ABSTRACT

Propolis is a resinous substance collected by honeybees from various plant sources. The honeybees use this substance to seal their honeycombs and protect it from the invasion of microorganisms. The beehive is believed to be the most sterile natural environment. Pure honey has been used in folk medicine for ages and possesses a miraculous 100 years shelf life. The medicinal properties of Propolis have been extensively studied. Propolis possesses hepato-protective, anti-tumor, anti-oxidative, anti-microbial, and anti-inflammatory properties. The chemical composition of Propolis varies in different regions of the world since it is related to the species of honeybees and also the type of vegetation prevalent in that geographical region. Propolis usually comprises of flavonoids and terpenoids, which possess many medicinal properties. Different extraction methods and purification processes have been adopted in various studies. Ethanol extract of Propolis has been observed to possess several biological properties. In many in-vitro studies Propolis has been found to inhibit the growth of many pathogenic microorganisms, thus substantiating the view that it has enormous medicinal scope.

KEY WORDS: Propolis, anti-bacterial, caries treatment

INTRODUCTION

Propolis is a complex resinous material produced by honeybees from plant exudates, beeswax, and bee secretions (Kusumoto et al. 2001) and is responsible for the sterility of honeycombs (Bosio et al. 2000). The chemical composition of Apis mellifera propolis and its wide spectrum of biological activities (hepato-protective, anti-tumour, anti-oxidative, anti-microbial, and anti-inflammatory properties) have attracted the attention of researchers (Banskota et al. 2001).

EXTRACTION OF PROPOLIS FROM BEEHIVES

Ethanol extraction of Propolis from beehives has been successfully performed in many studies. Beeswax does not dissolve in ethanol and gets settled down as sediment. Propolis dissolves well in ethanol and is easily extracted in 70 –80 % (v/v) ethanol. Upon vaporization of ethanol Propolis can be separated as a yellowish powder. Recently, Andreas Daugsch et al have obtained a reddish Propolis in beehives located along the sea and river shores in Northeastern Brazil. In a study in Lyon, France an ethanolic extract of propolis was obtained from beehives. On evaporation, 1 ml of this extract yielded 60 mg of solid resinous material. (Grange JM,1990)

In a study in Turkey an aliquot of crude propolis (7g) was dissolved in 80% ethanol by shaking at 50°C for 3 days and protected...
from light. The aqueous-ethanol extract was filtered through a Whatman 1 paper and concentrated at 50°C. The resin obtained was dissolved in 80% ethanol to a final concentration of 100 mg/ml (Sibel Silici, 2005). In a study in Bulgaria, Brazilian red propolis (61 g) was cut into small pieces and extracted with 70% ethanol (1: 10, w/v) at room temperature for 24 h. The ethanol extract was concentrated in vacuo and extracted successively with petrol ether (40–60°C) three times. The petrol ether extract was evaporated to give 5 g dry residue after evaporation (Boryana Trusheva 2006).

CHEMICAL CONSTITUENTS OF PROPOLIS

Propolis contains a variety of chemical compounds such as polyphenols (flavonoids, phenolic acids and their esters), terpenoids and aminoacids. The composition of Propolis depends on the species of honeybees and the type of vegetation present in that geographical region. Propolis from Europe and China contained flavonoids and phenolic acid esters. In contrast Propolis from Brazil contained terpenoids. A new prenylated flavonoid has been obtained from Japanese Propolis (Shigenori et al., 2004) In an unpublished study in Bangalore, Indian Propolis was found to contain both flavonoids and terpenoids.

PROPERTIES OF PROPOLIS

Propolis being extremely high in bioflavonoid content has antioxidant, antibacterial, antifungal, antiviral and anti-inflammatory properties. Other properties of propolis include acting as a local anesthetic, reducing spasms, healing gastric ulcers, and strengthening capillaries. Propolis can be used by humans internally or externally. (Beehive Botanicals)

ANTIMICROBIAL PROPERTIES OF PROPOLIS

The mechanism of antimicrobial activity of propolis is complex and could be attributed to the synergistic activity between phenolic and other compounds (Krol et al. 1993) mainly to the flavonoids pinocembrin, galangin, and pinobanksin (Castaldo & Capasso 2002). A stronger activity was observed on gram-positive bacteria growth (Burdock 1998). The antimicrobial activity was observed on Staphylococcus aureus (Fernandes Júnior et al. 2003,); Streptococcus pyogenes (Bosio et al. 2000); gram-positive and gram-negative bacteria species and Candida (Drago et al. 2000, Streptococcus mutans (Koo et al. 2002); anaerobic bacteria of human oral cavity (Santos et al. 2002); Salmonella (Orsi et al. 2005), and on miscellaneous microorganisms including Mycobacterium (Banskota et al. 2001) In screening studies at a dilution of 1: 20 (3 mg of solid material per ml) in nutrient agar, the preparation of propolis completely inhibited the growth of Staphylococcus aureus (including the...
MRSA strains), *Enterococcus* spp., *Corynebacterium* spp.. It partially inhibited growth of *Pseudomonas aeruginosa* and *Escherichia coli* but had no effect on *Klebsiella pneumoniae*. Thus it appeared to have a preferential inhibitory effect on cocci and Gram-positive rods. (Grange JM, 1990)

**ANTI FUNGAL ACTIVITY**

Propolis inhibited the growth Candida albicans (MIC 0.2 – 3.75 µg/ml), C. glabrata (MIC 0.03 – 7.5 µg/ml), Trichosporon spp. (MIC 0.1 – 0.4 µg/ml), and Rhodotorula sp (MIC <0.01 µg/ml). Among the strains of yeasts, C. albicans, C. glabrata, Trichosporon spp., and Rhodotorula spp. were tested, and the most sensitive strain was Rhodotorula spp. The most resistant strain was C. albicans (Sibel Silici, 2005) In an unpublished study in Bangalore, Indian Propolis has been observed to be more effective than routinely used anti – caries agents in inhibiting the growth of Streptococcus mutans which is a frequent cause of dental caries.

**SYNERGISTIC EFFECTS WITH DRUGS**

The in vitro synergism between ethanolic extract of propolis (EEP) and antimicrobial drugs by two susceptibility tests (Kirby and Bauer and E-Test) on 25 Staph. aureus strains was evaluated by Fernandes Jr.A and etal (2006) Petri dishes with sub-inhibitory concentrations of EEP were incubated with 13 drugs using Kirby and Bauer method and synergism between EEP and five drugs [choramphenicol (CLO), gentamicin (GEN), netilmicin (NET), tetracycline (TET), and vancomycin (VAN)] was observed. Nine drugs were assayed in their study by the E-test method and five of them exhibited a synergism [CLO, GEN, NET, TET, and clindamycin (CLI)]. The results demonstrated clearly the synergism between EEP and antimicrobial drugs, especially those agents that interfere on bacterial protein synthesis.

**ANTI CANCER PROPERTIES**

Ethanol extracts of propolis have been found to transform human hepatic and uterine carcinoma cells *in vitro*, and to inhibit their growth (Matsuno, 1992). Propolis was also found to have a cytotoxic and cytostatic effect *in vitro* against hamster ovary cancer cells and sarcoma-type tumours in mice (Ross, 1990).

A substance called Artepillin C has been isolated from propolis, and has been shown to have a cytotoxic effect on human gastric carcinoma cells, human lung cancer cells and mouse colon carcinoma cells *in vitro* (Kimoto, et al, 1995)

**ANTI OXIDANT PROPERTIES**

The flavonoids concentrated in propolis are powerful antioxidants. Antioxidants have been shown to be capable of scavenging free radicals and thereby protecting lipids and other compounds such as Vitamin C from being oxidized or destroyed (Popeskovic, et al. 1980). It is probable that active free radicals, together with other factors are responsible for cellular aging and degradation in such conditions as...
cardiovascular diseases, arthritis, cancer, diabetes, Parkinson disease and Alzheimer disease. Oxidative damage may also result in poor liver function. Studies on rats in vitro show that propolis extracts protect against damage to liver cells (Baset, et al, 1996).

CONCLUSION

Various studies on Propolis have established that it can be used as a therapeutic agent. Propolis can be used in the treatment of many serious systemic diseases caused by bacterial infections and chronic fungal infections. Dental caries can be effectively treated and prevented by using Propolis formulations. Propolis may be incorporated in toothpaste, mouth rinse etc to maintain the oral hygiene in patients. The anti cancer and anti oxidant properties of Propolis make it a novel drug for cancers and aging.

REFERENCES

- BeehiveBotanicals 16297 W. Nursery Road. Hayward, WI USA
- Boryana Trusheva, Milena Popova etal: Bioactive Constituents of Brazilian Red Propolis Advance Access Publication, eCAM 2006;3(2)249–254
- J M Grange , R W Davey Antibacterial properties of propolis (bee glue) J Roy Soc Med Volume 83 March 1990 159
- Tetsuya Matsuno ; Iori Goto :Glutaminase and Glutamine Synthetase Activities in human Cirrhotic Liver and Hepatocellular Carcinoma: Cancer Res 1992 52: (5)