A GUIDE TO THE COMPOSITION AND PROPERTIES OF PROPOLIS

Şt. STĂNGACIU, ROMANIA

Dr. Ştefan Stângaciu is a doctor in medicine, passionately interested in apitherapy. He struggles with all his forces for enlarging the applicative sphere of this method of treating and healing the diseases of mankind. The propolis is among the hive products that are largely used in apitherapy. In 1977, Dr. Ştefan Stângaciu published a book with the same title as above, divided into four parts, of which you will find in APIACTA the second and the third parts. Those who are interested in the whole work are kindly requested to direct themselves to the author's address (see end of article).

PART II – The main substances of propolis and their properties

Flavonoids
- anti-microbial properties (Ghisalberti, 1979);
- anti-inflammatory, increase the activity of ascorbic acid (Vitamin C) and action on capillary vessels (Ravina, 1969);
- anti-oxidant;
- decrease the permeability of capillaries ("vitamin P action") (Szent-György et al., 1936);
- stabilizes the collagen through inhibiting the hyaluronidase;
- anti-haemorrhage;
- influence in vitro of some flavonoids on the enzymatic metabolism of mucopolysaccharides from saphenous veins (Niebes and Laszt, 1971)

Chrysine
- gives also the colour of beeswax (Jaubert, 1926);
- tumor cytotoxicity (Hladon et al., 1987);
- anti-Helicobacter pylori (Itoh et al., 1994)

Apiigenin
- healing of gastric ulcers (The Hive and the Honey Bee, 1992)

Acacetin
- anti-inflammatory (Bankova et al., 1983)

Quercitin
- hystaminopexic activity (Di Maggio and Ciaceri, 1961);
- anti-viral (König and Dustmann, 1985);
- strengthening capillaries (Budavari, 1989);
- anti-tumoral activity (Matsuno Tetsuya, 1991);
- spasmolytic (The Hive and the Honey Bee, 1992)

Kaempferide
- spasmolytic (The Hive and the Honey Bee, 1992);
- anti-Mycobacterium phlei;
- anti – acid resistant micro-organisms

Kaempferol-7,4′-dimethyl ether
- anti-mycotic

Ermanin
- anti-mycotic
**Galangin**
- bacteriostatic activity (Villanueva et al., 1964; Pepeljnjak, 1982);
- anti-microbial and anti-mycotic (Metzner et al., 1979);
- anti-*Helicobacter pylori* (Itoh et al., 1994)

**Pinocembrin**
- bacteriostatic activity (Villanueva et al., 1970);
- anti-mould (Miyakado et al., 1976);
- anti-*Blastomyces* (Metzner et al., 1977);
- anti-microbial and anti-mycotic, *in vitro*, and in external use (Metzner et al., 1979);
- anti-*Candida* (Metzner and Schneidewind, 1978);
- local anaesthetic (Painz and Metzner, 1979);
- anti-*Helicobacter pylori* (Itoh et al., 1994)

**Pinobanksin**
- anti-microbial and anti-mycotic (Metzner et al., 1979)

**Pinobanksin-3-acetate**
- anti-microbial and anti-mycotic (Metzner et al., 1979)

**Pinostrobin**
- local anaesthetic (Painz and Metzner, 1979)

**3',4'-dihydroxyflavanoids**
- strengthening capillaries (The Hive and the Honey Bee, 1992)

**Flavan-3-ols**
- strengthening capillaries (Roger, 1988)

**Pectolinaringenin**
- spasmolytic (The Hive and the Honey Bee, 1992)

**Luteolin**
- antiviral (König and Dustmann, 1985);
- healing of gastric ulcers (The Hive and the Honey Bee, 1992)

**Artepillin C**
- anti-tumor effect; anti-leukemic effect

**Eriodictyol**
- helping pulmonary insufficiency;
- prevention of acute pulmonary insufficiency

**Pinosylvin (3,5-dihydroxystilbene)**
- anti-microbial against *Bacillus subtilis* and *Bacillus cereus*;
- anti-mycotic against *Mycobacterium phlei* and *M. Smegmatis*

**Ferulic acid**
- anti-bacterial effect (gram-positive and gram-negative micro-organisms) (Villanueva et al., 1970) (Cizmarik and Matel, 1970, 1973);
- agglutinant effect (useful in treating slowly healing wounds by the help of a soft propolis extract);
- collagogenic effect (described in 1938);
- promote build-up of collagen and elastin (two essential components in the matrix of connective tissues);
- permeates propolis

**Isoferulic acid**
- anti-\textit{Staphylococcus aureus}

**Benzoic acid**
- bacteriostatic and bactericide effects (Janes and Bumba, 1978);
- balsamic and antiseptic (Vanhaelen and Vanhaelen-Fastré, 1992)

**Cinnamic acid**
- anti-\textit{Staphylococcus aureus}

**Cinnamic acid derivatives**
- increase the cicatrization and the regeneration of epithelium

**Isopentyl ferulate**
- anti-influenza virus A/Hong Kong (H3N2) \textit{in vitro};
- inhibits the production of hemagglutinins \textit{in ovo}

**Cinnamylidene acetic acid**
- anti-microbial against \textit{Bacillus subtilis}, \textit{Bacillus cereus}, \textit{Escherichia coli};
- anti-mycotic against \textit{Mycobacterium phlei}, \textit{M. Smegmatic} and \textit{Candida albicans}

**Aromatic acids and their esters**
- anti-fungal and anti-bacterial properties;
- \textit{p-Coumaric acid benzyl ester};
- anti-microbial and anti-mycotic (METZNER et al., 1979)

**Caffeic acid**
- antiviral (König and Dustmann, 1985);
- anti-bacterial activity on some gram-positive and gram-negative microorganisms (Villanueva et al., 1970) (Cizmarik and Matel, 1970, 1973);
- anti-inflammatory (Bankova et al., 1983)

**Prenyl caffeate**
- potential contact allergen

**3-methyl-but-2-enyl caffeate**
- antiviral activity

**Caffeic acid esters**
- local anaesthetic (Paintz and Metzner, 1979)

**Caffeic acid phenethyl ester**
- anti-tumoral activity
**Methyl caffeate**

- tumor cytotoxicity or inhibition (Inayama et al., 1984; Grunberger et al., 1988)

**Methyl ferulate**

- tumor cytotoxicity or inhibition (Inayama et al., 1984; Grunberger et al., 1988)

**Diterpenoid of clerodan**

- anti-tumoural activity;
- anti-bacterial

**Pterostilbene**

- anti-diabetic (non-confirmed) (The Hive and the Honey Bee, 1992)

**Volatile compounds (etheric oils)**

- anti-microbial activity;
- Bisabolol;
- anti-inflammatory

**Volatile substances in beehive air**

- anti-hay fever

**Amino acids**

- Arginine – stimulates mitosis and enhance protein biosynthesis (Gabrys, 1986);
- Proline – promote build-up of collagen and elastin (two essential components in the matrix of connective tissues) (Gabrys, 1986)

**Minerals**

Even in very small doses (oligo- or trace-elements), the minerals are very important for the cellular metabolism.

Every biological or physiological process who takes place in the body of man or animals needs spur elements; they participate in the proteins, fats and glucidic balance and also in the protein synthesis, in the thermic balance, in haematopoiesis, osteogenesis, in cellular multiplication and in immunobiologic reactions.

It has been established that there are 24 spur elements in the human blood, 23 of them being present in propolis; if the spur elements are sufficient in our body several organs and/or biological processes will function properly; the spur elements selectively accumulate in different organs of the human body:

- zinc especially in the sexual glands, hypophysis and pancreas;
- copper in the liver and bone marrow;
- cadmium and molybdenum in the kidneys;
- nickel in the pancreas;
- strontium in the bones;
- manganese and chromium in the hypophysis.

The biological activity of many spur elements is linked with their synergetic action together with enzymes and vitamins:

- iron is part of the composition of the breathing enzymes;
- zinc is present in the enzymes which make up the glucide and protein balance; zinc helps to the decrease of cholesterol in the blood;
- manganese is related to the vitamin B1; the effect of vitamin B1 increase if there is enough manganese in the body;
- cobalt is related to the vitamin B12 and the formation of bone tissues; it is an useful adjuvant in the treatment of some liver diseases, hypertronic disease (high blood pressure) and glaucoma.

The physician B.M. Hecht showed that the addition in food of cobalt, iodine and honey intensifies the phagocytosis of the white blood cells and increases the resistance of the body to infectious diseases.
- copper is actively linked with the vitamins A, B, C, E and with the nicotinic acid, it helps in healing endarteritis and skin diseases.
PART III – Pharmacological properties of the main propolis substances

Anti-microbial substances in propolis (Schneidewind et al., 1975: flavones and flavanols (Ghisalberti, 1979):

**Flavones**
- chrysin;
- tectochrysin;
- 5-hydroxy-4',7-dimethoxyflavone;
- rhamnocitrin;
- galangin;
- galangin-3-methyl-ether (5,7-dihydroxy-3-methoxyflavone);
- isalpinin;
- pectolinaringenin;
- quercetin-3,3’-dimethyl ether

**Flavanones**
- pinostrobin;
- pinocembrin;
- alpinetin;
- alnusitol;
- pinobanksin;
- 3-acetyl-pinobanksin;
- pinobanksin-3-acetate;
- sakuranetin;
- 5-hydroxy-4', 7-dimethoxyflavanon

**Aromatic acids and their esters**
- benzoic acid;
- p-coumaric benzyl ester;
- p-coumaric acid benzyl ester;
- caffeic acid;
- an ester of caffeic acid with an aromatic alcohol

**Cinnamic acid derivatives**
- cinnamyldene acetic acid;
- anti-microbial against *Bacillus subtilis*, *Bacillus cereus*, *Escherichia coli*

**Heteroaromatic compounds**
- pinosylvin

**Volatile compounds (etheric oils)**

*Anti-bacterial activity*
- pinocembrin;
- pinobanksin;
- isalpinin;
- galangin;
- aromatic acids and their esters:
  - ferulic acid;
  - caffeic acid.
- a diterpenoid of clerodan

*Anti-Staphylococcus aureus*
- cinnamic acid;
- isoferulic acid;
- caffeic acid
Anti-Escherichia coli and Streptomyces aureofaciens

- several UV absorbing substances from propolis

Anti-mycotic substances

- aromatic acids and their esters;
- kaempferol-7,4’-dimethyl ether;
- ermanin (5,7-dihydroxy-3,4’-dimethoxyflavone);
- pinobanksin-3-acetate;
- pinocembrin;
- p-coumaric acid benzyl ester;
- a caffeic acid ester;
- caffeic acid;
- sakuranetin;
- pterostilbene;
- pinosylvin (3,5-dihydroxystilbene);
- cinnamylidene acetic acid:
  - anti-mycotic against Mycobacterium phlei, M. smegmatis and Candida albicans.

Anti-Candida activity:

- pinocembrin;
- cinnamylidene acetic acid

Anti-Mycobacterium phlei

- kaempferide (kaempferol-4’-methyl ether) (3,5,7-trihydroxy-4’-methoxy-flavone)

Anti-acid resistant micro-organisms

- kaempferide

Anti-mould substances

- pinocembrin (Miyakado et al., 1976)

Anti-Blastomycetes

- pinocembrin (Metzner et al., 1977)

Antiseptic substances:

- benzoic acid (Vanhaelen and Vanhaelen-Fastré, 1992)

Antiviral substances (König and Dustmann, 1985)

- caffeic acid;
- 3-methyl-but-2-enyl caffeate (Amoros et. al., 1994);
- luteolin;
- quercetin;
- 7-methoxyquercetin;
- 3,7-dimethoxyquercetin

Antitherpetic activity

- isopropyl alcohol extract of propolis

Anti-influenza virus A/Hong Kong (H3N2) (in vitro) + inhibition of the production of hemagglutinins in ovo

- isopentyl ferulate
**Tumor cytotoxicity or inhibition** (Grunberger et al., 1988; Inayama et al., 1984)
- caffeic acid phenethyl ester (methyl caffeate, methyl ferulate);
- caffeic acid phenethyl ester; quercetin and a diterpenoid of clerodan (Matsuno Tetsuya, 1991 cited by Yamamoto, 1996);
- artemillin C;
- chrysin (Hladon et al., 1987)

**Local anaesthetic**
- pinocembrin (Paintz and Metzner, 1979);
- pinostrobin (Paintz and Metzner, 1979);
- caffeic acid esters (Paintz and Metzner, 1979)

**Strengthening capillaries**
- quercetin (Budavari, 1989);
- 3',4'-dihydroxyflavanoids;
- flavan-3-ols (Roger, 1988)

**Decrease the permeability of capillaries** *(vitamin P action)*
- flavonoids (Szent-György et al., 1936)

**Anti-haemorrhagic activity**
- flavonoids

**Influence in vitro on the enzymatic metabolism of mucopolysaccharides from saphenous veins**
- some flavonoids (Niebes and Laszt, 1971)

**Spasmolytic activity**
- quercetin;
- kaempferide;
- pectolinaringenin

**Anti-inflammatory activity**
- caffeic acid (Bankova et al., 1983);
- acacetin (Bankova et al., 1983);
- bisabolol (Marinescu 1982);
- flavonoids (Marinescu, 1982)

**Anti-oxidant activity**
- flavonoids

**Hystaminopexic activity**
- quercetin (Di Maggio and Ciaceri, 1961)

**Anti-leukemic cells**
- artemillin C

**Anti-diabetic (unconfirmed)**
- pterostilbene

**Healing of gastro-duodenal ulcers**
- luteolin;
- apigenin;
- pinocembrin, galangin and chrysin *(anti-Helicobacter pylori)* (Itoh et al., 1994)
Helping pulmonary insufficiency (Aviado et al., 1974)
- eriodictyol

Prevention of acute pulmonary insufficiency
- eriodictyol

Stimulating mitosis and enhancing protein biosynthesis
- arginine (Gabrys, 1986)

Promoting build-up of collagen and elastin
- proline (Gabrys, 1986);
- ferulic acid (1938); (Cizmárik and Matel, 1971, 1978)

Agglutinant effect
- ferulic acid (Cizmárik and Matel, 1971, 1978)

Balsamic effect
- benzoic acid (Vanhaelen and Vanhaelen-Fastré, 1992)

Cicatrization and regeneration of the epithelium
- cinnamic acid derivatives

Wound healing
- phenolic acids;
- flavanoids

Allergy
- prenyl caffeate

Anti-hay fever
- volatile substances in beehive air

Tissues, organs related to the minerals from propolis

Arteries: copper
Bones: strontium, cobalt
Bone marrow: copper
Eyes: cobalt
Hypophysis: zinc, manganese, chromium
Kidneys: cadmium, molybdenum
Liver: copper, cobalt
Pancreas: zinc, nickel
Sexual glands: zinc
Skin: copper

Biological activities of spur elements from propolis

The spur elements have a synergetic action together with enzymes and vitamins.

Iron
- is part of the composition of the breathing enzymes
Zinc
- is present in the enzymes which make up the glucose and protein balance;
- zinc helps to decrease cholesterol in the blood

Manganese
- is related to the vitamin B1; the effect of vitamin B1 increases if there is enough manganese in the body

Cobalt
- is related to the vitamin B12;
- intensifies the phagocytosis of the white blood cells and increases the resistance of the body to infectious diseases (the physician B.M. Hecht showed that by adding cobalt, iodine and honey)

Copper
- is actively linked with the vitamins A, B, C, E and with the nicotinic acid

Diseases treatable by the spur elements from propolis

Endarteritis: copper
Glaucoma: cobalt
High Blood Pressure (Hypertonic disease): cobalt
Hypercholesterolemia: zinc
Infectious diseases: cobalt
Liver diseases: cobalt
Skin diseases: copper