ECTD_217

TITLE: Honey sources satellites :
Honeydew sources and their honeys

SOURCE: IBRA
[with P. Walker]

DATE: 1986
HONEY SOURCES SATELLITE 5.

HONEYDEW SOURCES AND THEIR HONEYS

by Eva Crane and Penelope Walker

London 1986

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

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

Titles of the Honey Sources Satellites are:

1. Bibliography (with author reference codes); country codes; other abbreviations

2. Plants listed alphabetically and by family; common name index; pollen grain information

3. Chemical composition of some honeys

4. Physical properties, flavour and aroma of some honeys

5. Honeydew sources and their honeys


Eva Crane
Woodside House
Gerrards Cross
SL9 9TE, UK
## CONTENTS OF SATELLITE 5

1. Introduction .................................................. 5
2. Complete printouts for important plant sources of honeydew honey ................. 7
3. Printouts of honeydew information for important nectar sources which can also yield honeydew ........................................... 21
4. Index to honeydew-producing insects on the plants ..................................... 25
5. Discussion paper "Important honeydew sources and their honeys" (reprinted from Bee World) ............................................. 27

### 1. INTRODUCTION

Section 2 gives printouts from the 1984 Directory for 15 important world sources of honey which is derived entirely from honeydew. Entries in the Directory for 23 of the sources of nectar honey show that these may also yield honeydew, and Section 3 here gives information on their honeydew production. Eight are considered to be important sources of honeydew honey (013, 014, 080, 354, 363, 364, 410, 415). Haragsim (1966) gave ratings to the importance of certain honeydew honey sources, and his highest rating is entered here as D1.

Section 4 provides an index to the 49 insects known to us as producing honeydew from the plants in Sections 2 and 3, together with some of their synonyms.

Section 5 discusses honeydew flows and honeydew honeys, with a useful summary Table.

The author reference codes in Sections 2 and 3 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. The 3-letter codes used for country names, e.g. FRA for France, and the 2-letter codes for languages, e.g. It for Italian, are also listed in the Directory and in Satellite 1.
2. COMPLETE PRINTOUTS FOR IMPORTANT PLANT SOURCES OF HONEYDEW HONEY

Old Abies alba Miller; Pinaceae
syn Abies pectinata (Lam.) DC.
silver fir; Edeltanne, Weisstanne (De); abete bianco (It)
Tree, <50 m, evergreen
Distribution temperate Europe. Habitat forests in mountainous areas of EUR; altitudes >500 m; widely planted in EUR; areas with atmospheric pollution not suitable
Soil deep moist soil preferred. Rainfall not drought tolerant

Economic and other uses
Timber. Land use amenity

Alert to beekeepers
Honey from Cinara pectinatae granulates v rapidly in combs, difficult to extract (FRA, Bab/56)

Honeydew
From Cinara confinis (Koch), previously Todolachnus abieticola (Cholodkovsky) and T. confinis (Koch), Lachnidae: flow viii-ix, "important to beekeepers" in parts of Black Forest, Alps, and on North Sea coast, honeydew analysis (mid EUR, Klo/65); flow (ROM, Cir/80); flow but not every yr (YUG, Rih/77)
From Cinara pectinatae (Nordlinger), previously Buchneria pectinatae Nordlinger, Lachnidae: rated D1, flow vii-ix (mid EUR, Hag/66); flow vii-x, very heavy in some yrs (mid Eur, Klo/65); yield "v important" (FRA, Bab/56); honey potential 40 kg/ha (ROM, Cir/80); yield 60-90 kg/colony/yr (SWI, Scd/50); flow vii-xii, yield 19 kg/colony/yr (YUG/Slovenia, Rih/77); honeydew analysis (Bab/56; Hag/66; Klo/65)
From Cinara pilicornis (Hartig), previously referred to as Cinara piceicola (Cholodkovsky), Lachnidae: rate of flow at 25° is twice that at 15°, but is reduced by direct sunlight and other factors (south-west GFR, Eck/72)
From Mindarus abietinus Koch, Thelaxidae: flow may be heavy, honeydew "thin", honey yield reported May 1957 (?GFR, Klo/65). Some records of honeydew "poisoning" of bees may relate to this insect
From Physokermes piceae (Schrank), Coccidae: flow mid-iv to early vii, coincides with heavy nectar flow from other plants, so not fully used by bees (mid EUR, Klo/65)

Insect not specified: mean honey yield 40-45 kg/colony/yr, mean honey potential 58.4, max 96 kg/ha (1968-1974, AUT, Peh/77); yield unspecified (GRE, Ric/80); "appreciable" (ITA/Apennines, Ric/78); honey potential 20 kg/ha (ROM, Apc/68); honey safe as winter food for bees (ROM/Muresh, Magyar, Fra/65); yield unspecified (TUQ, Ric/80); "much in some yrs" (YUG, Kul/59)
Honey: chemical composition
Water [low] 16.1%, 14.2% (insect not specified, AUT, GFR, Kir/61)
Sugars (insect not specified, ITA, Bat/73): glucose [medium] 36.90%; fructose [low] 33.86%; sucrose [low] 0.40%; maltose 9.05%; isomaltose 1.45%; trehalose 4.88%; gentiobiose 0.64%; raffinose 1.57%; melezitose 8.10%. Dextrin 2.98%, 4.45% dry wt (Kir/61)
Ash 1.14%, 1.01% dry wt (Kir/61)
pH 4.78, 4.96 (Kir/61)
Sucrase high (Vor/68)
Amino acid analysis (GFR, Kum/74). Colloids 0.31%, 0.24% dry wt (Kir/61)

Honey: physical and other properties
Colour, from Cinara pectinatae: black-brown with greenish tinge (mid EUR, Klo/65); white, yellow or brown (in combs, FRA, Bab/56); insect not specified: dark green (AUT, Kir/61; YUG, Kul/59); khaki green (GFR, Kir/61); v dark, often slightly greenish (ITA, Ric/78)
Optical rotation +2.89 deg (Bat/73); +9.55, +2.87 deg (insect not specified, AUT, GFR, Kir/61)
Granulation (alert to beekeepers) v rapid, in combs, difficult to extract (from Cinara pectinatae, FRA, Bab/56); rapid (YUG, Kul/59); none, or irregular (ITA, Ric/78); medium, becoming more green (GFR, Vor/68)
Flavour of treacle (AUT, Kir/61); v sweet (GFR, Kir/61); mild to resinous (aromatic) (GFR, Vor/68); "tonic" (ITA, Ric/78)

02D Abies borisii-regis Mattf.; Pinaceae
Tree, <60 m, evergreen; probably of hybrid origin, form variable
Distribution temperate (Med) Europe. Habitat mountains of Balkans

Honeydew
From Eulecanium sericeum (Lindinger), Coccidae: insect population small, so honey yield low; flow x-vii, but bees collect honeydew only v-vii (GRC/Tymphrystos, San/81)
From Mindarus abietinus Koch, Thelaxidae: of minor importance, flow late spring to early summer (GRC/Iti, Tymphrystos, San/81). Some records of honeydew "poisoning" may relate to this insect
From Physokermes hemicryphus Dalman, Coccidae: the main contributor, giving "abundant" secretion for which hives are migrated to forests; 5-10% of total honey production in Greece is from this insect on Abies borisii-regis and A. cephalonica(03D); flow late v to early vii (GRC/Eperos, Macedonia, Thessaly, San/81)

Honey no data
03D Abies cephalonica Loudon; Pinaceae

Greek fir
Tree, <30 m, evergreen
**Distribution** temperate (Med) Europe. **Habitat** mountainous areas of GRC; cultivated in ITA

**Economic and other uses**
Timber. **Land use** afforestation

**Honeydew**
Honeydew produced by the same insects as on Abies borisii-regis (02D). For A. cephalonica, insect distributions in Greece are: **Eulecanium sericeum** Parnis, Parnon; **Mindarus abietinus** central, Parnis, Iti, Tymphrystos; **Physokermes hemicryphus** central, Evia, Kephalonia, Peloponnnesus (San/81)

Honey no data

04D Calocedrus decurrens (Torr.) Florin; Cupressaceae
syn Libocedrus decurrens Torr.

California incense cedar, white cedar (En/USA)
Tree, 21-30 m, evergreen
**Distribution** subtropical N America; temperate N America, Europe.
**Habitat** higher altitudes, mountains of USA/CA,OR; atmospheric pollution not tolerated
**Soil** moist, well drained soil preferred. **Temperature** fully hardy

**Economic and other uses**
Timber. **Land use** amenity

**Honeydew**
From **Xylococcus macrocarpi** (Coleman), Coccoidea: 45-136 kg/colony/yr; flow abundant at times, early summer onwards; honeydew v "gummy", colour amber but white in xi (USA/CA,OR, Pel/76)

**Honey: chemical composition**
**Water** [low] 12.2, 15.2% (2 samples, age 9, 18 mths, insect not specified, USA/CA, Whi/62)
**Glucose** [low] 23.34, 27.94%. **Fructose** [low] 23.91, 26.22%.
**Sucrose** [low] 0.83, 0.74%. **Maltose** 5.85, 6.08%. **Higher sugars** 11.50, 8.70%
**Ash** [high] 1.097, 1.047%
**pH** 4.42, 4.71. **Total acid** 76.49, 56.08 meq/kg. **Free acid** [high] 66.02, 49.91 meq/kg. **Lactone** 10.47, 6.16 meq/kg
**Nitrogen** 0.049, 0.047%
Honey: physical and other properties
Pfund 104 to >114 mm, amber to dark amber (insect not specified, USA/LA, Whi/62)
Viscosity "heavy body" (USA, Pel/76)
Granulation slow
Flavour bland

05D Fagus sylvatica L.; Fagaceae
beech, red beech; Rotbuche (De); faggio (It)
Tree, <30 m, deciduous; monoecious
Distribution temperate Europe; native to Europe. Habitat woodland; mountains; widely planted
Soil well drained; lime tolerated. Temperature hardy
Economic and other uses
Fodder - nuts for pigs. Timber. Land use amenity
Honeydew
From Lachnus pallipes (Hartig), previously L. exsiccator Altum, and Schizodryobius pallipes Hartig, Lachnidae: honeydew produced, amino acid analysis reported (assumed to be F. sylvatica, GFR, Kum/74); honeydew produced (ROM, Cir/80)
From Phyllapis fagi (L.), Callaphididae: rated D1, flow v-vii (mid EUR, Hag/66); flow heaviest in v, early vi (mid EUR, Klo/65); also reported for ROM (Cir/80); honeydew waxy, more attractive to bees after rain (mid EUR, especially AUT, Klo/65)
Insect not specified: "yield obtained from time to time" (ITA-/Central Apennines, Ric/78)
Honey no data

06D Larix decidua Miller; Pinaceae
syn Larix europaea DC.
larch; europäische Lärche (De); larice (It)
Tree, <35 m, deciduous
Distribution temperate Europe, Asia. Habitat mountainous areas of EUR, especially Alps and W Carpathians; widely planted
Soil well drained light or gravelly loam preferred; wet low-lying areas not tolerated
Economic and other uses
Timber. Land use afforestation, amenity. Other uses tannin from bark; medicinal; turpentine from resin
Alert to beekeepers
Honeydew and honey may granulate very rapidly, on tree or in combs (Klo/65; Mal/79; Ric/78)

Honeydew
From **Cinara cuneomaculata** (del Guercio), previously C. boerneri Hille Ris Lambers, and C. laricicola Börner, Lachnidae: rated D1, flow v–viii (mid EUR, Hag/66); "important", flow vi (or vii)–x, honeydew analysis (mid EUR, Klo/65)
From **Cinara kochiana** (Börner), previously Laricaria kochiana (Börner), Lachnidae: flow from late vi to autumn, visited by bees (mid EUR, Klo/65)
From **Cinara laricis** (Hartig), previously Lachnus muravensis Arnhart, and Lachniella nigrotuberculata del Guercio, Lachnidae: honeydew analysis (CZE, Hag/63); "probably main honeydew producer on larch", flow heavy vi, also late viii to x, honeydew may granulate on tree due to high melezitose content (mid EUR, Klo/65), then called manna; honey yield obtained, honeydew analysis (ITA, Mal/79)

**Insect not specified:** crystallized honeydew contained (% dry wt) - 53.36% melezitose, 53.36% [sic] sucrose, 13.94% invert sugar, 30.03% dextrin (AUT, Goa/52); honeydew produced (FRA, Lou/81); "a main honey source" (Germany, How/79); honey yield "rather scarce" (ITA/Alps, Apennines, Ric/78)

**Honey: chemical composition**
Glucose 15.94, 13.70% (dry wt, 2 samples, Cinara laricis, ITA/W Alps, Mal/79). Fructose 29.18, 24.33%. Sucrose 0.73, 4.16%.
Meso-inositol 0.05, 0.06%. Turanose 2.49, 1.29%. Raffinose 2.13, 2.00%. Melezitose 44.47, 42.76%; "high" (Cinara cuneomaculata, mid EUR, Klo/65)

**Honey: physical and other properties**
Granulation (alert to beekeepers) very rapid, in combs (from C. laricis, Klo/65; Mal/79; Ric/78); colour then white (Mal/79)

07D *Nothofagus solandri var. cliffortioides* (Hook. f.) Poole; Fagaceae

mountain beech (En/NEZ)
Tree, <15 m, shrub in subalpine belt, monoecious
**Distribution** temperate Oceania; native to NEZ, South Island.
**Habitat** montane and subalpine forests, scrub (NEZ)

**Economic and other uses**
Timber
Honeydew
From Ultracoelostoma assimile (Maskell), Margarodidae: estimated honey yield 60 kg/colony/yr (Bet/79); abundant flow in late summer and autumn, honey safe (and often used as) winter food for bees (Coo/81).

About 30 species of scale insects are found on Nothofagus spp, and many secrete honeydew which may contribute to beech honeydew honey (Wao/79)

Honey: chemical composition
Water [medium] 19% (beech honeydew honey, plant and insect not specified, NEZ, Dal/75)
Sugars, total 64%. Fructose [medium] 35.6%. Sucrose [medium] 1%. Reducing sugars [low] 63%
Ash [low] 0.79%
Free acid [medium] 32 meq/kg
Amylase 20. HMF 0 ppm

Honey: physical and other properties
Colour brown (beech honeydew honey, Dal/75)
Flavour distinctive (Coo/81). Aroma strong (Dal/75)

08D Picea abies (L.) Karsten; Pinaceae
syn Picea excelsa (Lam.) Link; Picea vulgaris Link

Norway spruce; Fichte, Rottanne (De); abete rosso (It)
Tree, <60 m, evergreen
Distribution temperate Europe; native to Europe. Habitat widely planted as forest tree in N, W and C Europe; often in mountainous districts

Economic and other uses
Food - alcoholic drink from fermented shoots, lvs. Timber.
Land use afforestation, amenity. Other uses resin purified for pitch; turpentine from shoots, lvs; tannin from bark; when young, sold for Christmas trees

Honeydew
From Cinara costata (Zetterstedt), previously Lachniella costata (Zetterstedt), Lachnidae: heavy flow in some yrs, but only one report of bees flying directly to this source (mid EUR, Klo/65)
From Cinara piceae (Panzer), previously Mecinaria piceae (Panzer), Lachnidae: up to 15 kg/colony/yr; with Physokermes piceae reported to be "most important source" on P. abies in Alps; flow 3-6 days in vii or viii, almost every yr (mid EUR, Klo/65)
From **Cinara pilicornis** (Hartig), previously referred to as C. piceicola (Cholodkovsky), Lachnidae: rated **Dl**, flow vi-viii (mid EUR, Hag/66); "important" in S, mid and N GFR, flow from late v to vii, honeydew analysis (Klo/65); factors affecting secretion (Ecl/72)

From **Cinara pruinosa** (Hartig), previously C. bogdanowi (Mordvilko), Lachnidae: rated **Dl**, flow vi-viii (mid EUR, Hag/66)

From **Physokermes hemicryphus** Dalman, Coccidae: honey yield 3.2-42.8 kg/colony/yr, "the most important honeydew producer of mid EUR", flow from early vi to early vii (AUT, Peh/76); rated **Dl**, flow vi-vii (mid EUR, Hag/66); honey yield up to 39 kg/colony/yr, flow late v to mid vii, honeydew analysis (mid EUR, Klo/65); honeydew analysis (Hag/63)

From **Physokermes piceae** Schrank, Coccidae: flow mid-iv to mid-vi coincides with main nectar flow, so not fully used by bees; honeydew analysis (mid EUR, Klo/65); but important in Alps (see under Cinara piceae, Klo/65); heavy flow, collected by bees, gains of up to 4 kg/day per hive, water content of honeydew 14% (GFR, Got/51); honeydew analysis (Hag/63)

**Insect not specified**: honey potential 100-500 kg/ha (EUR, Nee/78); honeydew produced: (FRA, Lou/81); mean honey yield 40 kg/colony/yr (Germany, Pel/76); "rather scarce" (ITA/Alps, Ric/78); flow vii-viii (NOW, Lun/71); honey potential: 20 kg/ha (ROM, Apc/68); 50 kg/ha (ROM, Cir/80). Honey safe as winter food for bees (ROM, Fra/65)

**Honey: chemical composition**

**Water** [medium] 17.4% (insect not specified, AUT, Kir/61)

**Reducing sugars** 76.9% dry wt. **Dextrin** 3.57% dry wt

**Ash** 0.85% dry wt

**pH** 4.74

**Colloids** 0.24% dry wt. **Amino acid** analysis (insect not specified, GFR, Kum/74)

**Honey: physical and other properties**

**Colour** dark red brown (from Cinara piceae), reddish (from C. pilicornis), reddish brown (from Physokermes hemicryphus) (mid EUR, Klo/65); buff (insect not specified, AUT, Kir/61); greenish black (insect not specified) (SWI, Pel/76)

**Optical rotation** +3.48 deg (AUT, Kir/61)

**Granulation** slow (from C. piceae), slow (from C. pilicornis) (Klo/65)

**Flavour** fairly sweet (AUT, Kir/61)
**09D Pinus halepensis Miller; Pinaceae**

Aleppo pine, Jerusalem pine; pin d'Alep (Fr/ALG)  
Tree, 20 m, evergreen  
**Distribution** temperate (Med) Europe, Asia, Oceania; native to Med area  
**Soil** shallow soil preferred; limestone; heavy clay better tolerated than by other Pinus spp; not waterlogged or saline soils. **Temperature** brief occasional cold spells -18° to -20° tolerated, also high temperatures. **Rainfall** 355-400 mm (native range); drought tolerant, 250-800 mm annually but young seedlings not drought tolerant  

**Economic and other uses**  
Fuel. Timber. Land use windbreak, shade, afforestation in poor dry conditions, amenity. **Other uses** resin  

**Honeydew**  
From *Marchalina hellenica* (Gennadius), previously Monophlebus hellenicus (Gennadius), Margarodidae: "high" honey yield, mainly in Chalkidiki (GRC, Mai/52); 5-10 kg/colony/yr, abundant flow in autumn (GRC/Chalkidiki, Thasos, Nic/55); heavy flow from late vi to following spring, bees collect honeydew viii-ix (GRC/Med basin, San/81); main source of pine honeydew at altitudes <900 m, 60% of Greek honey is from this insect on pine trees, mainly P. halepensis (San/81)  
**Insect not specified:** much honeydew secreted, mainly in Oranie and southern mountains (ALG, Ske/77); main honey crop on Thasos and Ikaria (GRC, Adm/64); 60 000 colonies brought to forests by end vii for abundant flow viii (TUQ/west coast, Adm/77)  

**Honey:** **chemical composition**  
**Nitrogen** 14 mg/100 g dry wt (insect not specified, ?ITA, Bos/78).  
**Amino acids** free 54, protein 64 mg/100 g dry wt (Bos/78)  

**Honey:** **physical and other properties**  
**Colour** dark (insect not specified, ALG, Ske/72). **Pfund** light amber (from Marchalina hellenica, GRC, Nic/55)  
**Viscosity** "good body"  
**Granulation** [slow] does not granulate  
**Flavour** characteristic (Ske/72)  

**10D Pinus sylvestris L.; Pinaceae**  
Scotch fir, Scots pine; gemeine Kiefer, Rotkiefer (De); furu (No)  
Tree, <40 m, evergreen  
**Distribution** temperate Asia, Europe; native to Europe. **Habitat** open woodland; widely planted forest sp
Economic and other uses
Timber. Land use afforestation, amenity. Other uses rosin and turpentine from resin; tar, pitch and pine oil by distillation

Honeydew
From Cinara cembrae (Seitner), Lachnidae: rated D1, flow vii-ix (mid EUR, Hag/66)
From Cinara nuda (Mordvilko), Lachnidae: flow may be fairly heavy, honeydew collected by bees (mid EUR, Klo/65)
From Cinara pinea (Mordvilko), Lachnidae: flow vi-vii, honeydew collected by bees and in some areas hives are moved to forest for this flow, honeydew analysis (mid EUR, Klo/65); "good" flow vii-viii (NOW, Lun/71); honeydew honey potential on Pinus spp 10 kg/ha (ROM, Cir/80)
From Marchalina hellenica (Gennadius), Margarodidae: heavy flow late vi to following spring; 60% of Greek honey is from this insect on pine trees - P. sylvestris less important than P. halepensis (GRC, San/81)
From Schizolachnus pineti (Fabricius), Lachnidae: "considerable" flow visited by bees, but importance not known (EUR/Med, Klo/65)

Honey: chemical composition
Water [medium] 20.2, 20.5% (insect not specified, Dus/67)
Glucose [medium] 30.05% (presumed P. sylvestris, CZE, Svo/56).
Fructose [medium] 38.25%. Dextrin 3.11%
Ash [medium] 0.44%
Invertase 46, 47.3. Peroxide number 418.7, 662.5 μg/g/h
Amino acid analysis (Kum/74)

Honey: physical properties
Optical rotation laevorotatory (presumed P. sylvestris, CZE, Svo/56). Electrical conductivity 0.00112, 0.0012/ohm cm (Dus/67)

11D Populus spp; Salicaceae
poplar; Pappel (De)
Tree, deciduous, usually dioecious
Distribution temperate Europe, Asia, N America, (Med) Africa; subtropical N America, Asia, C America

Economic and other uses
Timber - many hybrids planted for pulp-wood (EUR)

Honeydew
From Chaitophorus populeti (Panzer), Chaitophoridae, on Populus alba, P. nigra and P. tremula: heavy flow collected by bees (AUT, Klo/65)
From *Chaitophorus populeti*, together with *Pterocomma salicis* (L.), Aphididae: intense flow from late v to mid vi, colonies gained 10-20 kg/colony in 10 days, of which 60% attributed to poplar honeydew; honey potential for *P. alba* 20 kg/ha, for *P. nigra* 20 kg/ha (ROM, Cir/80)

From *Pachypappa vesicalis* Koch, Pemphigidae: flow v to early vi, honeydew analysis (URS/Ukraine, Blz/79)

**Insect not specified:** crystallized honeydew (manna) contained 40% melezitose (AUT, Goa/52); honeydew produced, NOW (Lun/71); USA (Pel/76); honeydew shortened life span of bees (URS/Voronezh, Orz/58)

**Honey** no data

---

**12D Quercus robur** L.; **Fagaceae**

syn *Quercus pedunculata* Ehrh.

- common oak, English oak, pedunculate oak; farnia (It)
- Tree, <45 m, deciduous, monoecious
- **Distribution** temperate Europe, (Med) Africa, Asia; native to Europe.
- **Habitat** woodland, where it is often the dominant sp
- **Soil** wide range but brown-earth soils preferred

**Economic and other uses**

- **Timber** v hard, used for ship-building etc

**Alert to beekeepers**

Honey from *Quercus* spp not suitable as winter food for bees (ROM, Fra/65)

**Pollen**

- Pl ITA.  P3 FRA.  P URS.  **Pollen value** 80% of spring harvest (Ric/78).
- **Colour** of load yellow green (Han/80)

**Honeydew**

From *Kermes quercus* (L.), Kermesidae: on *Quercus robur* and *Q. pubescens* - rated D1, flow ?iv-v (mid Eur, Hag/66); "considerable" flow from end iv to mid v or vi, honeydew tastes only slightly sweet (?to man) but bees collect it actively in the afternoon (mid EUR, Klo/65)

From *Lachnus ilicophilus* (del Guercio), previously *Schizodryobius longirostris* (Mordvilko), Lachnidae: collected by bees in vi (mid EUR, Klo/65)

From *Lachnus roboris* (L.), Lachnidae: rated D1, flow v-vii (mid EUR, Hag/66); importance to bees not certain (Klo/65)

From *Thelaxes dryophila* (Schrank), Thelaxidae: heavy flow with
peak v or vi, continuing till autumn, collected by bees (mid EUR, Klo/65)
From Tuberculatus annulatus (Hartig), previously Tuberculoides annulatus (Hartig), Calliphidiidae: flow peak mid vi to vii, "most important producer on oak", honeydew granulates rapidly, bees collect it while liquid in the morning (mid EUR, Klo/65)
Insect not specified: flow every 4 yrs (ITA/Umbria, Marche, Abruzzo, Ric/78); FRA (Lou/81); URS (Fed/55); honeydew honey potential from Quercus spp 20 kg/ha (ROM, Cir/80). Alert to beekeepers honey from Quercus spp not suitable as winter food for bees (ROM, Fra/65)

Honey: physical and other properties
Colour "less dark than other honeydew honeys" (insect not specified, ITA, Ric/78)
Flavour sweet, also slightly sharp. Aroma intense

13D Quercus suber L.; Fagaceae
cork oak; chêne liège (Fr)
Tree, <20 m, evergreen, monoecious
Distribution temperate (Med) Europe, (Med) Africa, Oceania
Temperature fairly hardy

Economic and other uses
Land use shade, amenity. Other uses cork from bark for making hives

Alert to beekeepers
Honey from Quercus spp not suitable as winter food for bees (ROM, Fra/65); honeydew shortened life span of bees (URS/Voronezh, Orz/58)

Pollen
P ALG

Honeydew
Insect not stated: flow sometimes abundant in Dellys forest (ALG, Ske/77); "important" honey source in Morocco (Cra/73). Alert to beekeepers honey from Quercus spp not suitable as winter food for bees (ROM, Fra/65); honeydew shortened life span of bees (URS/Voronezh, Orz/58)

Honey no data
14D *Quercus virginiana* Mill.; Fagaceae

Live oak (En/USA)
Tree, <18 m, evergreen, monoecious
**Distribution** temperate N America; subtropical N America; tropical C America

**Economic and other uses**

**Timber**

**Honeydew**
From "live oak gall" (specific name not stated): yield 11 kg/colony/yr, flow viii to late autumn, "v useful source during drought" (USA/TX, Pel/76)

**Honey: chemical composition**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water</strong></td>
<td>[medium] 18.2, 16.2% (2 samples, age 8,9 mths, USA/FL, Whi/62, who says &quot;Quercus fagaceae&quot;, presumably Quercus (family Fagaceae) and we assume it to be Q. virginiana)</td>
</tr>
<tr>
<td><strong>Glucose</strong></td>
<td>[low] 29.51, 26.61%. Fructose [medium] 38.12, 34.59%.</td>
</tr>
<tr>
<td><strong>Sucrose</strong></td>
<td>[medium, also low] 1.14, 0.63%. Maltose 8.67, 10.59%. Higher sugars 1.28, 2.47%. Melezitose (1 sample) 0.38%</td>
</tr>
<tr>
<td><strong>Ash</strong></td>
<td>[medium] 0.212, 0.799%</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>3.90, 4.70. Total acid 50.71, 67.27 meq/kg. Free acid [medium, also high] 36.62, 64.57 meq/kg. Lactone 14.09, 2.58 meq/kg</td>
</tr>
<tr>
<td><strong>Amylase</strong></td>
<td>6.7, 41.4</td>
</tr>
<tr>
<td><strong>Nitrogen</strong></td>
<td>0.053, 0.223%</td>
</tr>
</tbody>
</table>

**Honey: physical and other properties**

Pfund 85 to >114 mm, amber to dark amber (Whi/62, see note under Water). Colour dark (from live oak gall, USA/TX, Pel/76)
Viscosity "heavy" (Pel/76)

15D *Zea mays* L.; Gramineae

[see paragraph 6 on page 29]

Maize, sweetcorn; Indian corn (En/USA)
Herb, 1-8 m, annual, monoecious
**Distribution** temperate N America, Asia, (Med) Africa, Europe and (Med) Europe; subtropical S America, N America, Asia, Africa; tropical S America, C America, Caribbean, Asia, Africa; native to N America. **Habitat** cultivated crop plant
**Soil** deep well drained fertile soil preferred; waterlogging not tolerated. **Rainfall** - rain during growth essential
Economic and other uses

Food - fresh seeds as vegetables, dried for flour/oil.  Fodder - lvs and seeds for forage, silage.  Fuel.  Other uses spathes for paper-making

Pollen
Pl ALG (Ske/72); URS/South (Glu/55); USA/TX (Pel/76)

Honeydew
Insect not specified:  occasional flow (ALG, Ske/72); honey yield reported as 45 kg/colony/yr (USA/LA, Ord/83); honeydew honey also reported in USA/IA, TX (Pel/76); USA/MA (Shw/50); ZIM (Pap/73).  Bees also collect sap from split stems (URS, Glu/55; USA, Pel/76)

Honey:  physical and other properties
Colour yellow (USA/IA, Pel/76); dark (USA/TX, Pel/76)
Granulation v coarse (USA/IA, Pel/76)
Flavour "peculiar", like corn silk
3. PRINTOUTS OF HONEYDEW INFORMATION FOR IMPORTANT NECTAR SOURCES

WHICH CAN ALSO YIELD HONEYDEW

013 Acer platanoides L.; Aceraceae

Honeydew produced, and collected by bees: from *Periphyllus aceris* (L.), previously Chaetophorella aceris, Chaitophoridae - rated D1 (mid EUR, Hag/66; Klo/65); and from *Periphyllus caracinus* (Koch), previously Chaitophorinus coracinus (Koch), Chaitophoridae (mid EUR, Klo/65). Honeydew also produced by *Drepanosiphum platanoidis* (Schrank) Callaphididae (mid EUR, Klo/65); also in ALG (insect not specified, Ske/72); ROM (Cir/80)

014 Acer pseudoplatanus L.; Aceraceae

Honeydew produced, and collected by bees: from *Periphyllus aceris* (L.) Chaitophoridae - rated D1 (mid EUR, Hag/66); from *Periphyllus testudinaceus* (Fernie), previously P. villosus (Hartig), Chaitophoridae - honeydew collected from early or mid v in yrs when tree flowers (mid EUR, Klo/65). Honeydew also produced (insect not specified) in: ALG (Ske/72); ROM (Apc/68; Cir/80); UK (How/79)

015 Acer tataricum L.; Aceraceae

Honeydew produced ROM (Apc/68, Cir/80)

080 Castanea sativa Mill.; Fagaceae

Honeydew produced, and collected by bees: from *Lachnus roboris* (L.), previously L. longipes (Dufour), Lachnidae - flow 1-2 wks during flowering (S EUR, Klo/65); also from *Myzocallis castanicola* Baker, Callophididae - (S EUR, Klo/65); and *Parthenolecanium rufulum* (Cockerell), previously Eulecanium rufulum (Cockerell), Coccidae - bees can only use this flow early in morning and/or? at high RH (S EUR, Klo/65). Honeydew produced by L. roboris and M. castanicola (ROM (Cir/80). Also produced (insect not specified) in ITA (Ric/78); YUG (Kul/59)

209 Gossypium barbadense L.; Malvaceae

Honeydew produced (Mcg/76)
221 Helianthus annuus L.; Compositae
Honeydew produced ROM (ApC/68)

267 Liriodendron tulipifera L.; Magnoliaceae
Honeydew produced USA/MA (Cao/79)

282 Malus domestica Borkh.; Rosaceae
Honeydew produced, and collected by bees from Aphis pomi De Geer, Aphididae: flow 3-4 wks, honeydew analysis; honeydew produced by Psylla mali Schmidberger, Psyllidae: heavy flow, sometimes visited by bees; also produced by Macrosiphum rosae (L.), Aphididae: honeydew analysis (mid EUR, Klo/65)

283 Mangifera indica L.; Anacardiaceae
Honeydew produced INI (insect not specified, Sig/62); ?NEP (Cra/84)

290 Medicago sativa L.; Leguminosae
Honeydew produced, and collected by bees from Therioaphis trifolii form maculata (Buckton), Callaphididae; honey analysis (USA/CA, Whi/62)

354 Robinia pseudoacacia L.; Leguminosae
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 (Bouché), previously Eulecanium corni robindarium (Douglas), Coccidae

357 Rubus spp [R. fruticosus L.]; Rosaceae
Honeydew produced NEZ (Wal/78)

359 Rubus ulmifolius Schott.; Rosaceae
Honeydew produced ALG (Ske/72)
362 Saccharum officinarum L.; Gramineae

Honeydew produced, and collected by bees: from Melanaphis sacchari (Zehntner), previously Aphis sacchari, Aphididae (HAW, Ken/76); also from Perkinsiella saccharicida Kirkaldy, Delphacidae (used to be in HAW, now in S America, Ken/76). Honeydew also produced (insect not specified) in ANA (Por/74); COL (Ken/76)

363 Salix alba L.; Salicaceae

Honeydew produced, and collected by bees: from Tuberolachnus salignus (Gmelin), Lachnidae - flow may be very heavy (mid EUR, Klo/65); honey yield from Salix spp up to 20 kg/colony (ROM, Cir/80); also from Pterocomma salicis (L.), Aphididae - secretion "high", visited by bees (Salix spp, mid EUR, Klo/65). Alert to beekeepers Salix honeydew honey is not suitable as winter food for bees (ROM, Fra/65)

364 Salix caprea L.; Salicaceae

Honeydew produced, and collected by bees: from Tuberolachnus salignus (Gmelin), Lachnidae - honey yield from Salix spp up to 20 kg/colony (ROM, Cir/80); also from Pterocomma salicis (L.), Aphididae - secretion "high", visited by bees (Salix spp, mid EUR, Klo/65). Honeydew produced URS (insect not specified, Glu/55). Alert to beekeepers Salix honeydew honey not suitable as winter food for bees (ROM, Fra/65)

410 Tilia cordata Mill.; Tiliaceae

Honeydew produced, and collected by bees from Eucallipterus tiliae (L.) Callaphididae - rated D1, (mid EUR, Hag/66); flow may be intense in vi or vii, viii, possibly ix, but bees can collect honeydew only early and late in day and/or when RH is high, because it granulates rapidly on tree; honey data below (mid Eur, Klo/65); honeydew analysis (ITA, Lom/77). Honeydew produced in FRA (insect not specified, Lou/81). For Tilia spp: honeydew analysis (from Eucallipterus tiliae, Klo/65); flow vi-vii in some yrs, honey yield 6-12 kg/colony (ROM, Cir/80)

411 Tilia japonica (Miq.) Simons.; Tiliaceae

Honeydew produced (ROM, Cir/80)
415 **Tilia platyphyllos** Scop.; **Tiliaceae**

Honeydew produced, and collected by bees from **Eucallipterus tiliae** (L.), Callaphididae - rated **D1** (mid EUR, Hag/66); flow may be intense vi or vii, viii, and possibly ix, but bees can collect honeydew only early and late in day and/or when RH is high because it granulates rapidly on tree; honeydew analysis for *Tilia* spp, also honey data below (S EUR, Klo/65). Honeydew produced (insect not specified): FRA (Lou/81); ITA (Ric/78); UK (How/79). **Alert to beekeepers** in 1928 honeydew reported toxic to bees in one area of GFR (Cra/77)

417 **Tilia tomentosa** Moench; **Tiliaceae**

Honeydew produced EUR (Maz/82); ROM (Cir/77; Cir/80)

418 **Tilia x europaea** L.; **Tiliaceae**

Honeydew produced UK (How/79)

430 **Trifolium pratense** L.; **Leguminosae**

Honeydew produced USA (Pel/76)

438 **Vicia faba** L.; **Leguminosae**

Honeydew produced EUR (Maz/82); ROM (Cir/80); analysis of honeydew from **Megoura viciae** Buckton, Aphididae (mid EUR, Klo/65)
4. INDEX TO HONEYDEW-PRODUCING INSECTS ON THE PLANTS

Plant entries 01D to 15D are in Section 2, and the others are in Section 3. In this index and in the entry, bold type indicates current names, others being synonyms. The authority and the family are given in the plant entry. Names were verified by the Commonwealth Institute of Entomology, London.

Aphis medicaginis 354
Aphis pomi 282
Aphis sacchari 362
Buchneria pectinatae 01D
Chaitophorinus coracinus 013
Chaitophorus populeti 11D
Cinara boerneri 05D
Cinara bogdanowi 08D
Cinara cembrae 10D
Cinara confinis 01D
Cinara costata 08D
Cinara cuneomaculata 05D
Cinara kochiana 05D
Cinara lariciola 05D
Cinara laricis 05D
Cinara nuda 10D
Cinara pectinatae 01D
Cinara piceae 08D
Cinara piceicola 01D,08D
Cinara pilicornis 01D,08D
Cinara pinea 10D
Cinara pruinosae 08D
Drepanosiphum platanoidis 013
Eucallipterus tiliae 410
Eulecanium corni robinianum 354
Eulecanium rufulum 080
Eulecanium sericeum 02D,03D
Kermes quercus 12D
Lachniella costata 08D
Lachniella nigrotuberulata 05D
Lachnus exsiccator 04D
Lachnus illicophilus 12D
Lachnus longipes 080
Lachnus muravensis 05D
Lachnus pallipes 04D
Lachnus roboris 080,12D

Laricaria kochiana 05D
"live oak gall" 14D
Macrosiphum rosae 282
Marchalina hellenica 09D,10D
Mecinaria piceae 08D
Megouia viciae 438
Melanaphis sacchari 362
Mindarus abietinus 01D,02D,03D
Monophlebus hellenicus 09D
Myzocallis castanicola 080
Pachypappa vesicalis 11D
Parthenolecanium corni 354
Parthenolecanium rufulum 080
Periphyllus aceris 013,014
Periphyllus coracinus 013
Periphyllus testudinaceus 014
Periphyllus villosus 014
Perkinsiella saccharicida 362
Phyllapis fagi 04D
Physokermes hermicryphus 02D,03D,08D
Physokermes piceae 01D,08D
Psylla mali 282
Pteroocomma salicis 363,364,11D
Schizodryobius longirostris 12D
Schizodryobius pallipes 04D
Schizolachnus pineti 10D
Thelexes dryophila 12D
Therioaphis trifoliol
form maculata 290
Todolachnus abieticola 01D
Todolachnus confinis 01D
Tuberolachnus salignus 363,364
Tuberculatus annulatus 12D
Tuberculoides annulatus 12D
Ultraceolostoma assimile 07D
Xylococcus macrocarpi 06D
Honeydew flows

Honeydew flows are the main source of honey in some parts of the world, but they are comparatively localized, and many beekeepers have no experience of them. Most honeydew flows are from trees in temperate-zone forests. They are especially important in parts of Europe, and are also used by beekeepers in New Zealand and North America. The famous Black Forest honey in Germany is from honeydew. In the eastern Mediterranean the flow from pines can give high honey yields, and in Greece 60% of the honey produced is from these trees. On the south-west coast of Turkey, 500,000 hives are moved to work the honeydew flow from Aleppo pine.

Honeydew is produced by different species of plant-sucking insects (Hemiptera), which have mouthparts capable of piercing the foliage or some other part of the host tree. The insect ingests the plant sap, and much of this is not digested but passes through special filter chambers in the insect and reappears as honeydew, which bees collect. Research work during the last thirty years has shown that a specific honeydew flow is produced on one tree species by one insect species that feeds on a certain part of the tree—usually leaves, stalks, stem or shoots. A prolific honeydew flow depends on the development of a large population of the insect concerned. Some tree species are host to half a dozen or more insect species, and some to only one. No honeydew is produced on the trees growing in areas where the appropriate insect is absent. In parts of Turkey, and of Greece (including Crete), beekeepers extend the area of honeydew flow by introducing Marchalina hellenica into areas of Pinus halepensis without it. In late summer, when the adult insects appear in good numbers, branches carrying them are removed and taken to an area where they do not occur. The branches are tied into a few trees, and if conditions are suitable the insects will multiply and spread.

Much of the research work on honeydew-producing insects and honeydew flows is published in German, or in languages less widely read by English-speaking peoples. One of the few books to give ratings to plants as producers of honeydew honey (see Table 1), by Haragsim, has been published in Czech and in Polish: a summary paper is available in French; Cirnu's book on bee plants, which includes many honeydew sources, is in Romanian. Rihar has done much work on forecasting honeydew flows in Yugoslavia, and his reports are in Croatian and Slovenian; there can be great economic value in a reliable method for such forecasting.

An important honeydew source which has only recently been exploited for honey production is the beech Nothofagus solandri var. clifforioides. The tree grows on certain mountain slopes of South Island, New Zealand, and honeydew is produced in areas where the soft scale insect Uliracoelosiontias assimile also occurs. The honeydew is entirely suitable as a source of winter food for bees (although some honeydews are not)

*Honeydew sources do not, however, provide the pollen required for brood rearing.

† Reprinted from Bee World 66(3): 105-112 (1985)
Fig. 1. A group of the greater black spruce bark aphid, *Cinara piceae* (Panzer), producing honeydew on the terminal shoot of spruce (*Picea abies*). This aphid is an important producer of honeydew flows in the higher Alpine forests. *Photo Dr A. Fossel*

Fig. 2. Production of honeydew by a small spruce scale insect (*Physokermes hemicryphus* Dalman) on a spruce stem. The insect is well camouflaged by its habit of attaching itself to the stem between bud scales. It is covered with wax threads and hardly looks like an insect at all. Here a young female is shown with the drop of honeydew she has excreted; the bees collect these drops directly from the insect. *Photo Dr A. Fossel*
and it has been used for that purpose for many years. Since about 1970, a large number of colonies have been moved to the beech forests—about 10,000 in 1981, giving 400 tonnes of honey. One estimate\(^4\) suggests that a further 3,000 tonnes of honey could be produced each year.

The 1984 *Directory of important world honey sources*\(^6\) includes 14 trees solely because of their importance as sources of honeydew honey; this compares with 452 important plant sources of honey from nectar. Table 1 gives information from the *Directory* on each of these trees. It includes the honey potential available in terms of yield per hectare, and honey yields actually obtained from the trees, with the names of the most important insects involved. Yields of 40 to 100 kg per colony per season are reported from several sources. Most of the identification and taxonomic work on honeydew-producing insects has been done within the last few decades, much of it in central Europe where honeydew is of special economic importance. Further insect species will certainly be identified in the future.

None of the above 14 trees have flowers that produce nectar, but there are 23 other plants listed in the 1984 *Directory*\(^6\) as important sources of honey from nectar, which also yield honey from honeydew. Eight of them are important sources of honeydew honey, and they are listed at the end of Table 1, with their honeydew-producing insects and corresponding honey yields.

The intensity of honeydew flows varies greatly from year to year according to the annual population growth of honeydew-producing insects, which is very sensitive to environmental factors. It has been shown repeatedly that the presence of a nest of ants, especially the red wood ant, *Formica polyctena* Först., actively increases honeydew production in its immediate neighbourhood\(^19\). In one set of records\(^21\) average honey yields for the years 1957-1965 were 43% higher in a forest area with ants than in a comparable area without them. The ants feed on honeydew, and are reported to protect honeydew-producing insects from predation.

Many forest areas have been felled, and honeydew production ceases if the host plants are killed in this way, or by atmospheric pollution. Certain areas that have been excellent for honeydew production are now endangered through ‘acid rain’.

Some honeydew-producing insects are pests of crop plants. Maize (*Zea mays*) has been referred to in the literature as a source of large yields of honeydew honey, and is included in the 1984 *Directory*\(^6\). However, the pest insects are the target of pesticide applications, and they no longer give honeydew flows where pest management is effective\(^12\). French law prohibits the use of pesticides dangerous to bees during the period of honeydew production resulting from aphid attack on cereal crops and on trees in forest plantations\(^5\).

**Honeydew honeys**

The main sugars in honey derived from either nectar or honeydew are almost always glucose and fructose, and some sucrose is usually also present. Honeydew honey (but not honey from nectar) characteristically contains appreciable amounts of trisaccharide sugars (such as melezitose, raffinose, fructomaltose), some higher saccharides, and also dextrin, and certain enzymes and amino acids not normally found in honey from nectar.
TABLE 1. Important sources of honeydew honey, with indications of honey yields. Information extracted from the 1984 Directory, which cites the publications on which the entries are based. Insect names were verified by the Commonwealth Institute of Entomology, London. In column 2 'mid Europe, major source' indicates a rating by Haragsim.  

<table>
<thead>
<tr>
<th>Plant and honeydew-producing insects</th>
<th>Honey production and flow period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CUPRESSACEAE</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Calocedrus decurrens</strong> (Torr.) Florin: incense cedar**</td>
<td>California and Oregon, USA, 45-136 kg honey/colony, from early summer onwards</td>
</tr>
<tr>
<td><em>Xylococcus macrocarpi</em> (Coleman), Coccoidea</td>
<td></td>
</tr>
<tr>
<td><strong>FAGACEAE</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Fagus sylvatica</strong> L.: beech**</td>
<td>mid Europe, major source, v-vii</td>
</tr>
<tr>
<td><em>Phyllapis fagi</em> (L.), Callaphididae</td>
<td></td>
</tr>
<tr>
<td><strong>Nothofagus solandri var. cliffortioides</strong> (Hook. f.) Poole: mountain beech**</td>
<td>New Zealand, estimated 60 kg honey/colony, late summer to autumn</td>
</tr>
<tr>
<td><em>Ultracoelostoma assimile</em> (Maskell), Magarodidae</td>
<td></td>
</tr>
<tr>
<td><strong>Quercus robur</strong> L.: English oak**</td>
<td>mid Europe, major source, ?iv-v or vi</td>
</tr>
<tr>
<td><em>Kermes quercus</em> (L.), Kermesidae</td>
<td></td>
</tr>
<tr>
<td><em>Lachnus roboris</em> (L.), Lachnidae</td>
<td>mid Europe, major source, v-vii</td>
</tr>
<tr>
<td><em>L. ilicophilus</em> (del Guercio)</td>
<td>mid Europe, 'most important producer on oak', mid vi to vii</td>
</tr>
<tr>
<td><em>Thelaxes dryophila</em> (Schrank), Thelaxidae</td>
<td>Romania, honey potential 20 kg/ha from Quercus spp</td>
</tr>
<tr>
<td>insect not specified</td>
<td>France, USSR and (every 4 years) Italy, flows reported</td>
</tr>
<tr>
<td><strong>Quercus suber</strong> L.: cork oak**</td>
<td>Morocco, 'important' source</td>
</tr>
<tr>
<td>insect not specified</td>
<td>Algeria, flow sometimes abundant</td>
</tr>
<tr>
<td><strong>Quercus virginiana</strong> Mill.: live oak**</td>
<td>Texas, USA, 11 kg honey/colony, viii to late autumn</td>
</tr>
<tr>
<td>'live oak gall'</td>
<td></td>
</tr>
<tr>
<td><strong>PINACEAE</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Abies alba</strong> Miller: silver fir**</td>
<td>mid Europe, major source, vii-ix</td>
</tr>
<tr>
<td><em>Cinara pectinatae</em> (Nördlinger), Lachnidae</td>
<td>Switzerland, 60-90 kg honey/colony</td>
</tr>
<tr>
<td><strong>C. confinis</strong> (Koch)</td>
<td>Yugoslavia, 19 kg honey/colony</td>
</tr>
<tr>
<td>insect not specified</td>
<td>Romania, honey potential 40 kg/ha</td>
</tr>
<tr>
<td></td>
<td>Black Forest, Alps, N Sea coast, flow may be important, vii-ix</td>
</tr>
<tr>
<td></td>
<td>Romania, Yugoslavia, flows reported</td>
</tr>
<tr>
<td></td>
<td>Austria, 40-45 kg honey/colony (honey potential 96 kg/ha)</td>
</tr>
<tr>
<td></td>
<td>Romania, honey potential 20 kg/ha</td>
</tr>
<tr>
<td>Plant and honeydew-producing insects</td>
<td>Honey production and flow period</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Abies borisii-regis Mattf.; Abies cephalonica Loudon: Greek fir</td>
<td></td>
</tr>
<tr>
<td>Physokermes hemicryphus Dalman, Coccidae</td>
<td>Greece, 5-10% of honey is from this flow, v-vii</td>
</tr>
<tr>
<td>Larix decidua Miller: larch</td>
<td></td>
</tr>
<tr>
<td>Cinara cuneomaculata (del Guercio), Lachnidae</td>
<td></td>
</tr>
<tr>
<td>C. laricis (Hartig)</td>
<td>mid Europe, major source, v-vii or vi-x</td>
</tr>
<tr>
<td>mid Europe, major source, flow heavy in vi, also late vii to x; honeydew may crystallize on tree</td>
<td></td>
</tr>
<tr>
<td>Italy, honey yield obtained</td>
<td></td>
</tr>
<tr>
<td>Picea abies (L.) Karsten: Norway spruce</td>
<td></td>
</tr>
<tr>
<td>Cinara pilicornis (Hartig), Lachnidae</td>
<td>mid Europe, major source, vi-viii</td>
</tr>
<tr>
<td>mid Europe, major source, vi-viii</td>
<td></td>
</tr>
<tr>
<td>GFR, important source, flow late v-vii</td>
<td></td>
</tr>
<tr>
<td>C. pruinosa (Hartig)</td>
<td></td>
</tr>
<tr>
<td>C. piceae (Panzer); see Fig. 1</td>
<td>mid Europe, up to 15 kg honey/colony, flow 3-6 days in vii or viii; honeydew may crystallize on tree (Fig. 3)</td>
</tr>
<tr>
<td>Physokermes hemicryphus Dalman, Coccidae; see Fig. 2</td>
<td></td>
</tr>
<tr>
<td>P. piceae Schrank</td>
<td></td>
</tr>
<tr>
<td>insect not specified</td>
<td>mid Europe, up to 39 kg honey/colony, late v to mid vii</td>
</tr>
<tr>
<td>GFR heavy flow, gains up to 4 kg/colony/day</td>
<td></td>
</tr>
<tr>
<td>Germany, mean 40 kg honey/colony</td>
<td></td>
</tr>
<tr>
<td>Europe, honey potential 100-500 kg/ha</td>
<td></td>
</tr>
<tr>
<td>Romania, honey potential 20, 50 kg/ha</td>
<td></td>
</tr>
<tr>
<td>Norway, flow vii-viii</td>
<td></td>
</tr>
<tr>
<td>Pinus halepensis Miller: Aleppo pine</td>
<td></td>
</tr>
<tr>
<td>Marchalina hellenica (Gennadius), Margarodidae</td>
<td>Greece, main source of pine honeydew below 900 m, 60% of Greek honey from this insect on pine; bees collect honeydew vii-ix</td>
</tr>
<tr>
<td>Chalkidiki and Thasos, Greece, 5-10 kg honey/colony in autumn</td>
<td></td>
</tr>
<tr>
<td>Thasos and Ikaria, Greece, main honey crop</td>
<td></td>
</tr>
<tr>
<td>Turkey (S &amp; W coast), abundant flow, vii</td>
<td></td>
</tr>
<tr>
<td>Algeria, flow reported</td>
<td></td>
</tr>
<tr>
<td>Pinus sylvestris L.: Scots pine</td>
<td></td>
</tr>
<tr>
<td>Cinara cembrae (Seitner), Lachnidae</td>
<td>mid Europe, major source, vii-ix</td>
</tr>
<tr>
<td>C. pinea (Mordvilko)</td>
<td>mid Europe, hives brought for flow vi-vii</td>
</tr>
<tr>
<td>Norway, 'good flow', vii-viii</td>
<td></td>
</tr>
<tr>
<td>Romania, honey potential on Pinus spp</td>
<td></td>
</tr>
<tr>
<td>10 kg/ha</td>
<td></td>
</tr>
<tr>
<td>Marchalina hellenica (Gennadius), Margarodidae</td>
<td>Greece, heavy flow late vi to spring (see Pinus halepensis)</td>
</tr>
<tr>
<td>Populus spp: poplar</td>
<td></td>
</tr>
<tr>
<td>Chaitophorus populeti (Panzer), Chaitophoridae</td>
<td>Romania, 10-20 kg gain/colony in 10 days (60% from this source), late v to mid vi; honey potential 20 kg/ha of P. alba or of P. nigra</td>
</tr>
<tr>
<td>Pterocomma salicis (L.), Aphididae</td>
<td></td>
</tr>
</tbody>
</table>

**SALICACEAE**
### Plant and honeydew-producing insects

<table>
<thead>
<tr>
<th>Plant Family</th>
<th>Common Name</th>
<th>Insects</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACERACEAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acer platanoides L.: Norway maple; Acer pseudoplatanus L.: sycamore</td>
<td></td>
<td></td>
<td>mid Europe, major source</td>
</tr>
<tr>
<td>Periphyllus aceris (L.), Chaitophoridae</td>
<td></td>
<td></td>
<td>mid Europe, major source</td>
</tr>
<tr>
<td><strong>FAGACEAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Castanea sativa Mill.: sweet or Spanish chestnut</td>
<td>Lachnus roboris (L.), Lachnidae</td>
<td>southern Europe, flow 1-2 weeks during flowering, honeydew collected by bees</td>
<td></td>
</tr>
<tr>
<td>Lachnus roboris (L.), Lachnidae</td>
<td></td>
<td>Romania, flow reported</td>
<td></td>
</tr>
<tr>
<td>Myzocallis castanicola Baker, Callophidiidae</td>
<td></td>
<td>southern Europe, flow reported, honeydew collected by bees</td>
<td></td>
</tr>
<tr>
<td>Parthenolecanium rufulum (Cockerell), Coccidae</td>
<td></td>
<td>Romania, flow reported</td>
<td></td>
</tr>
<tr>
<td><strong>LEGUMINOSAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robinia pseudoacacia L.: false acacia</td>
<td></td>
<td>Romania, up to 10-12 kg honey/colony in some years</td>
<td></td>
</tr>
<tr>
<td>Aphis medicaginis Koch, Aphididae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parthenolecanium corni (Bouché), Coccidae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SALICACEAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salix alba L.: white willow; Salix caprea L.: goat willow</td>
<td>Tuberolachnus salignus (Gmelin), Lachnidae</td>
<td>Romania, up to 20 kg honey/colony from Salix spp</td>
<td></td>
</tr>
<tr>
<td>Lachnidae</td>
<td></td>
<td>mid Europe, flow may be very heavy</td>
<td></td>
</tr>
<tr>
<td>Pierocomma salicis (L.), Aphididae</td>
<td></td>
<td>mid Europe, strong flow</td>
<td></td>
</tr>
<tr>
<td><strong>TILIACEAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tilia cordata Mill.: small-leaved lime; Tilia platyphyllos Scop.: large-leaved lime</td>
<td>Eucallipterus tiliae (L.), Callaphididae</td>
<td>mid Europe, major source vi or vii to viii or ix; honeydew crystallizes on tree</td>
<td></td>
</tr>
<tr>
<td>Tilia spp in some years</td>
<td></td>
<td>Romania, 6-12 kg honey/colony from Tilia spp in some years</td>
<td></td>
</tr>
</tbody>
</table>

The total mineral content, and the amounts of potassium, phosphorus and iron, are higher in honeydew honeys than in nectar honeys. Other constituents present in very small amounts are used as 'honeydew indicators' in the microscopic examination of honey, as pollen grains are indicators of the plant origin of honey from nectar. Of these indicators, algae and sooty moulds (fumago) are
particularly important\textsuperscript{15}. The presence of algae may impart a greenish tinge to some honeydew honeys; for example samples of honey from the honeydew of \textit{Cinara pectinatae} on \textit{Abies alba} have been described as 'black-brown with a greenish tinge', and 'dark green'. Not all honeydew honeys are dark, and even white honey has been obtained from \textit{Abies alba}. Many honeydew honeys have a characteristic flavour, much liked by people accustomed to them but not by everyone.

Melezitose is one of the less soluble sugars in honey, and the large amounts of it in some honeydews can cause them to crystallize, even on the tree (Fig. 3). Bees collect such honeydew when it is liquid in the morning, or when atmospheric humidity is high. The resulting honey also crystallizes very rapidly, particularly honeydew honey from \textit{Cinara laricis} feeding on larch (\textit{Larix decidua}); it contains about 42\% melezitose. Melezitose was named by Berthelot in 1859 from \textit{méleze}, the French word for larch, when he found this sugar in crystallized honeydew (known as Briançon manna) on young larch shoots. Honey from some other honeydews crystallizes slowly or not at all.

Honeydew honey has a higher electrical conductivity (6·3–16·41 \times 10^{-4}/\text{ohm cm}) than honey from most nectars (0·6–1·46 \times 10^{-4}/\text{ohm cm}), although nectar honey from heather (\textit{Calluna vulgaris}) is an exception (7·7 \times 10^{-4}/\text{ohm cm})\textsuperscript{20}. The optical rotation of honeydew honeys is also different from that of nectar honeys; the former are usually dextrorotatory—largely due to the presence of melezitose or erlose, as well as glucose—and the latter laevorotatory, because of their relatively high fructose content. Both the above properties are used in tests to establish whether a honey sample is entirely from nectar, or mostly or entirely from honeydew.

![Part of a branch of spruce covered with crystallized honeydew, from the greater black spruce bark aphid shown in Fig. 1. Photo Dr A. Fossel](image-url)
Honey sources Satellite

One of several Satellites to the Directory of important world honey sources to be published in 1985 is Honeydew sources and their honeys. This gives entries extracted from the 1984 Directory for the sources of honeydew honey listed in Table 1, including data on the chemical composition and physical properties of the honeys. It also gives information on 15 other important nectar sources that produce some honeydew.

References