



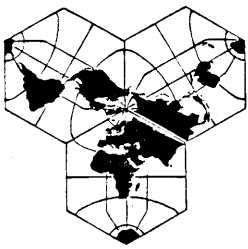
Eva Crane Trust

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

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[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

Directory of important world honey sources

GENERAL INTRODUCTION TO HONEY SOURCES SATELLITES

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
6. Drought-tolerant and salt-tolerant honey sources.

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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 englerianum* Henriques; Leguminosae
 139 *Echium lycopsis* L.; Boraginaceae
 149 *Eriobotrya japonica* (Thunb.) Lindl.; Rosaceae
 153 *Eucalyptus anceps* (Maiden) Blakely; Myrtaceae
 154 *Eucalyptus caleyi* Maiden; Myrtaceae
 156 *Eucalyptus camaldulensis* Dehnh.; 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 engelmannii* 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* Dehnh.; 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-TOLERANTAND/OR SALT-TOLERANT001 Acacia berlandieri Benth.; LeguminosaeDROUGHT

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.; LeguminosaeDROUGHT

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 RWA[tm](Bau/66)

Blooms ix-xi (southern Africa, Pag/77)

Pollen

P RWA

Honey no data

003 Acacia decurrens (Wendl.) Willd.; LeguminosaeSALT

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; LeguminosaeDROUGHT

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****DROUGHT**

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**Fodder** - pods, twigs and fls. **Fuel.** **Timber.** **Land use** shade.**Other uses** yields gum**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)

Pollen

P2 SOU

Honey: physical propertiesColour water coloured (And/73)Granulation slow008 Acacia senegal (L.) Willd.; LeguminosaeDROUGHTsyn Acacia verec 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 AfricaSoil poor; rocky sand/clay; no waterlogging; pH 5-8 (Usa/80).Temperature -4 to 48° (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 usesFood - pods. Fodder - pods and lvs. Fuel. Timber. Land use hedges, shade. Soil benefit N-fixation, erosion control, reclamation of refractory sites. Other uses yields gum arabic; rope from root fibres; medicinal; tanninWarning

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

Nectar rating + honeybee species

N1 SEN,tm(Dou/70)

PollenPollen grain illustrated and described (Smt/56a)Honey: physical and other propertiesPfund amber (Dou/70)Granulation rapidAroma v mild009 Acacia seyal Del.; LeguminosaeDROUGHT

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 tortilis* (Forssk.) Hayne; Leguminosae

DROUGHT

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****SALT**

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****DROUGHT/SALT**

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

N1 USA/AZ(Pel/76)

N3 ITA(Ric/78); SOU,tm(And/73); USA/AZ(Lov/56)

N HOD(Ord/63)

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)

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;**
VerbenaceaeDROUGHTsyn *Aloysia ligustrina* Small

beebrush, whitebrush (En/USA); huele de noche, jozmincillo, vera dulce (Es/MEX)

Shrub; fls white

Distribution subtropical N America. **Habitat** semi-desert**Rainfall** drought tolerant but plant dies back during dry spellEconomic and other uses**Land use** hedges, amenityNectar 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; marañon (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 conser-vation. **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

N1 COL(Cor/76); GUY[tm](Cra/73); INI/KER[ac](Dev/71; Hol/65)

N2 INO[ac](Bee/77)

Blooms ii-iii, also v-vi (tropical America, Ord/83)

Pollen

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

Reference slide

Honey no data

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

N1 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)

N2 CUB(Ord/83); USA/FL, TX(Mor/56)

N3 USA/FL, TX(Pel/76)

N GUS[tm](Sve/80); MAT(Bal/76); SUR(Cra/79); TRI(Lau/76)

Blooms vi-vii. **Nectar flow** 6-8 weeks USA/FL; trees can become salt-coated in dry weather, which discourages bees; v sensitive to weather (Pel/76). **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
(Forst.) Bakh.; Avicenniaceae

SALT

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**DROUGHT**

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

Food ?fruit. **Fodder** - lvs (Asia but not in W Africa). **Fuel**.

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****SALT**júcaro negro (Es/CUB); guaraguao (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****DROUGHT**

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.; LeguminosaeDROUGHT/SALT

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**DROUGHT**

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**Nl** 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****SALT**

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
checkcarefully**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

NI 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****DROUGHT**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.; LeguminosaeDROUGHT

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.; RutaceaeDROUGHT

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

SALT

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 CUB(Ord/44); HAI(Mul/78); JAM(Met/66)

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**SALT**

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(Ph1/14); 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

Pl 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

Nl ?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)

122 Dalbergia sissoo DC.; LeguminosaeDROUGHT/SALT

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

N1 INI/HIM[ac](Rah/41); INI/PUN[ac](Rah/41); INI/UTT,ad(Rae/80); PAK,ac,ad(Pak/77; Shi/77; Shr/48)

N INI/HIM,ac(Sig/48)

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

Water [medium] 18.75% (Sig/48)

Glucose [medium] 34.6%. **Fructose** [medium] 39.1%. **Sucrose** [medium] 1.04%

Ash [medium] 0.18%

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****N1** 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

DROUGHT

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 INO[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**DROUGHT**

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**DROUGHT**

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 Dehnh.; Myrtaceae****DROUGHT/SALT**syn *Eucalyptus rostrata* Schlecht.

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/RG[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)
N 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

P1 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,

protein 0.120% dry wt (Bos/78); 0.68%, also contents of 15 individual acids (Peo/72a; Peo/74)

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

DROUGHT

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

DROUGHT

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

angulosa mallee, giant angular mallee, lerp mallee, ridge-fruited 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)**172 Eucalyptus leucoxylon F. Muell.; Myrtaceae****DROUGHT**

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

N1 AUS/SA(Boo/72); AUS/VIC(Gom/73)

N2 SOU,tm(And/73); USA/CA(Pel/76)

N NEZ(Wal/76); URS(Glu/55)

Blooms iv-xii, best v-ix (SOU); v-xii, buds 6-10 mths before flowering (AUS, Pen/61). **Nectar flow** heavy every 2 yrs. **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

Water [medium] 15.4, 16.8% (Che/74; also gives data for samples age 5-12 mths)

Glucose [medium] 27.7, 30.6%. **Fructose** [medium] 43.7, 40.7%.

Sucrose [medium] 1.0, 4.8%. **Reducing sugars** 71.4, 71.3%

Ash [medium] 0.24, 0.11%

pH 5.19, 3.88 (Che/74); 4.3 (Lan/66). **Total acid** 10.6, 32.2 meq/kg

(Che/74). **Free acid** [low] 8.6, 22.8 meq/kg

Amylase 28 (Che/74); 13.9 (Lan/66). **HMF** 2.0, 1.4 ppm

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)

176 Eucalyptus melliodora A. Cunn. ex Schauer; Myrtaceae **DROUGHT**

yellow box, yellow jacket (En/AUS, SOU)

Tree, <25 m, drooping habit; fl stamens white, rarely pink

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

N1 AUS/NSW(Cok/63; Goo/47); AUS/QD(Bla/72); AUS/VIC(Gom/73); KEN[tm](Tow/69); SOU,tm(And/73; Bey/68; Loo/70; Mou/72)

N URS(Glu/55); ZIM[tm](Pap/69)

Blooms 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

Water [low] 14.0% (Che/74; also gives data for 2 samples age 5-12 mths); 17.2% (Woo/76; Woo/76a)

Sugars, total 79.5% (77.6% after 44 days at 50°, Woo/76a).

Glucose [medium] 30.4% (Che/74); 33.3% (28.0%, Woo/76a).

Fructose [medium] 42.9% (Che/74); 36.1% (38.2%, Woo/76a).

Sucrose [medium] 5.1% (Che/74); 1.2% (0.7%, Woo/76a). **Reducing**

sugars 73.3% (Che/74). **Maltose** 5.1% (4.2%, Woo/76a). **Melezitose** 2.3% (2.0%). **Turanose** 0.0% (4.5%)

Ash [low] 0.06%

pH 4.10 (Che/74); 4.18 (4.05, Woo/76); 4.4 (Woo/78). **Total**

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 $\mu\text{M}/100\text{g}$ (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 (Sou/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.; MyrtaceaeDROUGHT

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 resistantEconomic and other uses**Timber.** **Land use** windbreak (low shelter), amenity. **Other uses** tannin from barkNectar 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**P1** 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 data182 Eucalyptus polyanthemus Schauer; MyrtaceaeDROUGHT

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 tolerantEconomic and other uses**Fuel.** **Timber.** **Land use** windbreak, shadeAlert 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**SALT**

swamp mahogany, swamp messmate (En/AUS); robusta gum (En/SOU); eucalyptus rouge (Fr/MAE, MAY); eucalypto (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

DROUGHT

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 DROUGHT

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)

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

Food - pods. **Fodder** - pods for cattle/pigs; lvs. **Fuel**.

Timber. **Land use** hedges, windbreak, shade, amenity. **Soil**

benefit conservation; erosion control

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.; LeguminosaeDROUGHT

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 toleratedEconomic 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, soapsNectar 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

NI 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

Pl 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 *Viguiera 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

N1 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**P1 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)

Total acid 24.38, 32.19 meq/kg. **Free acid** [medium] 14.41, 21.94meq/kg. **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****DROUGHT/SALT**

sunflower; tournesol (Fr); girasol (Pt/BRA); Sonnenblume (De);

bunga matahari, kembang srengéngé (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)

N ALG(Ske/72); BRA/RG[tm](Cor/70); NEZ(Wal/78); SPA(EUR,Maz/82); ZIM,tm(Pap/73)

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/yrs, AA1231/78).

Sugar value (mg/fl/day) [medium] 0.27 (Han/80); 0.097-0.192 (means, various cvs/yrs, AA1231/78); 0.1135-0.2522 (means, 4 yrs, AA805/60); 0.11-0.25 (Frj/70).

Sugar analysis (Bat/73a; Wyk/52; AA171/61; 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, AA127/65).

Honey potential (kg/ha) [moderate] 39.7 (BUL, Pek/78); 18.6-49.0 (10 cvs, BUL, AA1231/78); 30-60 (GDR, 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 (AA1244/78). **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)

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 $<10^{\circ}$ 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

NI 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

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** **DROUGHT**

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** **DROUGHT/SALT**

bacon and eggs, birdsfoot trefoil; gemeine Hornklee (De); lotier corniculé (Fr/ALG); 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

P1 MEX. Reference slide

Honey: physical properties

Pfund light amber (Ord/83)

290 **Medicago sativa L.; Leguminosae**

DROUGHT

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(Les/54); USA/?NE,NM,NV,NY,OK(Pel/76); USA/UT(Nye/71); USA/VT(Med/54); USA/WI,WY(Pel/76)
N2 AUS/NSW(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/OH(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/fl/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

Water [low] 14.4-17.5% (6 samples, age 7-15 mths, Whi/62); [medium] 18.6% (Woo/76)

Sugars, total 79.4% (77.7% after 44 days at 50°, Woo/76a).

Glucose [medium, also low] 22.30% (Moh/82); 32.62-35.01% (Whi/62); 35.1% (33.2%, Woo/76a). **Fructose** [medium, also low] 36.20% (Moh/82); 38.37-40.87% (Whi/62); 34.8% (36.0%, Woo/76a).

Sucrose [medium] 5.21-6.80% (Moh/82); 2.05-4.80% (Whi/62); 2.5% (0.8%, Woo/76a). **Reducing sugars** 71.60% (Moh/82). **Maltose** 9.00% (Moh/82); 4.72-6.87% (Whi/62); 4.0% (5.1%, Woo/76a).

Isomaltose 0.27%, **trehalose** 1.92%, **gentiobiose** 0.24%, **raffinose** 0.17% of total sugars (Bat/73). **Melezitose** 1.6%, **turanose** 1.4% (Woo/76a)

Ash [low] 0.10% (Moh/82); 0.035-0.078% (Whi/62)

pH 5.5 (Moh/82); 3.60-4.05 (Whi/62); 3.80 (3.45 after 44 days at 50°, Woo/76). **Total acid** (meq/kg) 17.81-33.89 (Whi/62); 15.5 (16.5, Woo/76). **Free acid** (meq/kg) [low] 16.70 (Moh/82); 9.22-22.23 (Whi/62); 11.1 (12.5, Woo/76). **Lactone** (meq/kg) 3.24-12.06(Whi/62); 4.4 (4.4, Woo/76)

Amylase 7.6-7.7 (Edw/75); 12.8 (after dialysis, Mau/71); 18.2 (Sce/66); 12.9-21.9 (Whi/62). **Sucrase** trace (Mau/71). **Acid phosphatase** 8.8 μ moles/100 g/h (Mau/71)

Nitrogen 0.025% dry wt (Bos/78); 0.018-0.039% (Whi/62); 0.18% (0.17%, Woo/76). **Amino acids**, free 0.110% dry wt (Bos/78); 741.7 μ M/100 g (261.2, Woo/176a); protein 0.099% dry wt (Bos/78). Contents of individual acids (proline 80% of total, Woo/76a).

Protein 0.0052-0.0065% (4 samples, Gen/67); 0.18% (Mau/71)

Volatile compounds - 46 present, 13 named (Woo/78a)

Honey: physical and other properties

Colour light, hardly affected by heating, 44-79° (Stn/81).

Pfund 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); <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)

Viscosity 472.00 poise (Moh/82); "good body" (Cra/75; Lov/56; Van/41). **Optical rotation** -36.50 deg (Bat/73); -6.27 deg (Moh/82)

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

SALT

belbowrie, broad-leaved tea-tree (En/AUS)
 Tree, <25 m; fls white/yellow, fragrant. M leucadendron, which is often confused with M. quinquenerva, does not grow in USA; all data from there are entered under M quinquenerva
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

DROUGHT

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/NSW(Goo/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); 14.2-30.8% (various dates/local-
 ities, Mog/58); 33% on wet soil, 55% on dry soil (Nye/71); 40.3%
 (Pek/77); 42.21% (Pet/77); 36-48% (Shw/53); 24.8% (Sim/80);
 35% (Van/49); 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)
pH 3.65. **Total acid** 19.37 meq/kg. **Free acid** [medium] 15.62 meq/kg. **Lactone** 3.75 meq/kg
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/ALG); melilot jaune (Fr/CAF); erba vetturina, meliloto (It)
 Herb, 40-250 cm, biennial; fls yellow, fragrant
Distribution temperate Europe, N America, (Med) Africa, Asia.
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); motlhwane 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 data314 Onobrychis viciifolia Scop.; LeguminosaeDROUGHTsyn *Onobrychis sativa* Lam.

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 resistantEconomic and other uses**Fodder** - hay, pastureWarning

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

DROUGHT

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)

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

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)

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**DROUGHT/SALT**

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)

Blooms 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**DROUGHT/SALT**

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; water-logging 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

DROUGHT/SALT

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

♀ PAK

Honey no data

337 Prosopis farcta (Sol. ex Russell) J.F. Macbride;
Leguminosae

SALT

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 Prosopis 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,TX(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**DROUGHT**

algaroba (En/AUS, USA); mesquite (En/AUS, SOU, USA); cashaw (En/JAM); cupesí (Es/BOL); duitswesdoring (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

Food - flour from pods. **Fodder** - pods. **Fuel.** **Timber.** **Land use** shade. **Soil benefit** dune stabilization

Warning

Aggressive invader; should be grown only in v 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.)**DROUGHT/SALT****Kunth; Leguminosae**

kiawe (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.; BignoniaceaeDROUGHT

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.; RhizophoraceaeSALT

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 aquaculture of fish; tannin; resins; wood pulp

Warning

Mangrove swamps are often breeding sites for mosquitoes

Nectar rating

N1 JAM(Met/66)

Honey no data**354 Robinia pseudoacacia L.: Leguminosae****DROUGHT**

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, morraines (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

Pl 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

Water [medium] 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)
Glucose [low] 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). **Fructose** [high, also medium] 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). **Sucrose** [medium, also low] 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). **Maltose** 6.51% (Bat/73); 5.44% (Ech/77); 10.14% (Whi/62). **Isomaltose** 0.40% (Bat/73). **Trehalose** 2.98%. **Gentiobiose** 0.27%. **Raffinose** 0.27%. **Melezitose** 1.35-3.89% (Pae/77). **Erllose** present (Bel/79). **Dextrin** 1.45-5.93% (Bac/65)
Ash [low] 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)
pH 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)
Amylase 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
Nitrogen 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)
Fermentation on storage unlikely, yeast count low (Maa/73)
Vitamins 260 ppm (180 ppm after 30 min at 50°, Ech/77)
 Compounds probably contributing to flavour (Wab/80)

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); 1.4080-1.4440 (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

NI 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

SALT

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

SALT

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**SALT**

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%

pH 3.89, 4.10. **Total acid** 46.78, 35.71 meq/kg. **Free acid** [medium] 31.48, 21.59 meq/kg. **Lactone** 15.29, 14.12 meq/kg

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**DROUGHT**

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

N1 CHA[tm](Gad/80); ?HAI(Mul/78); INI/KAR,KER[ac](Kha/59);

INI/TAM[ac](Ram/37); MAY(Bro/82; Cra/73); THA(Smt/83)

N2 DOR(Ord/64); INI/MAD[ac](Kh/48); INI/TAM[ac](Sig/62);

INI/UTT[ac](Koh/58); INO[ac](Bee/77); NIA(Ord/63a)

N3 INI/MAH[ac](Chu/80)

N HOD(Ord/63)

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 (Kh/48); "quite sweet, but when swallowed tastes slightly acid like flower" (Koh/58)

405 Thymus capitatus (L.) Hoffm. & Link; Labiatae**DROUGHT**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

Nl CRE(Adm/54; Nic/55); CYP(Adm/54); GRC(Mai/52; Nic/55);
MAQ(Far/79)

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)

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,
phenylamine, tyrosine high (Mak/78)

422 Tournefortia argentea L.f.; Boraginaceae**SALT**

tree heliotrope

Tree/shrub

Distribution tropical Oceania, Asia. **Habitat** widespread coastal
plant; coral islands

Soil salt tolerant

Nectar rating; blooms, nectar flow

Nl WAK(Lar/72)

Blooms 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 occurHoney: physical and other properties**Colour** deep gold to red to almost black**Flavour** strong426 *Trifolium alexandrinum* L.; LeguminosaeDROUGHT/SALT

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 resistantEconomic and other uses**Fodder** - forage, green fodder, pasture. **Soil benefit** green manure, soil coverNectar 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)

pH 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

427 Trifolium fragiferum L.; Leguminosae

SALT

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**SALT**

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)

441 Viguiera helianthoides Kunth; Compositae

DROUGHT

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

448 Ziziphus mauritania Lam.; Rhamnaceae

DROUGHT

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.;**Rhamnaceae****DROUGHT**

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.; RhamnaceaeDROUGHT

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

Food - fruit. **Fodder** - lvs, branches, fruit. **Fuel**. **Timber**.

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).