79)

Blooms ii–v (MAQ). Sugar analysis of nectar (Bat/72)

Honey flow
Honey yield - in Italy, highest in Calabria, Sicily and Sardinia (Ric/77)

Pollen
Pl ITA. Colour of load grey (Ric/77). Pollen grain in honey is regarded as indicative of Italian source, although it is also found in N African honey (Ric/77). Reference slide

Honey: chemical composition

Water [medium] 15.3–20.3% (19 samples, Fin/74)

Sugars, total 71.30–79.30%. Sucrose [medium] 1.42–5.20% (Fin/74).
Sugars (as % of total): glucose 44.57% (Bat/73); 47.0% (Maz/59);
fructose 46.44% (Bat/73); 49.2% (Maz/59); maltose 3.9% (Maz/82);
also contents of isomaltose, trehalose and gentiobiose (Bat/73)

Ash [low] 0.060% (10 white samples, Fin/74); 0.044% (17 samples, Pes/80); [medium] 0.169% (9 light amber samples, Fin/74)

Lactone 9.97, 10.25 meq/kg

Amylase 15.85, 26.92. HMF 1.68, 1.04 ppm

Nitrogen 0.032% dry wt (Bos/78). Amino acids, free 0.145%, protein 0.120%

Honey: physical and other properties

Colour v light (Cra/75); yellowish (Far/79). Pfund 11–34 mm, white (Bab/61; Fin/74; Ric/78); also 46–82 mm, light amber (Fin/74); white to water white (Pia/81)

Optical rotation -26.36 deg (Bat/73). Electrical conductivity 0.000173 per ohm cm (Pes/80)

Granulation fine grain (Pes/80); becomes white but not hard (Pia/81)

Flavour mild (Cra/75); delicate but characteristic, in drought areas taste is slightly acerbic like raw green beans (Pia/81).

Aroma v slight, almost none (Pes/80; Pia/81; Ric/78)

**221 Helianthus annuus L.; Compositae**

sunflower; tournesol (Fr); girasol (Pt/BRA); Sonnenblume (De);
bunga matahari, kembang srenge'ns (In)

Herb, <1–3 m, annual/perennial; fls yellow, large capitulum, 1000–2000 florets/head on single-headed plant; nectary in fl, also extrafloral nectaries in bract edges beneath fl head and in basal edges of laminae of top lvs of stem (Frj/70)

**Distribution** temperate Europe, S America, N America, Asia;
subtropical Asia, Africa, Oceania, N America, S America; tropical Africa, Asia, S America; native to N America and Mexico.

**Habitat** cultivated crop plant; well adapted to all tropical/sub-tropical savannah regions

**Soil** wide range but deep moisture-retentive soils preferred; "strong" nitrogen-rich; some salinity/alkalinity tolerated.

**Temperature** warm climates preferred, occasional low temperatures tolerated; low temps tolerated better than by soya bean.

**Rainfall** some drought tolerated especially when plant well established; intermittent rainfall preferred

**Economic and other uses**

**Food** - oil from seed; seed. **Fodder** - oilcake; stems and lvs, fresh/silage; bird-seed. **Land use** amenity. **Other uses** oil for varnish/soap; dried green stems/lvs for smoker fuel (How/79)

**Warning; alert to beekeepers**

**Warning** plants in high rainfall areas may be damaged by disease (Liz/76). **Alert to beekeepers** swarming has been recorded when hive space is insufficient for brood rearing (Cri/57)

**Nectar rating + honeybee species; blooms, nectar flow; composition**

| N1 | BUL (Sim/65); BUM (Zma/80); CAF/MAN (Smi/72); ETH [tm] (Cra/73); FRA (Lou/81); INI/MAH, ac (Chu/80); ITA (Ric/76); MOZ [tm] (Cra/73); PAK, ac (Pak/77); PAR (Bra/54a); ROM (Cir/77; Int/65); UGA [tm] (Nsu/77); URS (Ave/78) |
| N2 | INO (Bee/77); ISR (Chi/65); SOU, tm (Mou/72); SOU/TVL, tm (And/73; Cri/57); URS (Fed/55); ?YUG (Kon/77) |
| N3 | AUS/VIC (Gom/73); GFR (Gle/77); USA/UT (Nye/71) |

**Blooms** xii-iii (BRA, Jul/72); xi-xii, iv (BUM); vii-ix (GDR, Bec/67); vii (HUN, Pet/77); vii-ix (ROM). **Nectar flow** each fl 2-3 days (AA1231/78). **Nectar secretion** (mg/fl/day) 0.33 (Han/80); 0.212-0.500 (means, 10 cvs, AA1231/78). Secretion is highest: during first 10 days of bloom (AA127/65); at 09.00 h (AA969/79); from 10.00-14.00 h (Maz/82); in plants with long daily exposure to light (experimental, AA165/79); at 80-90 m from shelter belt (AA127/65). Effects of various fertilizers also reported (AA1231/78). **Sugar concentration** [medium] 42% (Jul/72); 35-38%, up to 60% in hot areas (Maz/82); 53.5% (Mog/58); 42.2% (Pek/78); 45.4% (Pet/77); 38% (Zma/80); 33.3-48.9% (means, various cvs/hrs, AA1231/78). **Sugar value** (mg/fl/day) [medium] 0.27 (Han/80); 0.097-0.192 (means, various cvs/hrs, AA1231/78); 0.1135-0.2522 (means, 4 yrs, AA805/60); 0.11-0.25 (Frj/70). **Sugar analysis** (Bat/73a; Wyk/52; AA17/61; AA753/75). **Potassium content and fluorescence** AA491/80
Honey flow
Honey yield (kg/colony/season) [moderate] 2.5-15.0 (poor year, usually double, ROM, AA577/81); 12 (URS/Rostov, AA27/65).
Honey potential (kg/ha) [moderate] 39.7 (BUL, Pek/78); 18.6-49.0 (10 cvs, BUL, AA1231/78); 30-60 (CDR, Bec/67); 56-69 (HUN, Pet/77); 34-102 (ROM, Apc/68; Cir/77); 56.7 (ROM, Bac/60); 34-140 (ROM, Cir/80); 43-63 (4 yrs, ROM, AA305/60); 24-63 (4 cvs, ROM, AA815/63); in URS, varies from 13 (Bashkiria) to 27.4 (Ukraine, Fed/55)

Pollen
P1 FRA; INO; SOU/TVL. P2 AUS/VIC; GFR; INI/MAH; ITA; SOU/TVL. P3 NEZ; PAK; ROM; UNY/UT; ZIM. Yield 3.9-11.5 mg/10 fls (means for 13 cvs, BUL, AA1231/78); stamen yields 26 mg/day (Maz/82); high (Cri/57). Chemical composition (Cir/80; Sta/74); 18.5% crude protein (AA244/78). Colour light yellow to dark orange (varies with cv, Wal/78). Pollen grain illustrated and described (Saw/81); [under-represented in honey] 11 000 grains in 10 g (Pes/80). Reference slide

Honeydew produced ROM (Apc/68)

Recommended for planting to increase honey production
?NEZ, Wal/78; URS, Ave/78. Propagate by seed. Cultural notes (Liz/76). See Warning; alert to beekeepers

Honey: chemical composition
Water [medium] 14.70-18.58% (15 samples, Bac/61); 15.60-20.96% (28 samples, Iva/78)
Sugars, total 74.24-79.30% (Iva/78). Glucose [medium] 34.72-42.33% (Bac/65); 31.09% (Mur/76). Fructose [medium] 34.75-40.28% (Bac/65); 41.16% (Mur/76). Sucrose [medium] 1.32-3.60% (Bac/65); 0.00-6.65% (Iva/78). Reducing sugars 69.40-77.76% (Iva/78); 72.86% (Mur/76). Dextrin 1.00-5.30% (Bac/65)
Ash [low] 0.06-0.27% (Bac/65); 0.04-0.15% (Iva/78); 0.32% (Mur/76); 0.09-0.11% (5 samples, Pes/80)
PH 3.6-3.9 (Uni/83). Total acid 16.0-48.0 meq/kg (Iva/78)
Amylase 8.3-38.5 (Bac/65); 8.0-20.4 (Iva/68). HMF 0.19-9.41 ppm (Iva/78)
Nitrogen 0.237% dry wt (Bos/78). Amino acids, free 0.212%, protein 0.217%. Protein 0.0067-0.0070% (13 samples, Gen/67)
Other constituents - antibacterial properties reported (Pop/79a)

Honey: physical and other properties
Colour yellow or golden (And/73; Mur/66; Ric/78); egg-yolk yellow or dark (Cra/75); golden with greenish tinge (Fed/55). Pfund amber (Fed/55); Pfund-Lovibond grade (Aub/83)
Relative density 1.425-1.452 (Bac/65). Optical rotation -0.65 to -3.10 deg (Iva/78). Electrical conductivity (per ohm cm) 0.000306 (Iva/78); 0.000307-0.000347 (5 samples, Pes/80)
Granulation rapid (Mot/64); fine (Pes/80); soft (Ric/78)  
Flavour mild (And/73); mild but characteristic (Cra/75); distinctive, rather like butter (Uni/83). Aroma strong (Cra/75); fairly strong (Pes/80)

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**237 Ipomoea batatas (L.) Lam.; Convolvulaceae**  
DROUGHT  

sweet potato; batata doce (Pt/MOZ)  
Herb, perennial/annual with trailing stems; fls dark pink  
**Distribution** temperate (warm) N America, Europe; subtropical N America; tropical C America, S America, Caribbean, Asia; native to S America. **Habitat** cultivated crop plant especially in wetter regions of tropics  
**Soil** wide range; sandy loam preferred. **Temperature** frost tender; prolonged exposure to <10° is damaging. **Rainfall** moderately drought resistant; minimum 900 mm, evenly distributed; high humidity undesirable  

**Economic and other uses**  
**Food** - tubers. **Fodder** - tubers. **Other uses** - for commercial starch

**Nectar rating + honeybee species; blooms, nectar flow**  
NL MOZ(tm)(Cra/73)  
Blooms x-ii (tropical America, Ord/83); rainy season (ZIM, Wid/72)  

**Honey: chemical composition**  
Water [high] 24.3% (Lin/77)  
Glucose [medium] 33.4%. Fructose [medium] 37.0%. Sucrose [medium] 0.1%  
pH 3.9. **Free acid** [medium] 30.9 meq/kg (39.8 after 1 yr)

**Honey: physical and other properties**  
**Colour** earth yellow  
**Relative density** 1.37

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**244 Jacquemontia nodiflora G. Don; Convolvulaceae**  
DROUGHT

campanitas (Es/DOR)  
Herb, climber  
**Distribution** tropical C America, Caribbean. **Habitat** dry areas  
where it covers other xerophytic vegetation; roadsides  
**Soil** poor dry soil; not fertile damp soil. **Rainfall** low rainfall areas; drought resistant
Nectar rating; blooms, nectar flow
N1 DOR(Ord/64; Ord/66)
N3 DOR(Ord/83)
Blooms ix–xi or xii (tropical America); ix–xii (DOR).
Nectar secretion "plentiful for most of the day" (Ord/83)

Honey flow
Honey yield "one of the most valuable sources" in DOR (Ord/64)

Pollen
P DOR

Honey no data

246 Julbernardia paniculata (Benth.) Troupin; Leguminosae

mucondo, mumué, omanda (ANA); munsa (TAN)
Tree, <15 m, semi-evergreen; fls creamy-white, calyx and stalks hairy, brown
Distribution tropical Africa. Habitat dry evergreen forest
Soil plateau and escarpment soils; sandy. Rainfall dry areas

Economic and other uses
Timber for log hives (Ros/60). Other uses strong rope from bark for thatching; hives made from bark (Ros/60)

Nectar rating + honeybee species; blooms, nectar flow
N1 ANA,tm(Ros/60); TAN,tm(Smt/60; Tak/76); ZAM,tm(Smt/59; Sto/82; Zam/79)
Blooms iv (southern Africa, Pag/77); iii–vi, vii (ZAM)

Honey: physical and other properties
Colour "clearer than Brachystegia honey" (Ros/60). Pfund extra light amber (Cra/75)
Granulation slow, coarse (Cra/75)

272 Lotus corniculatus L.; Leguminosae

bacon and eggs, birdsfoot trefoil; gemeine Hornklee (De); lotier corniculé (Fr/ALC); trifoglio giallo, ginestrina (It)
Herb, perennial, long tap-root; fls yellow tinged red
Distribution temperate Europe, Asia, N America, S America, Oceania; subtropical Africa; native to temperate EUR and Asia. Habitat cultivated forage crop; on hilly, marginal and poorly drained land not suitable for alfalfa (CAN)
Soil poor shallow dry soil tolerated; also waterlogged and saline conditions. Rainfall drought resistant

**Economic and other uses**

Fodder - pasture; hay. Land use amenity, eg roadside ground cover

**Nectar rating; blooms, nectar flow; composition**

N1 CHL(Kar/56; Kar/60); FRA(Lou/81); IRN(Cra/73); ITA(Ric/78); USA/VT(Med/54)

N2 CAF/ONT(Ada/79); HUN(Pet/77); URS(Fed/55)

N ALG(Ske/72); BRA,tm(Caa/72); EUR(Maz/82); NEZ(Wal/78)

Blooms x (BRA); v-ix (EUR); vi-viii (USA). Nectar secretion (mg/fl/day) 0.19 (Han/80); 0.33-0.55 (3 yrs, AA712/67). Sugar concentration [medium] 41% (Caa/72); 40% (Han/80); 19-39% (during one day, max at 15.00 h, Mor/58); 35% (mean, Pek/77); 30.73% (Pet/77); 27.5-66.7% (3 yrs, AA712/67); 5-18% (3 yrs, AA1244/77); see also Mue/82; [low] 15%, 26% (Frj/70); 13.8-17.0% (Mog/58). Sugar value (mg/fl/day) [medium] 0.1-0.221 (AA712/67); [low] 0.08 (Han/80). Sugar analysis (Bat/73a; Kay/78; Maz/59; Pec/61)

**Honey flow**

Honey potential (kg/ha) [moderate] 1st crop 13.3, 2nd crop 12.9 (BUL, Pek/77); 15-30 (GDR, Bec/67; ROM, Apc/68; Cir/80); 16-37 (3 yrs, POL, AA712/67); 15-25 (URS, Fed/55)

**Pollen**

P1 FRA. P3 ITA. P NEZ. Colour of load light brown (Han/80); light grey (Ric/78). Pollen grain illustrated and described (Nak/65). Reference slide

**Honey: chemical composition**

Sugars (as % of total sugars): Glucose 42.9, 48.2% (Maz/59); 33.8% (Maz/64). Fructose 52.3, 50.3% (Maz/59); 54.8% (Maz/64). Sucrose 4.8, 1.5% (Maz/59); 4.6% (Maz/64). Maltose 4.7% (Maz/64). Fructomaltose 2.1%

**Honey: physical and other properties**

Colour light (Cra/75); greenish (Ske/72). Pfund white (Lov/56) Viscosity "heavy body" (Lov/56). Electrical conductivity 0.000115 per ohm cm (Vor/64) Granulation rapid (Ske/72) Flavour like clover (Lov/56)

280 Mahonia trifoliata (Moric.) Fedde; Berberidaceae DROUGHT

agritos, palo amarillo (Es/MEX) Shrub, <4m, forms large thickets; fls yellow, fragrant
**Distribution** subtropical N America, C America.  **Habitat** steppe area of N and central states of MEX, W of USA/TX and S of USA/NM; highways and road verges; fallow ground

**Rainfall** <400 mm; drought tolerant

**Economic and other uses**

Food  - fruit for jellies, cakes, wine; seed for coffee substitute.

Other uses  dye and ink from wood

**Nectar rating; blooms, nectar flow**

N1 MEX(Ord/83)

**Blooms** i-iv (tropical America, Ord/83). Juice of fruit also collected by bees, then combs in hive show reddish spots (Ord/83)

**Honey flow**

Honey yield "high" (Ord/83)

**Pollen**

Pl MEX.  Reference slide

**Honey: physical properties**

Pfund light amber (Ord/83)

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**290 Medicago sativa L.; Leguminosae**  

 alfalfa, lucerne; luzerne (En/CAF); alfalfa (Es/ARG, CHL, MEX); luzerna (Pt/MOZ); erba medica (It)

Herb, <80 cm, perennial; winter-hardy; wilt- and drought-resistant cvs; fls purple, white, greenish-yellow depending on subspecies

**Distribution** temperate Europe except N, Oceania, N America, S America, Asia; subtropical Oceania, Africa, N America, Asia; tropical Africa, Asia; native to Europe and southern central Asia; native to NW Iran.  **Habitat** cultivated crop plant but often naturalized; sun needed; steppe region and irrigated zones of C Asia and Transcaucasia

**Soil** deep well drained alkaline soil preferred; limestone (SOU); not heavy soils; rhizobia (bacteria) must be added to some soils; plant not salt tolerant.  **Temperature** warm dry climates best; high temperatures tolerated; plant hardy only at low RH; hardiness dependent on cv.  **Rainfall** short or moderate droughts tolerated; drought tolerance dependent on cv

**Economic and other uses**

Fodder - pasture, hay, silage, lucerne meal.  **Soil benefit** N-fixation
Warning; alert to beekeepers

Warning not grown in Egypt as it harbours cotton pests during the dry season (Why/53). Alert to beekeepers in some areas pollen inadequate for brood rearing (USA, Mcg/76)

Nectar rating + honeybee species; blooms, nectar flow; composition

N1 ARG(Lut/63; Per/80); AUS/SA(Pur/68); BEG(Grn/65); CAF/ONT-(Tow/76); CAF/QUE(Cha/48); CAF/SASK(Mec/58); CHN(Tse/54); FRA(Bor/59; Lou/81); ITA(Ric/78); MOZ(tm)(Cra/73); PAK,ac(Pak/77); URS(Ave/78; Fed/55); USA/CA(Jay/54; Pel/76; Van/41); USA/CO(Pel/76; Wio/58); USA/?IA,ID,KS(Pel/76); USA/ND(Lei/54); USA/?NE,NM, NV, NY, OK(Pel/76); USA/UT(Nye/71); USA/VT(Med/54); USA/WI,WY(Pel/76)

N2 AUS/NW(Goo/47); AUS/VIC(Gom/73); CAF/ALTA(Hen/77; Wes/49); CAF/QUE(Cou/59); INI/MAH(ac)(Chu/80); MEX(Ord/72); SOU,tm(And/73); URU(Rod/59); USA/AL(Bas/67); USA/CO(Wio/65); USA/SH(Bai/55); USA/SD(Pel/76)

N3 AUS/QD(Bla/72); MEX(Ord/83)

N CHL(Roj/39); CZE(Svo/58); EUR(Maz/82); NEZ(Wal/78); OMA(Dut/77)

Blooms xii-ii (AUS/QD); vi-ix (EUR); viii-ix (INI/MAH); v-vii (USA/OR). Nectar secretion 0.24-0.83 mg/fl/day (Han/80); v dependent on soil moisture and temperature (Maz/82); secretion lower after low night temp (AA415/59). Sugar concentration [medium] 18-48% (Cir/80); 14.7% (Haa/60); 17-60% (Han/80); 20-25% (Mog/58); 30-60%, depending on soil moisture (Nye/71); 27-33% (Shw/53); 28.6-44.6% (AA849/64); 40-57% (AA850/64); 27.3-63.6% (AA347/77); 21-41% (AA694/77). Sugar value [medium] 0.07-0.25 mg/TIl/day (Han/80). Sugar analysis (Bat/72; Maz/59; Maz/82; Wyk/52; AA156/55; AA493/66; AA582/77). Potassium content and fluorescence (AA491/80)

Honey flow

Honey yield (kg/colony/season) [high] 56-112 (Mcg/76); 45-136 (USA, Lov/77). Honey potential (kg/ha) [high] 473-1060 (CZE, AA849/64); [moderate] 25-270 (GDR, Bec/67); 25-30, and irrigated 200 (ROM, Apc/68; Cir/80); irrigated 260 (URS, AA336/83). Heaviest honey yields when M. sativa is grown for seed and fields are left uncut (Nye/71); low rainfall areas best for honey production (SOU, And/73); not reliable (NEZ, Wal/78)

Pollen

P1 AUS/VIC; FRA; URS. P3 AUS/SA; AUS/QD; INI/MAH; SOU; USA/CA; USA/CO. P CAF/QUE; NEZ; PAK; USA/UT. Yield 5.3 mg/fl (Maz/82); heavy (AUS/VIC, Gom/73). Pollen value greater in dry hot regions, also varies according to area and other crops nearby (Frj/70); bees prefer other sources (SOU, And/73). Alert to beekeepers in some areas pollen inadequate for brood rearing (USA, Mcg/76). Chemical analysis (Shp/79). Colour lemon yellow but load auburn and hazel (Nye/71). Pollen grain illustrated and described (Nye/71). Under-represented in honey (Maz/82).

Reference slide
Honeydew

Honeydew produced, and collected by bees from *Therioaphis trifolii* form *maculata* (Buckton), Callaphididae; honey analysis (USA/CA, Whi/62)

Recommended for planting to increase honey production

URS(Ave/78). Propagate by seed. Useful in crop rotation schemes, especially prior to cotton. See Warning; alert to beekeepers

Honey: chemical composition

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Low: 14.4-17.5%</td>
</tr>
<tr>
<td></td>
<td>Medium: 18.6%</td>
</tr>
<tr>
<td>Sugars, total</td>
<td>79.4% (77.7% after 44 days at 50°, Woo/76a)</td>
</tr>
<tr>
<td>Glucose</td>
<td>Medium, also low: 22.30% (Moh/82); 32.62-35.01% (Whi/62); 35.1% (33.2%, Woo/76a)</td>
</tr>
<tr>
<td>Fructose</td>
<td>Medium, also low: 36.20% (Moh/82); 38.37-40.87% (Whi/62); 34.8% (36.0%, Woo/76a)</td>
</tr>
<tr>
<td>Sucrose</td>
<td>Medium: 5.21-6.80% (Moh/82); 2.05-4.80% (Whi/62); 2.5% (0.8%, Woo/76a)</td>
</tr>
<tr>
<td>Reducing sugars</td>
<td>71.60% (Moh/82)</td>
</tr>
<tr>
<td>Maltose</td>
<td>9.00% (Moh/82); 4.72-6.87% (Whi/62); 4.0% (5.1%, Woo/76a)</td>
</tr>
<tr>
<td>Isomaltose</td>
<td>0.27%</td>
</tr>
<tr>
<td>Trehalose</td>
<td>1.92%</td>
</tr>
<tr>
<td>Gentiose</td>
<td>0.24%</td>
</tr>
<tr>
<td>Raffinose</td>
<td>0.17% of total sugars (Bat/73)</td>
</tr>
<tr>
<td>Melezitose</td>
<td>1.6%</td>
</tr>
<tr>
<td>Turanose</td>
<td>1.4%</td>
</tr>
<tr>
<td>Ash</td>
<td>Low: 0.10% (Moh/82); 0.035-0.078% (Whi/62)</td>
</tr>
<tr>
<td>pH</td>
<td>5.5 (Moh/82); 3.60-4.05 (Whi/62); 3.80 (3.45 after 44 days at 50°, Woo/76)</td>
</tr>
<tr>
<td>Total acid</td>
<td>17.81-33.89 (Whi/62); 15.5 (16.5, Woo/76)</td>
</tr>
<tr>
<td>Free acid</td>
<td>16.70 (Moh/82); 9.22-22.23 (Whi/62); 11.1 (12.5, Woo/76)</td>
</tr>
<tr>
<td>Lactone</td>
<td>3.24-12.06 (Woo/76); 4.4 (4.4, Woo/76)</td>
</tr>
<tr>
<td>Amylase</td>
<td>7.6-7.7 (Edw/75); 12.8 (after dialysis, Mau/71); 18.2 (Sce/66); 12.9-21.9 (Whi/62)</td>
</tr>
<tr>
<td>Acid phosphatase</td>
<td>8.8 µmoles/100 g/h (Mau/71)</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.025% dry wt (Bos/78); 0.018-0.039% (Whi/62); 0.18% (0.17%, Woo/76)</td>
</tr>
<tr>
<td>Amino acids</td>
<td>Free 0.110% dry wt (Bos/78); 741.7 µM/100 g (261.2, Woo/176a); protein 0.099% dry wt (Bos/78)</td>
</tr>
<tr>
<td>Contents of individual acids (proline 80% of total, Woo/76a)</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>0.0052-0.0065% (4 samples, Gen/67); 0.18% (Mau/71)</td>
</tr>
<tr>
<td>Volatile compounds</td>
<td>46 present, 13 named (Woo/76a)</td>
</tr>
</tbody>
</table>

Honey: physical and other properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Light, hardly affected by heating, 44-79° (Stn/81)</td>
</tr>
<tr>
<td>Pfund</td>
<td>27 mm, white (Bla/72; Ric/78; Roc/68); white or extra light amber (Lov/56); extra light amber to light amber (Pia/81); water white (Wal/78); &lt;4 to 27 mm, water white to white (Whi/62); 12.1 mm, extra white (112.2 mm, amber after 44 days at 50°, Woo/76); Pfund-Lovibond grade (Aub/83)</td>
</tr>
<tr>
<td>Viscosity</td>
<td>472.00 poise (Moh/82); &quot;good body&quot; (Cra/75; Lov/56; Van/41)</td>
</tr>
<tr>
<td>Optical rotation</td>
<td>-36.50 deg (Bat/73); -6.27 deg (Moh/82)</td>
</tr>
</tbody>
</table>
Granulation rapid, hard fine grain (Bla/72); rapid (Cra/75; Pia/81) rapid, fairly hard white grain (Gom/73); slow (Moh/82); often irregular (Ric/78); dull appearance (Wal/78)
Flavour mild (And/73; Cra/75; Stn/81); unusual, slightly acid (Bla/72); insipid (Gom/73); strong, characteristically irritates the throat (Pia/81); flat, delicate (Wal/78). Aroma rather strong (Pia/81); delicate (Ric/78)

291 Melaleuca leucadendron (L.) L.; Myrtaceae

belbowrie, broad-leaved tea-tree (En/AUS)
Tree, <25 m; fls white/yellow, fragrant. M leucadendron, which is often confused with M. quinquenervia, does not grow in USA; all data from there are entered under M quinquenervia
Distribution tropical C America, Caribbean, S America; native to Australia. Habitat coastal gullies where tidal water-courses occur and on lower ground; grows well in exposed situations
Soil wide range but marshy ground preferred; brackish moist soil. Temperature tree damaged by severe frost

Economic and other uses
Timber. Land use amenity. Soil benefit erosion control.
Other uses bark for fruit packing and ornamental wall-covering; oil from lvs; beekeeper's smoker fuel from bark (Goo/47)

Nectar rating + honeybee species; blooms, nectar flow; composition
N1 MOZ[tm](Cra/73)
N2 AUS/NSW(Goo/47)
Blooms x-xi (AUS/NSW). Nectar flow annual, fairly consistent (AUS/NSW, Goo/47). Sugar concentration [low] 8% (Zma/80)

Pollen
P AUS/NSW

Honey: physical and other properties
Colour dark (Goo/47)
Granulation rapid
Flavour strong

296 Melilotus alba Desr.; Leguminosae

sweet clover, white melilot, white sweet clover; biennial Bokhara clover (En/AUS); bee clover, Bokara clover, melilot (En/USA); sweet white clover (En/ZIM); meliloto, trébol de olor (Es/ARG); melilot blanc, trèfle hubam (Fr/ALG); melilot (Fr/MAY); meliloto-branco, trevo-branco (Pt/BRA)
Herb, 30-150 cm, biennial (cv Hubam is annual); fls white, fragrant

**Distribution** temperate Europe, S America, N America, Asia, Oceania, (Med) Africa; subtropical S America; tropical Africa. **Habitat** cultivated crop plant; waste places, persists in fields turned to other crops.

**Soil** neutral to alkaline soil; lime preferred; rhizobia (bacteria) must be added to some soils. **Rainfall** >500 mm per season or irrigation needed; some drought tolerance.

**Economic and other uses**

**Fodder** - hay, pasture, seed; hay/silage (but toxic to livestock if poorly harvested or if fermented) (Why/53). **Land use** amenity.

**Soil benefit** erosion control; N-fixation.

**Warning**

Persists in fields turned to other crops; seed often harvested with alfalfa seed; stalks can cause problems when harvesting wheat (Van/49); hay/silage toxic to livestock if poorly harvested or if fermented (Why/53).

**Nectar rating + honeybee species; blooms, nectar flow; composition**

**N1** ARG(Lut/63); CAF/BC(Con/81); CAF/NWT(Hat/81); CAF/QUE(Cha/48); CHN(Mad/81); IRN(Cra/73); POL(Dem/64a); URS(Ave/78; Fed/55); USA/AL(Pel/76); USA/CO(Pel/76; Wio/58; Wio/65); USA/IA,IL,KS,MI, MN,MO(Pel/76); USA/ND(Les/54; Pel/76); USA/SD(Pel/76)

**N2** AUS/N(Woo/47); CAF/BC(Dav/69); FRA(Lou/81); ROM(Int/65); USA/CA(Jay/54); USA/MD(Die/71); USA/UT(Nye/71)

**N3** USA/CA(Van/41); USA/MS(Tat/56)

**N ALG(Ske/72); ARG(Per/80); BRA/SP(tm)(Caa/72); EUR(Maz/82); ZIM(tm)(Pap/73)

**Blooms** iv-vi, ix-xi (BRA/SP); vii-ix (ROM, Cir/80); vi-frost, mainly midsummer (USA/UT, Van/49). Flowering period 7 wks, each fl blooms 3.0-4.5 days (POL, Dem/63a); fl period 100 days (ROM, Jua/64). **Nectar secretion** (mg/fl/day) 0.1 (Han/80); 1.09 (Sim/80). **Sugar concentration** [medium] 23-33% (Caa/72); 15.4-44.2% (Dem/63a); 35% (Han/80); 42.21% (Pet/77); 36-48% (Shw/53); 24.8% (Sim/80); 45.0-52.5% (2 yrs, AA560/65); 57, 35% (2 yrs, AA696/73); 55.2% (AA665/80). **Sugar value** (mg/fl/day) [low] 0.04 (Han/80); 0.016 (Jua/64); 0.054 (Sim/80). **Sugar analysis** (Jua/64; Maz/59; Maz/80; Wyk/52)

**Honey flow**

**Honey potential** (kg/ha) [high] 26-678 (POL, Dem/63a); [moderate] 211.8 (BUL, Pek/77); 218, 180 (1st, 2nd crops, BUL, AA560/65); 200-500 (ROM, Cir/80); 174 (ROM, Jua/64)
Pollen
P2 FRA; USA/CA; USA/UT. P3 USA/CO. P ALG; BRA; CAF/QUE.
Yield good (Cir/80); abundant (Van/49); load size small-medium (Nye/71). Colour of load yellow (Cir/80); load green-brown (Han/80). Pollen grain illustrated and described (Sao/61).
Reference slide

Recommended for planting to increase honey production
USA (Pel/76). Propagate by seed. Recommended for roadsides and railways to prevent soil erosion and for eradicating obnoxious weeds by crowding them out. See Warning

Honey: chemical composition
Water [medium] 18.8% (1 sample, 5 mths, Whi/62)
Glucose [medium] 33.72%. Fructose [medium] 36.77%. Sucrose [medium] 1.00%. Maltose 5.51%. Higher sugars 0.79%. Also contents as % of total sugars (Maz/64)
Ash [low] 0.041% (Whi/62)
Amylase 20.4
Nitrogen 0.010%

Honey: physical and other properties
Colour slightly green (Con/81); light (Pel/76). Pfund water white or white (Lov/56); 4-8 mm, water white (Whi/62)
Viscosity "heavy body" (Lov/56). Electrical conductivity 0.000174 per ohm cm (Vor/64)
Granulation rapid (How/79; Pel/76); within a week of removing from hive (USA/AK, Liv/84)
Flavour of cinnamon (Con/81); mild (Lov/56); mild, peppery (Pel/76)

297 Melilotus officinalis (L.) Pall.; Leguminosae DROUGHT/SALT
sweet clover, yellow melilot, yellow sweet clover; melilot officinal (Fr/ALC); melilot jaune (Fr/CAF); erba vetturina, meliloto (It)
Herb, 40-250 cm, biennial; fls yellow, fragrant
Habitat cultivated crop plant; weed of cultivated ground; waste places
Soil wide range, often clay or saline soil; neutral or alkaline soil; fair amount of available lime needed. Rainfall dry areas; >450 mm per season or irrigation needed; drought resistant
Economic and other uses

**Fodder** - pasture and hay; hay/silage (but toxic to livestock if poorly harvested or if fermented) (Why/53). **Land use** amenity.

**Soil benefit** soil improvement, erosion control on banks and roadsides. **Other uses** medicinal (source of coumarin)

**Warning**

Persists in fields turned to other crops; seed often harvested with alfalfa seed; stalks cause problems when harvesting wheat (Van/49); hay/silage toxic to livestock if poorly harvested or if fermented (Why/53)

**Nectar rating; blooms, nectar flow; composition**

| N1  | CAF/NWT(Hat/81); CAF/QUE(Cha/48); CHN(Mad/81); IRN(Cra/73); URS(Ave/78; Fed/55); USA/CO(Wio/58; Wio/65); USA/ID/KS(Pel/76); USA/ND(Les/54); USA/SD(Pel/76); USA/UT(Nye/71) |
| N2  | FRA(Lou/81); USA/MD(Die/71) |
| N3  | ITA(Ric/78); ROM(Cir/77) |
| N   | ALG(Ske/72); USA/MA(Shw/50) |

**Blooms** vii–ix (ROM); vi–frost (USA/UT). **Nectar secretion** 0.110 mg/fl/day (Sim/80); reduced by insufficient soil moisture.

**Sugar concentration** [medium] 41.5, 43.6% (2 yrs, Dem/63a); 27.3–48.5% (various dates and localities, Mog/58); 37.9% (Pek/77); 38–57% (Shw/53); 27.1% (Sim/80); 52% (Van/49). **Sugar value** [low] 0.060 mg/fl/day (Sim/80). **Sugar analysis** (Bat/73a)

**Honey flow**

**Honey potential** (kg/ha) [moderate] 200 (ALG, Ske/72); 172.2 (BUL, Pek/77); 23.5, 10.0 (POL, Dem/63a); 130–300 (ROM, Cir/77; Cir/80)

**Pollen**

| P1  | USA/CO; USA/UT |
| P2  | FRA; ITA |
| P   | ALG; CAF/QUE; ROM; USA/MA |

**Yield** abundant (Van/49). **Colour** of load dark yellow (Han/80)

**Recommended for planting to increase honey production**

USA (Pel/76). Propagate by seed. Recommended for roadsides and railways to prevent erosion and for eradicating obnoxious weeds by crowding them out. See **Warning**

**Honey: physical and other properties**

**Colour** light (Pel/76). **Pfund** white or amber (Ske/72)

**Granulation** rapid (Pel/76)

**Flavour** mild, slightly peppery (Pel/76). **Aroma** delicate, like vanilla (Ske/72)
298 *Metrosideros excelsa* Sol. ex Gaertn.; *Myrtaceae*  
**SALT**  
syn *Metrosideros tomentosa* A. Rich.

pohutukawa (NEZ)  
Tree, <50 m; fls brilliant scarlet, buds white  
**Distribution** temperate and subtropical Oceania; native to New Zealand.  
**Habitat** coastal but also inland (NEZ/Auckland Province)  
**Soil** salt tolerant

**Economic and other uses**  
**Land use** hedges if kept cut; windbreak

**Nectar rating; blooms, nectar flow**  
N1 NEZ(God/52; Rob/56)  
N NEZ(Wal/78)  
**Blooms** xi. **Nectar flow** heaviest in dry season; shortened if high winds damage fls (Wal/78). **Nectar secretion** profuse (Mao/82)

**Pollen**  
P NEZ. **Colour** greenish-yellow (Wal/78).  
**Reference slide**

**Recommended for planting to increase honey production**  
NEZ(Wal/78)

**Honey: physical and other properties**  
**Pfund** water white (Cra/75); white (Mao/82)  
**Granulation** rapid, coarse (Cra/75; Mao/82)  
**Flavour** unique salty flavour (Cra/75)

313 *Olea africana* Mill.; *Oleaceae*  
**DROUGHT**  
syn *Olea chrysophylla* Lam.; *Olea europaea* L. subsp. *africana* (Mill.) P.S. Green

wild olive; swartolienhout (Af); motlhware sigwana (BOT)  
Shrub/tree, 5-18 m; fls greenish-white or whitish-cream, fragrant  
**Distribution** tropical Africa. **Habitat** usually near water but also in open woodland, among rocks or in mountain ravines (southern Africa)  
**Temperature** frost tolerant. **Rainfall** drought resistant

**Economic and other uses**  
**Food** - fruit.  
**Fodder** - browsed by stock but said to be astringent.  
**Fuel**. **Timber**. **Other uses** medicinal

**Nectar rating + honeybee species; blooms, nectar flow**  
N1 BOT[tm](Cra/73); ETH[tm](Cra/73); RWA,tm(Bau/66)  
**Blooms** xi (RWA)
Pollen
P RWA

Honey no data

314 Onobrychis viciifolia Scop.; Leguminosae
syn Onobrychis sativa Lam.

drought

esparcette, sainfoin; esparceta (Es/ARG); esparsette, sainfoin (Fr); crocetta, lupinella (It)
Herb, 10-80 cm, perennial; fls rose pink

Distribution subtropical Africa; temperate S America, Asia, Europe, N America; native to S Europe, W Asia. Habitat cultivated crop plant; not at altitudes >300 m (UK)

Soil chalk/limestone areas; well drained soil; dry soil; pH not too acid, 6.0-7.5 optimum. Temperature not winter-hardy in northern UK. Rainfall drought resistant

Economic and other uses
Fodder - hay, pasture

Warning
Seriously affected by stem rot in USA (Lov/77)

Nectar rating; blooms, nectar flow; composition

| N1 | FRA(Lou/81); IRN(Cra/73); ITA(Ric/78); URS(Ave/78; Fed/55) |
| N2 | HUN(Pet/77); ROM(Cir/80; Int/65); UK(How/79); YEA(Fie/80) |
| N3 | POL(Dem/64a) |
| N  | ARG(Per/80); CZE(Svo/58) |

Blooms vi-viii (ROM); v (UK); v-vi (URS). Nectar flow 10-14 days (How/79). Nectar secretion 0.1-0.9 mg/fl/day (Maz/82); secretion at temps 14-30°, optimum 22-25° (Frj/70); highest with full mineral and phosphate fertilizers (AA316/57); secretion of plants on well fertilized soil double that on soil with no fertilizers (AA291/56). Sugar concentration [medium] 40-60% (Cir/80); 31.2% (Haa/60); 26-45% (Maz/82); 33.8% (Pek/77); 41.62% (Pet/77); 7.3-50.4% (AA130/72); 30-45% (AA131/72); 42-52% (AA343/73); after temperature rise of 1° at night, sugar concentration increased by 25% (AA722/72). Sugar value [low to medium] 0.01-0.28 mg/fl/day (Maz/82). Sugar analysis (Bat/72; Bat/73a; Maz/59; Maz/82; Wyk/52)

Honey flow

Honey yield (kg/colony/season) [high] up to 54.2 in Kazakhstan, 20-30 in Ukraine (URS, AA686/77); 43.6 (mean wt gain, 2 hives, USA/MT, Dul/68); high in central Italian Apennines (Ric/78). "Miel du Gatinais" (France) was largely from this source. Honey potential (kg/ha) [high] 500-600 (URS/Transcaucasia, Fed/55);
[moderate] 65.5 (BUL, Pek/77); 120 (GDR, Bec/67); 120-300 (ROM, Cir/80); 100 (ROM, AA655/70); 90-400 (URS, Ave/78)

Pollen
Pl FRA; ITA. P URS. Yield moderate (Cir/80). Chemical analysis (Cir/80); pollen v oily (How/79). Colour of load dark brown, consistency of load sticky/rubbery (Ric/78). Pollen grain illustrated and described (Saw/82). Reference slide

Honey: chemical composition
Water [medium] 17% (Dul/68); 16.39% (Sac/55)
Sugars (as % of total sugars): glucose 41.89% (9 samples, Bat/73); 40.8-42.9% (3 samples, Maz/59); fructose 50.26% (Bat/73); 51.3-55.0% (Maz/59); 51.6% (Maz/64); sucrose 0.43% (Bat/73); 2.2-8.4% (Maz/59); 2.0% (Maz/64); maltose 3.41% (Bat/73); 4.8% (Maz/64); isomaltose 0.23% (Bat/73); fructomaltose 2.0% (Maz/64); trehalose 1.57% (Bat/73); gentiobiose 0.14%; melezitose 0.81%; raffinose 0.15%
Nitrogen 0.038% dry wt (Bos/78). Amino acids, free 0.180%, protein 0.130%
Fermentation likely (Pia/81)

Honey: physical and other properties
Colour yellow (Bab/61); deep yellow, bright and sparkling (How/79); v clear, pale yellow (Lov/56); light yellow (Ric/78). Pfund light amber (Cra/75); 7.5 mm, water white (Dul/68); white to extra light amber (Pia/81)
Optical rotation -27.90 deg (Bat/73). Electrical conductivity 0.000140 per ohm cm (Vor/64)
Granulation rapid, fine, solid consistency (Spo/50); regular, fine-grained (Ric/78)
Flavour sweet, quite pronounced (Cra/75); characteristic (How/79); sweet, like fruit (Pia/81); less sweet than other honeys, sometimes characteristic (Spo/50). Aroma faint (Pia/81; Ric/78); delicate (Spo/50)

315 Opuntia engelmannii Salm-Dyck; Cactaceae

Indian fig, prickly pear (En/USA); nopal, tuna (Es/MEX)
Herb, cactus; fls yellow tinged red, large
Distribution tropical C America; subtropical N America. Habitat desert areas of south-eastern USA and MEX; increasingly common where heavy grazing has occurred (USA)
Rainfall arid areas; drought resistant

Economic and other uses
Food - fruits. Fodder - fruits
**Nectar rating; blooms, nectar flow**

N1 USA(Ord/83)
N2 MEX(Ord/83); USA/TX(Pel/76)
N  MEX(Ord/72)

**Blooms** vi-vii (northern and central America, Ord/83). **Nectar flow** brief, seldom more than 4-5 days (USA/TX, Pel/76)

**Honey flow**

**Honey yield** [high] 30 kg/colony/season (south-west USA, Ord/83); about every 4 yrs (USA, Pel/76). **Honey potential** high, especially during partial drought (USA/TX, Pel/76)

**Pollen**

P1 MEX; USA. P USA/TX. **Yield** abundant (Pel/76). **Pollen value** important (Ord/83). **Pollen grain** illustrated and described (Nye/71)

**Honey: physical and other properties**

**Pfund** light amber (Cra/75; Pel/76); amber (Ord/83)

**Viscosity** high (Cra/75; Ord/83). **Other physical properties** - exhibits stringiness (Pel/76; Pry/50; Pry/52); also dilatancy (Pry/50; Pry/52)

**Granulation** - large crystals in clear liquid (Cra/75)

**Flavour** strong (Cra/75); v rank (Pel/76)

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**317 Paliurus spina-christi Mill.; Rhamnaceae**

Christ's thorn, Jerusalem thorn; marruca (It)

Shrub/tree, <3 m, deciduous; fls greenish-yellow, small

**Distribution** temperate Europe, (Med) Africa; native from S Europe to E Asia. **Habitat** hedges, roadsides, thickets, maquis and garigue

**Temperature** hotter areas. **Rainfall** drier areas

**Economic and other uses**

**Land use** hedges (v resistant to grazing)

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**Nectar rating; composition**

N1 ITA(Ric/78)

**Sugar analysis** (Bat/73a)

**Honey flow**

**Honey yield** - in ITA honey usually mixed with that from Erica sp (in Grosseto) or Trifolium pratense (in Abruzzo) (Ric/78)

**Pollen**

P3 ITA. **Colour** of load greenish-yellow (Ric/78). **Reference slide**

**Honey** no data
319 Parkinsonia aculeata L.; Leguminosae

Jerusalem thorn; horsebean (En/USA); retama (USA)
Tree, <10 m, thorny; fls bright yellow, numerous

**Distribution** tropical Africa; subtropical N America, S America, Africa; native from SW USA to Argentina. **Habitat** desert grasslands and canyons (USA); escaped and naturalized in southern Africa; coastal sandy sites; in full sun

**Soil** dry sites; poor gravelly or sandy alluvial; salt tolerant; waterlogging not tolerated. **Temperature** up to 36°; light frost tolerated. **Rainfall** 200-1000 mm; drought resistant

**Economic and other uses**

**Food** - seeds. **Fodder** - pods and young branches. **Fuel. Land use** hedges and "living fences", windbreak, amenity. **Soil benefit** cover for soil conservation; erosion control

**Warning**
Thorny; reproduces easily from seed - can become a nuisance (Usa/80)

**Nectar rating + honeybee species; blooms, nectar flow; composition**

N1 MOZ[tm](Cra/73)
N2 USA/TX(Lov/61d)
N3 USA/CA,TX(Lov/56)

**Bloom**s all summer (USA/TX). **Sugar concentration** [medium] 30.5%, fairly dilute nectar collected by bees in hot months, viii, ix (ISR, Eis/82)

**Pollen**
P USA/CA. **Pollen grain** illustrated and described (Mag/78; Smt/56a). **Reference slide**

**Honey: physical properties**
Pfund amber (Lov/56; Mot/64)

330 Pithecellobium dulce (Roxb.) Benth.; Leguminosae

Madras thorn (En/USA); chiminango (Es/COL); jina extranjera (Es/DOR); guamúchil (Es/MEX)
Tree, <20 m, almost evergreen, thorny; fls white/yellowish

**Distribution** tropical S America, C America, Caribbean, Asia, Africa, Oceania; subtropical N America; native from southern California to Venezuela and Colombia. **Habitat** widely planted and naturalized in tropics; some dry coastal areas of Africa; warmer drier areas of Philippines and India; arid/semi-arid areas; altitudes <1500 m
Soil wide range; oolitic limestone, clay and barren sand; waterlogging and salt tolerated. **Temperature** shade and heat tolerated. **Rainfall** 450-1650 mm; drought resistant; max dry period 4-5 mths.

**Economic and other uses**

**Food** - pods; oil from seeds. **Fodder** - lvs and twigs; pressed cake from seeds. **Fuel.** **Timber.** **Land use** hedges, windbreaks, shade, amenity. **Soil benefit** N-fixation. **Other uses** oil from seeds; tannin from bark; gum

**Warning**

Irritant sap; seed germinates rapidly; thorny, infests pastures in HAW; branches and trunks break in high wind (Usa/80)

**Nectar rating; blooms, nectar flow**

N1 tropical America (Ord/83)
N2 DOR(Ord/83); MEX(Wis/53); USA/FL(Ord/83)
N COL(Ken/76)
Blooms xii-iv (Ord/83)

**Pollen**

P2 DOR; tropical America; USA/FL. **Yield** abundant (USA/FL, Mot/64). **Pollen value** high (Ord/83)

**Recommended for planting to increase honey production**

Tropical America (Ord/83). Propagate by seed/cuttings. Grows 1 m per yr; fls in 2nd yr. See **Warning**

335 **Pongamia pinnata (L.) Pierre; Leguminosae**

syn Pongamia glabra Vent.

sour fruit; hunge, karanji (INI)
Tree, medium height, deciduous; fls pale pink
**Distribution** tropical Asia, Oceania; subtropical N America; native to India. **Habitat** humid lowland tropics, also drier parts of INI; coastal forests and tidal river banks (INI/south); shade tolerated well; altitudes <1200 m
**Soil** wide range including sandy/rocky; highly salt tolerant, survives with roots in salt water. **Temperature** 0-50°, mature trees only. **Rainfall** 500-2500 mm; drought resistant

**Economic and other uses**

**Fodder** - lvs; pressed cake for poultry. **Fuel.** **Land use** shade, afforestation, amenity. **Soil benefit** erosion control; green manure. **Other uses** roots/seeds as a fish poison; oil from seed for lamps etc; bark fibres; medicinal; pesticides
Warning
Toxic seeds and roots. Aggressive surface root system; suckers and seedlings may run wild (Usa/80)

Nectar rating + honeybee species; blooms, nectar flow
N1 INI/BIH,ac(Nai/76); INI/KAR,KER[ac](Kha/59)
N3 INI/MAH[ac](Chu/80)
Blooms iii (INI); iv-vi (INI/MAH)

Pollen
P1 INI/BIH. P3 INI/MAH. P INI/KAR, KER

Honey: physical and other properties
Colour dark (Mot/64)
Flavour sweet at first, with chalky after-taste (Mot/64)

336 Prosopis cineraria (L.) Druce; Leguminosae DROUGHT/SALT
mesquite
Tree, 5-9 m, evergreen, prickly; fls yellow
Distribution tropical and subtropical Asia. Habitat low altitudes; regions with hot dry winds
Soil alluvial; coarse sandy soil; alkaline, pH up to 9.8; black cotton soil in open forest; dry stony land; moderately salt tolerant. Temperature in shade 40-50° to -6°. Rainfall 75-850 mm with long dry season

Economic and other uses
Fodder - browse. Fuel. Timber. Land use shade, afforestation. Soil benefit erosion control; dune stabilization; increase of soil fertility beneath canopy; organic manure

Warning
Prickly pestilential weed in sub-humid areas (Usa/80)

Nectar rating + honeybee species; blooms, nectar flow
N1 PAK,ac(Pak/77)
Blooms xii-iii (PAK)

Honey flow
Honey yield "important" in parts of PAK (Pak/77)

Pollen
P PAK

Honey no data
337 Prospopis farcta (Sol. ex Russell) J.F. Macbride; SALT
Leguminosae

mesquite
Shrub/tree, 0.3-3.0 m, prickly; fls creamy green
Distribution temperate (Med) Africa; subtropical Africa, Asia; native to N Africa, E Med, Iraq, Iran, Afghanistan, Pakistan, URS/Transcaucasia and Turkestan. Habitat open dry scrubland; mountainous areas
Soil deep alluvium with shallow ground-water preferred; also dry clayey soil; untilled saline soil

Economic and other uses
Fodder. Fuel. Other uses tannin from roots

Warning
Noxious invasive weed in Transcaucasia (URS, Buk/76)

Nectar rating + honeybee species; blooms, nectar flow; composition
N1 PAK,ac(Pak/77)
Blooms iv-ix (PAK). Sugar concentration [high] 75% (Fah/49)

Honey flow
Honey yield "important" in PAK/NWFP (Pak/77)

Pollen
P PAK

Honey no data

338 Prospopis glandulosa Torrey; Leguminosae DROUGHT

mesquite; honey mesquite, honey-pod (En/USA); guajilla, uña de gato (USA)
Tree/shrub, 1.5-9.0 m, often multistemmed, straggly, deciduous, spiny; fls pale yellow
Distribution subtropical N America, Africa, Asia, Oceania; tropical Asia, Caribbean; native to north Mexico and south-west USA. Habitat dry plains, mesas, canyons and hillsides (USA); altitudes 760-1520 m (USA)
Soil light, shallow; sandy. Rainfall v drought resistant

Economic and other uses
Fodder young shoots; pods, but not as exclusive diet for cattle (Usa/79). Other uses gum
Warning
Do not feed cattle on pods only (Usa/79). Major pest of grassland in southern USA; highly invasive especially in moist locations or good soils (Usa/79)

Nectar rating + honeybee species; blooms, nectar flow
N1 PAK,ac(Pak/77); USA/AZ,CA,NM,?NV,?OK,?UT(Lov/56); USA/TX(Ord/83)
N2 USA/AZ,CA,NM,?NV,?OK,?UT(Pel/76)
N3 INO(Bee/77)
N USA/AZ(Mof/81)
Blooms iii–ix (PAK); iv, vi–vii (USA/TX). Most fls produced when soil moisture is low; fls shed during rain (Lov/56a).
Nectar secretion higher on sandy than on heavy soil (Pel/76)

Honey flow
Honey yield (kg/colony/season) [high] mean 27, max 90 (USA/TX, Lov/56a); up to 90 (USA, Roo/74); main source in Punjab and Sind (PAK, Pak/77)

Pollen
P1 PAK. Pollen value high (Van/49)

Honey: physical and other properties
Pfund 30–40 mm, white to extra light amber (Lov/56a); light amber (Roo/74)
Granulation rapid (Roo/74)
Flavour mild, sweet (Lov/57a)

339 Prosopis juliflora (Sw.) DC.; Leguminosae

algaroba (En/AUS, USA); mesquite (En/AUS, SOU, USA); cashaw (En/JAM); cupeší (Es/BOL); duitswedoring (Af)
Tree/shrub, 3–12 m, deciduous, somewhat spiny; fls greenish white to light yellow; often confused with other Prosopis spp; all USA records for this sp now treated as P. glandulosa; records from southern Africa included here, but see Buk/76
Distribution tropical C America, Caribbean, S America, Africa, Asia; native to C America, Caribbean and northern S America
Habitat coastal; planted in many arid areas; altitudes <1500 m
Soil wide range; sandy; rocky if root growth not impeded
Temperature v warm climates preferred; some cvs not frost hardy.
Rainfall 150–750 mm; v drought resistant

Economic and other uses
Warning
Aggressive invader; should be grown only in very arid problem sites (Usa/80)

Nectar rating + honeybee species; blooms, nectar flow
N1 AUS/WA (Col/62); BOL, tm (Kem/71); HAI (Mul/78); JAM (Met/66); PAK, ac (Pak/77)
N2 NAM [tm] (Joh/73); SOU, tm (And/73)
N3 INO (Bee/77)
Blooms xi-xii (AUS/WA); vii-viii (BOL); i-iv (JAM); iv-vi (PAK); x-xii (NAM); viii-xii, peak x-xii (SOU)

Honey flow
Honey yield "important" in Punjab and Sind (PAK, Pak/77); "heavy" (SOU, And/73)

Pollen
P1 AUS/WA. P3 SOU. P BOL; PAK. Reference slide

Honey: physical and other properties
Pfund v light amber (And/73)
Granulation medium (And/73)

340 Prosopis pallida (Humboldt & Bonpl. ex Willd.) Kunth; Leguminosae

DROUGHT/SALT

kiale (HAW)
Tree, shrub when on sterile soils, 8-20 m, spines small/absent; fls greenish yellow

Distribution tropical Oceania, Caribbean, S America; subtropical Asia; native to Peru, Ecuador, Colombia. Habitat coastal; naturalized in HAW and PUE; cultivated in INI and AUS; altitudes <300 m

Soil wide range including old lava flows, coastal sand; highly salt tolerant. Rainfall 250-1250 mm; v drought resistant

Economic and other uses
Food - pods for syrup to use in drinks. Fodder - lvs and pods.
Fuel. Timber. Land use windbreak, afforestation, amenity

Warning
May become invasive and form thickets. Shallow-rooted, easily blown down in storms (Usa/80)

Nectar rating
N1 HAW (Esb/80)
Honey flow
Honey yield [high] Puako region 227-363, Molokai Island 120-150 kg per colony/season (HAW, Esb/80)

Honey: chemical composition
Water [medium] 17% (Eck/52)

Honey: physical properties
Pfund 1.9 mm, water white (2.1, 2.6 mm after 2, 22 h at 70°, Eck/52)

349 Rhigozum trichotomum Burch.; Bignoniaceae
DROUGHT
driedoring (Af)
Shrub, spiny
Distribution tropical Africa; native to Africa. Habitat Kalahari, Wiesskalk Plateau and Schwarzrand (NAM, SOU)
Rainfall arid areas

Nectar rating + honeybee species; blooms, nectar flow
N1 ?SOU[tm](Joh/73)
N2 NAM[tm](Joh/75a)
Blooms after rain (SOU). Nectar flow light, after rains in NW Cape (SOU, Joh/73)

Honey no data

350 Rhizophora mangle L.; Rhizophoraceae
SALT
red mangrove; mangle rojo (Es)
Tree, 24-30 m, ?evergreen, stilt-like aerial roots; fls white
Distribution tropical Caribbean. Habitat calm bays into which rivers flow gently; shallow water
Soil mud flats; deep black muds usual but sand and carbonate soils colonized; regular flushing with sea or freshwater required for optimal growth; highly salt tolerant. Rainfall >1000 mm

Economic and other uses
Fuel. Timber. Soil benefit coastal protection, binds and builds sand and soil. Other uses reserves for aquiculture of fish; tannin; resins; wood pulp

Warning
Mangrove swamps are often breeding sites for mosquitoes
Nectar rating
Nl JAM(Met/66)

Honey no data

354 Robinia pseudoacacia L.: Leguminosae

false acacia, white acacia; black locust, honey locust, white locust, yellow locust (En/USA); acacia blanca (Es/ARG); faux acacia, robinier (Fr); falsche Akazie, Robinie (De); kikar (INI) Tree, 13-35 m, deciduous, thorny stipules; many cvs listed (Kee/83); fls white, fragrant

Distribution temperate Asia, N America, S America, Oceania; subtropical Asia, Africa, N America; native to eastern N America.

Habitat temperate deciduous forests; widely naturalized in EUR; steppes, plains; banks and steep hillsides; valleys and urban areas (INI/KAS); subtropical highlands; gravel ridges, moraines (USA); wasteland where other species have failed

Soil wide range tolerated; light sand if not too acid; pure quartz sand and gravel; waterlogging for long periods not tolerated.

Temperature frost damages young growth but degree varies with cv.

Rainfall 1000-1500 mm with 500-700 mm in growing season; humid regions of eastern USA; drought tolerant

Economic and other uses

Food - fls in fritters. Fodder - lvs, especially for goats (Alb/78); toxic to livestock (Why/53). Fuel. Timber - many uses including vine posts and props. Land use hedges, windbreaks, shade, afforestation, amenity. Soil benefit erosion control; improves poor soil; N-fixation

Warning: alert to beekeepers
Warning toxic to livestock (Why/53). Reseeds freely and also produces root suckers, sometimes becomes a pest (Why/53). Alert to beekeepers blooms early in season so beekeepers must make colonies strong to harvest honey (INI/KAS, Sha/72; USA, Lov/77; YUG, Kon/77)

Nectar rating + honeybee species; blooms, nectar flow; composition

N1 AFG(Cra/73); BEG(Grn/65); BUL(Jur/65); CHN(Mad/81); CZE(Svo/58); ETH(Cra/73); FRA(Lou/81; Mar/81); HUN(Kee/77; Kee/77a); INI/KAS,ac(Sar/73; Sha/72; Sha/76); ITA(Ric/78); JAP(Sak/82); PAK,ac(Cra/73); ROM(Cir/77; Int/65); URS(Glu/55); YUG(Kon/65; Kon/77; Kul/59)

N2 CAF(Cou/59); GFR(Gle/77); USA/AL,IN(Pel/76); USA/MD(Die/71); USA/NC(Stp/54); USA/OH(Bai/55)

N3 SOU,tm(And/73); USA/CA,TX(Pel/76)

N ARG,?tm(Per/80); CAF/BC(Con/81; Dav/69); INI/KAS,ac(Sha/79);
LUX(Poo/65); NEZ(Wal/78); URS(Fed/55); USA/MA(Shw/50; Shw/50a; Pel/76)

**Blooms** v-vi (EUR, FRA, ROM, USA, YUG); v, lasting for 8-15 days, varies with cv (HUN, Kee/83). **Nectar flow** 10-12 days, cvs can give a succession of flows (HUN, Kee/77a); 3 days (INI/KAS, Sha/72); 8-14 days (ROM, Int/65). **Alert to beekeepers** blooms early in season so beekeepers must make colonies strong to harvest honey (INI/KAS, Sha/72; USA, Lov/77; YUG, Kon/77). **Nectar secretion** (mg/fl/day) 2, but only 20% of available nectar was collected by bees (Kee/77a); other published results range from 1.59 to 3.7 (Maz/82; AA129/72; AA213/78); secretion best at high temperatures (Maz/82); optimum 27° (Sha/72). **Sugar concentration** [high] 33.0-62.3% (48 cvs, Hal/77); means 34-59%, max 67% (Maz/82); other published results range from 20 to 63% (Ded/57; Pet/72; AA271/56; AA129/72; AA213/78). **Sugar value** (mg/fl/day) [high] 0.76-4.0 (Cir/77); other published results range from 0.95 to 2.3 (Kee/83; Han/80; Maz/82; Sim/75; AA213/78). **Sugar analysis** (Bat/72; Maz/82; Sad/60; Wan/64; Wyk/52; AA678/66; AA213/78)

**Honey flow**
**Honey yield** (kg/colony/season) [high] 40-80 (CZE, Svo/58); 18, every 3 or 4 yrs (USA/MD, Lov/77); 80 (YUG, Kon/77; Kul/59); 8-10 kg/colony/day (ROM, Sad/60); >10 kg/colony/day (YUG, Kul/58); 50-60% of all honey produced in HUN (Kee/83a); 50% in YUG (Kul/58)

**Honey potential** (kg/ha) [high] 1000 (GDR, Bec/67); 200-1600 (ROM, AA815/63); 371 from trees age 6 yrs, increasing to 418 at 15 yrs, then decreasing (ROM, Kee/77); other published results for ROM range from 48 to 1550 (Bac/60; Cir/77; Sad/60; AA766/65; AA129/72); also 0.44 kg/tree (EUR, Maz/82)

**Pollen**
P1 FRA; JAP; URS; YUG. P3 GFR; SOU. P EUR; INI/KAS; NEZ; ROM. **Pollen yield** 0.01 mg/10 fls (BUL, Sim/75); small loads collected by bees (EUR, Maz/82). **Pollen value** high (EUR, Sta/74). **Chemical analysis** low protein content, 14.1% of dry matter (Maz/82). **Colour** of load light to dark grey (Han/80; Maz/82); pale yellow (Wal/78). **Pollen grain** illustrated and described (Ada/76; Ayt/71; Saw/81); 14 000 grains/10 g honey, under-represented (ITA, Mal/77; Pes/80); generally under-represented in honey in FRA but much higher in honey from HUN (Alb/78). **Reference slide**

**Honeydew**
**Honeydew** produced in some yrs, eg during vi-vii in 1959 and 1960, when extra 10-12 kg honey/colony was attributed to secretion mainly from *Aphis medicaginis* Koch, Aphididae, also from *Parthenolecanium corni* (Bouche), previously Eulecanium corni robinarium (Douglas), Coccidae
Recommended for planting to increase honey production
HUN (Kee/83a); NEZ(Wal/78); URS(Ave/78). Propagate by root/softwood cuttings or by grafting or by seed. Good for growing on slag heaps, spoil banks, roadsides and railway banks; also for snow-fencing (Kee/83a). Few pests or diseases (Kee/83a). Not sensitive to air pollution therefore good for towns and industrial areas (EUR, Maz/82). See Warning; alert to beekeepers

Honey: chemical composition

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Source (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water [medium]</td>
<td>15.2-20.4% (34 samples, Iva/78); 15.8% (1 sample, age 13 mths, Whi/62); other published results range from 14.5 to 20.4% (Bac/65; Cer/64; Dus/67; Mal/77; Pae/77; Sha/79)</td>
<td></td>
</tr>
<tr>
<td>Glucose [low]</td>
<td>29.02% (Ech/77); 24.49% (Tou/80); 24.34% (Whi/62); other results 23.7 to 39.9% (Bac/65; Bat/73; Cer/64; Gon/79; Pae/77)</td>
<td></td>
</tr>
<tr>
<td>Fructose [high, also medium]</td>
<td>41.42% (Ech/77); 43.02, 42.84% (Tou/80); 43.29% (Whi/62); other results 30.1 to 47.9% (references as for glucose)</td>
<td></td>
</tr>
<tr>
<td>Sucrose [medium, also low]</td>
<td>1.01% (Ech/77); 2.20, 2.07% (Tou/80); 0.63% (Whi/62); other results 0.15 to 13.41% (Bac/65; Bat/73; Bon/66; Cer/64; Iva/78; Pae/77)</td>
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</tr>
<tr>
<td>Maltose</td>
<td>6.51% (Bat/73); 5.44% (Ech/77); 10.14% (Whi/62)</td>
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</tr>
<tr>
<td>Isomaltose</td>
<td>0.40% (Bat/73)</td>
<td></td>
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<tr>
<td>Trehalose</td>
<td>2.98%</td>
<td></td>
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<tr>
<td>Gentiose</td>
<td>0.27%</td>
<td></td>
</tr>
<tr>
<td>Raffinose</td>
<td>0.27%</td>
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<tr>
<td>Melezitose</td>
<td>1.35-3.89% (Pae/77)</td>
<td></td>
</tr>
<tr>
<td>Erlose</td>
<td>present (Bel/79)</td>
<td></td>
</tr>
<tr>
<td>Dextrin</td>
<td>1.45-5.93% (Bac/65)</td>
<td></td>
</tr>
<tr>
<td>Ash [low]</td>
<td>0.04-0.21% (Iva/78); 0.043% (Whi/62); other results 0.017 to 0.80% (Bac/65; Cer/64; Pae/77; Pes/80). Contents of elements (Cer/64; Var/70)</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>3.68 (Ech/77); 4.30 (Whi/62); other results 3.56 to 4.5 (Dus/72; Pae/77; Sha/79). Total acid (meq/kg) 12.99-28.03 (Pae/77); 9.88 (Whi/62). Free acid (meq/kg) [low] 10.53-16.71 (Pae/77); 7.64 (Whi/62). Lactone (meq/kg) 0.5-6.0 (Pae/77); 2.15 (Whi/62); other results for acid contents (Cer/64; Mal/77)</td>
<td></td>
</tr>
<tr>
<td>Amylase</td>
<td>5.2-14.8 (Iva/78); 7.5 (Whi/62); other results 2.5 to 17.9 (Bac/65; Bon/66; Mal/77; Pae/77). Invertase 3.9-5.8 (Gontarski 1957 method, Dus/67); also Bon/66. Glucose oxidase 214 units/100 ml honey (Ech/75). Peroxide number 17.5-32.2 μg/g/h (Dus/67); also Dus/72. HMF 0.19-10.98 ppm (Iva/78); also Mal/77; Pae/77</td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.009, 0.011% dry wt (Bos/78); 0.19% (Whi/62). Amino acids, free 0.037, 0.060%, protein 0.035, 0.036% dry wt (Bos/78). Protein 0.20-1.90% (Cer/64); 0.24% (Ech/75). Lipid composition (Pop/79a)</td>
<td></td>
</tr>
<tr>
<td>Fermentation</td>
<td>on storage unlikely, yeast count low (Maa/73)</td>
<td></td>
</tr>
<tr>
<td>Vitamins</td>
<td>260 ppm (180 ppm after 30 min at 50°, Ech/77)</td>
<td></td>
</tr>
</tbody>
</table>

Honey: physical and other properties

Colour pale yellow (Kee/77a); v clear (Pes/80); water clear, yellow tinge if not monofloral (Ric/78). Pfund 4-8 mm, water white (Whi/62; also Lov/56; Pia/81; Sha/79)
Relative density 1.414-1.435 (Bac/65); 1.408-1.4440 (Cer/64).

Viscosity "heavy body" (Cra/75). Optical rotation -36.90 deg (Bat/73); -3.3 to -0.7 deg (Cer/64). Electrical conductivity 0.000095-0.000208 ohm/cm (Iva/78); other results are within this range (Dus/67; Pae/77; Pou/70)

Granulation slow, may take yrs (Dem/64; Kee/77a; Pes/80); small grain (Fed/55); large, slightly transparent crystals (Pia/81)

Flavour sweet (And/73; Cra/75); mild (Kee/77a); delicate, sweet like mature fruit (Pia/81); strong (Sha/79); analysis of flavour components (Wab/80). Aroma slight (And/73; Cra/75; Pes/80); reminiscent of flower, not persistent (Pia/81); strong (Sha/79)

361 Sabal palmetto (Walt.) Lodd. ex Schultes; Palmae

SALT
cabbage palm, palmetto, swamp cabbage, thatch palm (En/USA)
Tree, <26 m; fls whitish-yellow, small

Distribution subtropical N America; tropical Caribbean. Habitat prairies, marshes, pinelands and hammocks (USA/FL); USA/GA, NC, SC, especially common on coast and coastal islands; dominant palm; widely planted

Soil sandy; salt tolerant

Economic and other uses

Food - central bud but its removal kills the tree. Fuel.
Timber. Land use amenity. Other uses lvs for roofing

Alert to beekeepers

Honey likely to ferment even in capped cells of comb (Lov/65a; Mot/64)

Nectar rating; blooms, nectar flow

N1 USA/FL(Lov/65a)

Blooms summer, chiefly vii (southern USA); iv-vi (subtropical/ tropical America). Nectar secretion yields well every 3 yrs (Pel/76); nectar abundant on damp soils, absent on dry ones (Ord/83)

Honey flow

Honey yield [high] mean 13, max 45 kg/colony/season (USA, Lov/65a)

Pollen

Reference slide

Honey: chemical composition

Water [high] can be v high (Lov/55e); 19.7% (1 sample, age 13 mths, Whi/62)

Glucose [medium] 31.20% (Whi/62). Fructose [medium] 37.96%.
Sucrose [low] 0.63%. Maltose 6.25%. Higher sugars 0.99%
Ash [low] 0.084%

pH 3.61. Total acid 44.94 meq/kg. Free acid [medium] 37.62 meq/kg. Lactone 6.97 meq/kg

Amylase 20.1

Nitrogen 0.099%

Fermentation (alert to beekeepers) - likely, even in capped cells of comb (Lov/65a; Mot/64)

Honey: physical and other properties

Colour light yellowish (Pel/76). Pfund light amber (Mot/64); 27-34 mm, white (Whi/62)

Viscosity "thin body" (Pel/76)

Flavour and aroma mild (Mot/64)

377 Scaevola frutescens (Mill.) Krause; Goodeniaceae

veloutier (Fr/CHG)

Distribution tropical Asia. Habitat characteristic plant of tropical beach jungle; on some islands in Indian Ocean, eg Diego Garcia; Chagos archipelago, where it lines beaches

Soil from coral rock

Nectar rating

N1 CHG(Sil/69)

Honey flow

Honey yield on Diego Garcia provides rest of honey not derived from Cocos nucifera (CHG, Sil/69)

Honey no data

379 Schinus terebinthifolius Raddi; Anacardiaceae

Brazilian pepper, Mexican pepper; poivrier sauvage (Fr/MAY, REU)

Tree, 12 m, evergreen, vigorous; fls ivory-white, slightly fragrant, some trees bear only male fls

Distribution subtropical N America; tropical Africa, Caribbean; native to Brazil. Habitat coastal, thrives in salt spray; widespread escape in USA/FL; low-medium altitudes (MAY); covers large areas (REU; USA/FL)

Economic and other uses

Food - seeds as condiment. Fodder - for goats, but toxic to cattle, horses and birds (Mot/78). Timber. Land use hedges, shade, amenity. Other uses resins and tannins from bark; toothpicks; medicinal
Warning
Fodder toxic to cattle, horses and birds (Mot/78). Rapid aggressive growth; designated noxious weed in HAW (Mot/78). In USA/FL "fruit may cause enteritis in children and pets; also skin and respiratory irritation when plant is in bloom" (Mot/64)

Nectar rating; blooms, nectar flow; composition
Nl BER(Har/75); MAY(Bro/82; Cra/73); REU(Cra/82); USA/FL(Ord/83)
Blooms iii-iv (MAY); vii-x (USA/FL). Nectar flow autumn (BER).
Sugar analysis (Vah/72)

Honey: physical and other properties
Pfund medium amber (Mot/64); amber (Ord/83)
Flavour distinctive, peppery (Mot/64); spicy (Mot/78). Aroma slightly pungent (Ord/83)

382 Serenoa repens (Bartr.) Small; Palmae
saw palmetto (En/USA)
Shrub, dwarf scrub sp; fls yellowish white, small, fragrant
Distribution subtropical N America; native to USA/FL. Habitat USA: uncultivated pastures, pineland in NC, SC and coasts of Gulf of Mexico to eastern TX; hammocks, scrub and sand dunes
Soil salt tolerant

Nectar rating; blooms, nectar flow
Nl USA/FL(Lov/56; Mor/58; Smt/60)
Blooms iv-vi (USA/FL). Nectar secretion highest in dry seasons (USA, Lov/65a). Bees sometimes collect berry juice (Mot/64)

Honey flow
Honey yield [moderate] mean 5, max 14 kg/colony/season (USA, Lov/65a); "in commercial quantities" (USA/FL, Mot/64)

Pollen
P USA/FL. Pollen value low (Lov/65a). Colour bright yellow (Lov/65a). Pollen waxy (Lov/65a). Reference slide

Honey: chemical composition
Water [low, also medium] 15.1, 18.0% (age 7, 8 mths, Whi/62)
Glucose [low] 30.88, 30.96%. Fructose [medium] 37.40, 39.07%.
Sucrose [low] 0.62, 1.04%. Maltose 5.60, 7.36%. Higher sugars 1.67, 1.70%
Ash [medium] 0.458, 0.245%
Amylase 21.1, 7.7
Nitrogen 0.019, 0.024%
Honey: physical and other properties

**Colour** rich yellow (Lov/55e); sometimes dark if bees collect berry juice (Mot/64). **Pfund** 34-50 mm, light amber (Whi/62)

**Viscosity** "thick and waxy" (Cra/75); "heavy body" (Lov/65a)

**Granulation** rapid (Rof/75); slow, soft grain (Lov/65a)

**Flavour** pronounced (Cra/75); mild (Lov/56; Lov/65a); distinctive (Lov/55e); sometimes strong, medicinal if bees collect berry juice (Mot/64). **Aroma** fragrant (Lov/65a)

397 *Tamarindus indica* L.: Leguminosae

Tamarind; tamarindo (Es/DOR, HOD, NIA); tamarin (Fr/MAY); asem (In); hunase, imli, puli, tentul (INI)

Tree, <25 m, evergreen, vigorous, hurricane-resistant; fls yellow spotted red

**Distribution** tropical Asia, C America, Caribbean, Africa, Oceania; subtropical N America; native to tropical Africa. **Habitat** widely cultivated in tropics; low altitudes; coastal and inland areas; open sites preferred; dry savanna and monsoon regions; wasteland

**Soil** wide range; sandy; deep soil preferred but must be well drained. **Temperature** damaged by frost. **Rainfall** >800 mm; extended period of dry weather required; humid and sub-humid zones; drought resistant

**Economic and other uses**

**Food** - fruit for flavouring eg drinks, soups; lvs, fls and pods in curries; oil from seed. **Fodder** - crushed seed. **Fuel.**

**Timber.** Land use shade, amenity, firebreak. **Other uses** medicinal; crushed seed for making size; oil from seed

**Nectar rating + honeybee species; blooms, nectar flow**

<table>
<thead>
<tr>
<th>N1</th>
<th>CHA<a href="Gad/80">tm</a>; HAI(Mul/78); INI/KAR,KER<a href="Kha/59">ac</a>; INI/TAM<a href="Ram/37">ac</a>; MAY(Bro/82; Cra/73); THA(Smt/83)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N2</td>
<td>DOR(Ord/64); INI/MAD<a href="Khn/48">ac</a>; INI/TAM<a href="Sig/62">ac</a>; INI/UTT<a href="Koh/58">ac</a>; N0<a href="Bee/77">ac</a>; NIA(Ord/63a)</td>
</tr>
<tr>
<td>N3</td>
<td>INI/MAH<a href="Chu/80">ac</a></td>
</tr>
<tr>
<td>N</td>
<td>HOD(Ord/63)</td>
</tr>
</tbody>
</table>

**Blooms** v-viii (central America, Ord/83); iv-vii (INI); xii-i (MAY)

**Pollen**

P1 INO. P3 INI/MAH. P DOR; INI/KAR, KER. **Pollen grain** illustrated and described (Smt/54a)

**Honey: physical and other properties**

**Colour** dark (Cra/75); rich golden (Koh/58)

**Viscosity** "thin" (Koh/58)

**Flavour** sour (Khn/48); "quite sweet, but when swallowed tastes slightly acid like flower" (Koh/58)
405 Thymus capitatus (L.) Hoffm. & Link; Labiatae
syn Coridothymus capitatus (L.) Reichenb. f.

Mediterranean wild thyme, mountain thyme, wild thyme; saghtar (MAQ)
Shrub, 20-50, exceptionally to 150 cm, v aromatic; fls purplish-pink rarely white
**Distribution** temperate (Med) Europe and Africa; native to Europe.
**Habitat** dry sunny hills; bare parched hillsides (CYP)
**Soil** stony. **Temperature** on Malta, where shrub grows, temp is <40° but rarely <0°. **Rainfall** drought resistant

**Economic and other uses**
Oil for medicine and perfumery

**Nectar rating; blooms, nectar flow**

| Country | Rating
|---------|--------|
| NL CRE(Adm/54; Nic/55); CYP(Adm/54); GRC(Mai/52; Nic/55); MAQ(Far/79) | Nl
| Blooms v-viii (EUR); vi-vii (GRC); v-vii (MAQ). **Nectar flow** vii-viii (MAQ). **Nectar secretion** total yield 0.0001 ml/fl, (Mcg/59); dependent on RH (Adm/54); dry wind from Sahara desert stops flow (GRC, Nic/55) | WAK(Lar/72)

**Honey flow**
"Hymettus honey" from GRC is mostly a mixture from Thymus spp, Satureia spp and Origanum vulgare

**Honey: chemical composition**
**Amino acids** - contents of individual free amino acids; proline, phenylamline, tyrosine high (Mak/78)

422 Tournefortia argentea L.f.; Boraginaceae

**tree heliotrope**
**Tree/shrub**
**Distribution** tropical Oceania, Asia. **Habitat** widespread coastal plant; coral islands
**Soil** salt tolerant

**Nectar rating; blooms, nectar flow**

| Country | Rating
|---------|--------|
| NL WAK(Lar/72) | WAK(Lar/72)
| Blooms all yr (WAK) | all yr (WAK)

**Honey flow**
**Honey yield** "10 kg/colony every 6-8 wks throughout yr" (WAK, Hit/76); "in the 1 yr (1971/72) since honeybees arrived on Wake Island the 2 original colonies and others reared from them have produced 680 kg of honey" (Lar/72)
Pollen
P WAK

Honey: chemical composition
Water [medium] 18.6, 16.3% (Hit/76)
Glucose [low] 28.6%. Fructose [medium] 38.2%. Sucrose [high] 5.1%
Fermentation on storage may sometimes occur

Honey: physical and other properties
Colour deep gold to red to almost black
Flavour strong

426 Trifolium alexandrinum L.; Leguminosae
berseem, Egyptian clover
Herb, 0.5-1.0 m, annual; fls yellowish
Distribution temperate Asia; subtropical Asia, Africa; native to Asia Minor. Habitat cultivated crop plant
Soil heavy alkaline loam preferred; also light soil; salt tolerant. Temperature v high temps not tolerated; damaged by frost, killed at temps below -3°. Rainfall >250 mm; winter dryland crop, or irrigated crop sown in spring/summer; drought resistant

Economic and other uses
Fodder – forage, green fodder, pasture. Soil benefit green manure, soil cover

Nectar rating + honeybee species; blooms, nectar flow; composition
NI EGY(Waf/51); INI/BIH,ac(Nai/76); INI/PUN, ac,ad also am(Atw/70; Atw/73; Chd/77); PAK,ac(Pak/77; Shr/48)
Blooms iv-vi (INI/PUN); iv-v (PAK). Sugar concentration [medium] 32.4% (Pek/77)

Honey flow
Honey yield (kg/colony/season) [moderate] 9 (PAK, Pak/77); 27, together with T. resupinatum (PAK, Shr/48). Honey potential [moderate] 165 kg/ha (BUL, Pek/77); "important in Baluchistan, Punjab, Sind, NWFP" (PAK, Pek/77)

Pollen
P1 INI/BIH; INI/PUN. P EGY; INI/PUN; PAK

Honey: chemical composition
Water [low] 15.6-16.8% (39 samples, almost certainly from this sp, Els/79)
Sugars, total 73.4-83.0%.  Glucose [medium] 31.6-35.8% (Els/79); 30.18% (Moh/82).  Fructose [medium] 38.2-42.5% (Els/79); 38.80% (Moh/82).  Sucrose [medium] 3.6-4.7% (Els/79); 1.67-2.30% (3 samples, Moh/82).  Reducing sugars 71.82% (Moh/82).  Maltose 3.30%.  Raffinose 3.90%  

Ash [low] 0.085-0.098% (Els/79); 0.06% (Moh/82).  Contents of K, Na, Ca, Mg, Fe, Cu, Mn, P (Els/79); K, Na, Ca (Moh/82)  
P H 5.0 (Moh/82).  Free acid [medium] 21.00 meq/kg  

Nitrogen 0.340-0.470% (Els/79)  

**Honey: physical and other properties**  
Viscosity at 20°, 78.14 poise (Moh/82).  Optical rotation -8.74 deg  
Granulation slow  

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**427 *Trifolium fragiferum* L.; Leguminosae**  
strawberry clover (En/AUS, NEZ)  
Herb, low creeping perennial; fls pinkish-white  
Distribution temperate Europe, Oceania.  Habitat pastures; common in swampy ground in southern VIC but also in drier areas (AUS/VIC)  
Soil moist alkaline soil; heavy swampy ground; prolonged flooding by salt water tolerated.  Rainfall regions with limited or no summer drought preferred  

**Economic and other uses**  
Fodder pasture.  Soil benefit - improves heavy swampy soil  

**Nectar rating; blooms, nectar flow**  
N1 AUS/SA(Pur/68)  
N2 AUS/VIC(Gom/73); ROM(Int/65)  
N NEZ(Wal/78)  
Blooms iv (NEZ); i to mid-autumn (AUS/VIC); xii-iii (AUS/SA).  
Nectar secretion varies with soil moisture (AUS/SA, Pur/68)  

**Honey flow**  
Honey potential [moderate] 100 kg/ha (ROM, Cir/80)  

**Pollen**  
P2 AUS/SA, VIC  

**Honey: physical and other properties**  
Pfund white (Wal/78)  
Viscosity "rather light body"  
Flavour delicate
**438 Vicia faba L.; Leguminosae**

broad bean, faba bean, field bean, horse bean, mazagan bean, tick bean; haba (Es/MEX); fève des champs (Fr); fava (It); fava (Pt/BRA)

Herb, <2 m, annual/biennial; fls white often with a black blotch, fragrant; nectary in fl, also extrafloral nectaries on undersides of stipules (Frj/70)

**Distribution** temperate Europe, (Med) N Africa; subtropical Africa, S America, Asia; tropical Africa, S America, C America; native to N Africa and SW Asia. **Habitat** cultivated crop plant; seed seldom sets in warm regions therefore grown at altitudes >2000 m in tropics

**Soil** moderate to good fertility preferred; medium texture; plant moderately salt tolerant. **Temperature** a cool-season crop grown in winter period in subtropics and at altitudes >2000 m in tropics; high temps cause fl drop; v hardy. **Rainfall** much water required at flowering time followed by dry conditions and sun for seed ripening

**Economic and other uses**

**Food** - beans, both fresh and dried. **Fodder** - beans; whole plant for silage. **Soil benefit** N-fixation

**Nectar rating + honeybee species; blooms, nectar flow; composition**

N1 BEG(Grn/65); ETH(tm)(Cra/73); UK(How/79)
N2 FRA(Lou/81); ITA(Ric/78); URS(Glu/55)
N BRA/SP(tm)(Caa/72); ZIM(tm)(Pap/73)

Blooms vii-viii (BRA/SP); v-vii (EUR). **Nectar secretion** increased by higher planting density (AA510/69); sometimes absent, depends on weather (URS, south west, Glu/55). **Sugar concentration** [medium] 28% (Caa/72). **Sugar value** higher in 2nd crop than 1st (AA304/69). **Sugar analysis** (Wyk/52). **Amino acid analysis** of floral and extrafloral nectar (AA905/80)

**Honey flow**

**Honey potential** (kg/ha) [moderate] 20 (GDR, Bec/67); 30-60 (ROM, Cir/80)

**Pollen**

P2 FRA; ITA. **Chemical analysis** (Maz/82). **Colour** of load grey (Han/80); load grey-green (Ric/78). **Reference slide**

**Honeydew**

Honeydew produced EUR (Maz/82); ROM (Cir/80); analysis of honeydew from *Megoura viciae* Buckton, Aphididae (mid EUR, Klo/65)

**Honey: physical and other properties**

**Colour** light but dark if honeydew present (Cra/75). **Pfund** white
(Cha/48); light to dark amber (How/79)

**Granulation** often rapid, coarse (Cra/75); fairly rapid, coarse (How/79)

**Flavour** mild (Cra/75; How/79)

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**441 Viguiera helianthoides Kunth; Compositae**

Romerillo de costa (Es/CUB, MEX); tah (MEX)

Herb, 1-1.5 m, forms large clumps; fls yellow

**Distribution** tropical C America, Caribbean. **Habitat** coastal areas, wasteland, hills and roadsides (CUB); rocky areas and fields where maize and henequen have been cultivated (MEX/Yucatan)

**Soil** calcareous, gravelly; rocky.

**Rainfall** low; semi-arid areas of MEX

**Nectar rating; blooms, nectar flow**

N1 MEX (Ord/83; Saf/73; Smt/60; Wis/53)

N2 CUB (Ord/44; Ord/56)

**Blooms** i-ii (CUB); late xii to early i; (MEX/Yucatan). **Nectar flow** intense but short (Ord/44); fairly short (Saf/73)

**Honey flow**

**Honey yield** 30% of MEX/Yucatan honey crop (Saf/73)

**Pollen**

P1 CUB; MEX

**Honey: physical and other properties**

**Colour** light (Cra/75). **Pfund** dark amber (Ord/44); light amber (Ord/83)

**Granulation** rapid (Cra/75)

**Flavour and aroma** pronounced

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**448 Ziziphus mauritania Lam.; Rhamnaceae**

syn Ziziphus jujuba (L.) Gaertn.

Zyzyphus; Indian jujube, bor (INI)

Tree, 3-12 m, evergreen, spiny but spineless varieties in INI/Assam; fls greenish, small

**Distribution** tropical Africa, Asia, Oceania, C America, Caribbean, S America; native to S Asia. **Habitat** cultivated; sub-Himalayan hill country but best below 600 m

**Soil** wide variety including oolitic limestone. **Temperature** severe heat and frost tolerated. **Rainfall** 300-500 mm; v drought resistant
Economic and other uses
Food - fruit, fresh, dried or for drinks. Fodder - lvs and fruit; lvs for silkworms. Fuel. Timber. Land use living fence. Other uses tannins; host plant for lac insects

Warning
Can form dense spiny clumps (Usa/80)

Nectar rating + honeybee species; blooms, nectar flow; composition
N1 CHA[tm](Gad/80); PAK,ac(Pak/77)
N3 INI/MAH[ac](Chu/80); INO[ac](Bee/77)
Blooms vii-x (INI/MAH). Sugar concentration [medium] usually >50% (Zma/80)

Pollen
P3 INI/MAH; INO. P PAK

Honey: chemical composition
Water [high] 23.0% (TAI, Lin/77)
Glucose [medium] 31.5%. Fructose [medium] 35.3% (Lin/77); "high" (Mad/81). Sucrose [low] 0.1% (Lin/77)
Ash [medium] 0.63%
pH 5.9. Free acid [medium] 15.4 meq/kg (28.0 after 1 yr)

Honey: physical and other properties
Colour yellow brown (Lin/77). Pfund amber (Mad/81)
Relative density 1.38 (Lin/77)
Granulation slow (Mad/81)
Flavour extra sweet

450 Ziziphus nummularia (Burm. f.) Wight & Arn.; DROUGHT
Rhamnaceae
kokan ber (PAK)
Shrub, <4 m
Distribution subtropical Asia; native to Arabia, Iran, Afghanistan and Pakistan. Habitat desert areas of NW India and Pakistan; wadis
Soil gravel/sand. Rainfall drought tolerant

Economic and other uses
Food - berries. Fodder - browse plant for camels. Fuel. Land use hedges. Other uses medicinal

Nectar rating + honeybee species; blooms, nectar flow
N1 PAK,ac(Pak/77)
Blooms iii-vi (PAK)
Honey flow

Honey yield "important" in several parts of PAK (Pak/77)

Pollen
P PAK

Honey no data

452 Ziziphus spina-christi (L.) Desf.; Rhamnaceae  

DROUGHT

Christ's thorn; elb (YEA)
Tree, 3-10 m, evergreen, spiny
Distribution tropical Africa, Asia; subtropical Africa, Asia; native to Africa and (Med) Asia. Habitat dry desert areas but wadis preferred; altitudes <1500 m; rocky hills (EUR/Med)
Soil deep (alluvial plains) preferred, with access to ground water. Temperature v high temperatures tolerated. Rainfall desert (100 mm rainfall), also less arid areas; v drought resistant

Economic and other uses
Land use hedges, windbreaks. Soil benefit erosion control, dune stabilization

Warning
Forms spiny impenetrable thickets; planted only in v dry areas where few other species can survive (Usa/80)

Nectar rating + honeybee species; blooms, nectar flow; composition
N1 YEA(Fie/80; Fil/80)
N2 OMA(Dut/79)
N ?ISR(Eis/80); OMA,af(Dut/77)
Blooms iv-vi (Africa and (Med) Europe); viii-xi (ISR). Nectar flow xi (OMA). Nectar secretion 0.2-2.6 mg/fl/day (Eis/80).
Sugar concentration [medium] 25.3, 51.5% (Eis/80). Sugar value [medium] 0.12-0.66 mg/fl/day (Eis/80)

Honey flow
Honey yield [moderate] 1 kg/colony/season (OMA, Dut/79)

Pollen
P ISR; YEA

Honey: physical properties
Pfund white (Dut/77)
5. EXPLANATORY NOTES TO PRINTOUTS IN SECTION 4

For each plant, information available is presented in a standard order, and is fully described in the 1984 Directory (pages 9-15). Codes and abbreviations used are explained briefly below.

Author reference codes

The author reference codes lead to the full references in the Bibliography, published in both the Directory and Satellite 1. Data for which no reference is given are from the last reference quoted.

Country and language codes, and other abbreviations

The 3-letter country codes, e.g. TAN for Tanzania, and the 2-letter language codes, e.g. It for Italian, are listed in both the Directory and Satellite 1, which also give other abbreviations.

Nectar rating + honeybee species; blooms, nectar flow; composition

The nectar rating of a plant in a country is:

N1 = a major source of surplus honey
N2 = a medium source of surplus honey
N3 = a minor source of surplus honey
N = a honey source, importance unrated

The honeybee collecting the nectar is European Apis mellifera (am) unless otherwise indicated (tm = tropical A. mellifera, ac = A. cerana, ad = A. dorsata, af = A. florea). Square brackets indicate that we deduced the species from the context.

Most plants have two or more N1 ratings. Each rating N1, N2, N3 is followed by a list of countries (in code) in which it was recorded, with the reference. The ratings N1, N2, N3 usually refer to the amount of honey produced.

Blooms - months (i = January, xii = December) during which the plant flowers in the country or region specified. The reference is that cited in the nectar rating. The months of the Nectar flow, or its duration, are cited similarly.

The sugar concentration in the nectar is classed by us as [low], [medium], or [high], and the class is coded for searches:

low <21% by wt; medium 21-60%; high 61%+

(The medium class includes all values starting with 60, e.g. 60.7%. The high class starts at 61%)
Sugar value (mg/fl/day) is treated similarly:
  low <0.1; medium 0.1-2; high 3+

Honey flow

Honey yield is quoted as kg/colony/season; the bees involved are European Apis mellifera unless otherwise indicated under Nectar rating. Yields are usually from beekeepers' records, and most refer to surplus honey taken, although Russian figures are likely to be for the total amount stored. The honey yield is classed by us as [moderate] or [high]:
  moderate <30; high 30+

Honey potential is a term in common use in Eastern Europe for the estimated weight (kg) of honey that could be obtained in the course of a season from 1 hectare of land covered with the plant, assuming optimal conditions (Cra/75). The honey potential is classed by us as [moderate] or [high]:
  moderate <500; high 500+

Pollen

Ratings P1, P2, P3, P are on a similar basis to N1, N2, N3, N; where an author reference is the same for both (and there is no ambiguity), this is not repeated for pollen. Yield relates to the amount produced by the flowers. Pollen value (to bees) gives further information, e.g. on nutrition/toxicity. Colour is designated "of load" if the author cited states this. Representation of pollen grains in honey is reported here for only <20 000 grains in 10 g honey [under-represented], or >100 000 grains in 10 g [over-represented]. The words Reference slide indicate that a slide of the pollen grain is in the collection maintained by Dr G. Vorwohl (see the Directory, p. 13, or Satellite 2).

Recommended for planting to increase honey production

The country is cited where such a recommendation has been made by the author quoted. We emphasize that this is not a blanket recommendation to introduce an exotic plant: any proposal for introduction into new country should be discussed with plant quarantine and other appropriate authorities before any action is taken.

Honey composition and properties

The presentation of the data is explained in the Directory and in Satellite 3 (for honey composition) and Satellite 4 (for physical properties, flavour and aroma).