WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 12, Issue 4, 2131-2144. Review Article ISSN 2277– 7105

# PROPOLIS: A RICH SOURCE OF BIOLOGICALLY ACTIVE COMPOUNDS.

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Article Received on
07 February 2023,
Revised on 28 Feb. 2023,
Accepted on 20 March 2023
DOI: 10.20959/wjpr20235-27581

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## ABSTRACT

Bees coat the walls of their hives with propolis, which is extracted from plants. This substance is also used as a natural antibiotic against microbial pathogens. This is similar to how many other animals use natural products for selfmedication. Analyzes and laboratory bioassays were performed. Valois destructor. Applied to the brood cells, propolis can affect breeding parasites, has a positive effect on honey bees, and has been found to affect varois populations. It concludes that it can be considered a natural insecticide used to control dangerous parasites. These findings greatly advance our understanding of behavioral immunity in animals and may have important implications for managing the world's most important threat to honeybees.

**KEYWORDS**: Apis mellifera, propolis, Varroa destructor, natural pesticide, social medication.

## 1. INTRODUCTION

Propolis is a substance derived from resins collected in plants by foragers and used by bees to coat the walls of their hive burrows.[1] Propolis is also used to seal unwanted empty spaces in hives, wrap the corpses of potential intruders, and polish comb cells between successive breeding cycles[2], There is little information about this latter use. Propolis, due to its antibacterial properties, can directly affect several honeybee pathogens, including Paenibacillus larvae[3], Ascosphaera apis[4] and Nosema seranae.[5] and they are the causative agents of American rot, chalk disease, and nosebleeds., Respectively. Furthermore, by

reducing the microbial load of the hive, propolis can reduce bees' investment in individual immune function and facilitate detoxification pathways, resulting in positive effects at the colony level.[6] For these reasons, propolis is considered an important component of bee sociology.[7] Propolis, or bee glue, is a resinous mixture produced by bees by mixing saliva and beeswax with exudates from tree buds, sap streams, or other plant sources. fulfill. Propolis is used for small gaps (about 6 millimeters (1⁄4 inch) or less), but gaps larger than the bee space (about 9 millimeters (3⁄8 inch)) are usually filled with bar combs. Its color depends on the botanical origin, with dark brown being the most common. Propolis is sticky from 20 °C, but at lower temperatures it becomes hard and brittle.Worker bees primarily collect pollen and nectar, but they also collect water and plant resins necessary for the production of propolis. The chemical composition and 3 properties of propolis depend on environmental conditions and the harvested resource. A The last decades, society has become aware that it to act in a new scenario with new sustainable attitudes is necessary, aiming a social development. The increase of humanitarian and environmental crises, as well as the presence of institutions and programs that fail to meet emerging social needs, underscore the importance of socially entrepreneurial initiatives and new models application that create social and environmental value[8] It is worth noting that some countries tend to create policy space aimed at reducing social asymmetries, some of which can be considered social enterprises. They have different purposes as they are aimed at community development and improvement. They are usually in precarious economic situations, with low incomes and few jobs.[9]

**Fig 1: Honey Bees.**

Honeybees have been around for 125 million years, and their evolutionary 4 success has allowed them to become perennial species that can use almost any habitat on Earth. This success is largely due to the chemistry and application of the specific products that bees make.Honey, beeswax, poison, propolis, pollen, royal jelly. Propolis has been used medicinally since ancient times as the honeybee's most important 'chemical weapon' against pathogenic microorganisms. It is still one of the most commonly used remedies in the Balkans[10] and is used to treat wounds, burns, sore throats and stomach ulcers. Today, in temperate zones around the world, it is well documented that the main source of bee paste is the resinous exudates of poplar buds, mainly the black poplar Populus nigra.[11] For this reason, European propolis contains typical "poplar bud" phenols. Flavonoid aglycones (flavones and flavanones), phenolic acids and their esters.[12]

## IMPORTANCE OF THE KNOWLEDGE OF PLANT SOURCES

Knowledge of the botanical sources of propolis is not only of academic interest. This may serve as a basis for chemical standardization of propolis.Beagle can be readily characterized from its botanical sources, which can be confirmed by simple TLC[13], HPLC, or GC comparisons. This method provides information on the qualitative composition of the sample if the composition of the corresponding plant excreta is known. For example, when it comes to "poplar-type" propolis, it is clear that the product is a mixture of flavonoid aglycones, hydroxycinnamic acids and their esters. Additionally, knowledge of the botanical source of propolis is important for beekeepers to ensure that bees have suitable plants within flight range.Bee colonies are known to suffer if propolis cannot be harvested. It is even said that bees use “propolis substitutes” such as paint, asphalt and mineral oil.

## HISTORY OF PROPOLIS

Propolis has been used by humans since 300 BC. Used as a traditional medicine[15] Researchers said propolis' healing activity was identified by Roman. As did other scientists such as Dioscorides, Galen, Aristotle, and Pliny,[16] similarly physicians used propolis effectively to treat injuries during the Boer War and World War II. The early Egyptians recognized the putrid properties of propolis and used it to protect corpses from decay[18] and to heal wounds.[19][20] In addition, propolis was recognized as an antibacterial agent in Europe in his 17th century and his 20th century.[21] In 17th-century England, propolis was recognized as an excellent medicine for healing wounds.[22] Similarly, propolis is approved in China as a medicine against cancer and infections.[23] The first scientific report on propolis, its

composition and chemical effects was published in 1908.[24] It was used as a varnish in the 17th century.

**Fig 2: Drapers Super Bee.**

**BIOMEDICAL APPLICATION OF PROPOLIS** -Propolis use has great effect on human health and is used for various purposes. Nowadays, it is used as an antibacterial, antifungal, anti-inflammatory, antiviral, anesthetic, antioxidant[25], antitumoural, antiprotozoal, anticancer[26] antihypertensive, anticarcinogenic and anti-hepatotoxic in addition to possessing cytotoxic activity, etc.[27]

**ANTI-BACTERIAL ACTIVITY OF PROPOLIS** – Propolis has significant activity against bacteria such as Enterococci, Escherichia coli, and Staphylococcus aureus[28] and ethanol extracts are more effective against Gram-positive bacteria, and against Gram-negative bacteria.[29] but high concentrations of propolis stopped the growth of Gram-negative bacteria.[30] based on interactions with other compounds such as galangin and pinobanksin.[31]

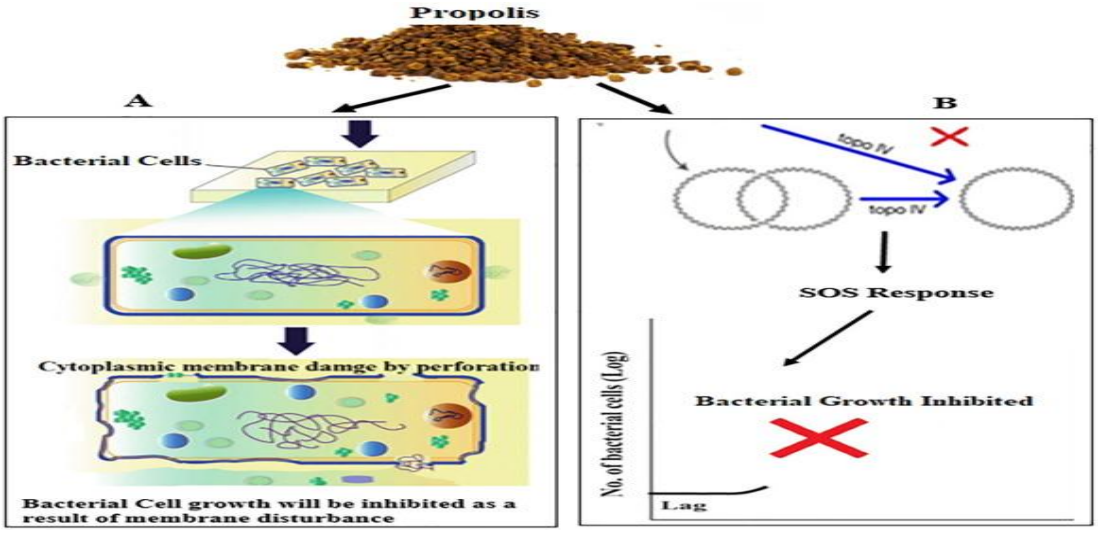


**Fig. 3: Antibacterial Activity of Propolis.**

**ANTI-FUNGAL ACTIVITY OF PROPOLIS –** Propolis showed activity against different fungi[32]. It was investigated that, propolis inhibit the aflatoxigenic fungi, and also decreases conidial growth in Aspergillus flavus. Propolis from different areas show activity against Candida guilliermondii, C. guilliermondii, C. krusei, C. albicans. In another investigation, a French propolis was effectively used against human fungal pathogen C. albicans, C. glabrata, Aspergillus fumigates. A constituent of propolis called pinocembrin shows activity against Penicillium italicum, which stops mycelial growth and acting on the pathogen respiration and energy homeostasis leading to the rupturing of cell membrane and metabolism disorder.[33]

**ANTI-TUMOURAL ACTIVITY OF PROPOLIS –** Propolis components have antitumor properties[34] Ingredients such as caffeic acid phenethyl ester (CAPE)[35] and artepillin C have been studied and found to have anti-tumor effects. These propolis compounds are involved in cell cycle inhibition, matrix metalloproteinase inhibition, anti-angiogenic effects, and also inhibit the transmission of disease from one part of the body to another.[36] It has the ability to stop DNA synthesis in tumor cells, has the property of causing senescence (apoptosis) in tumor cells, and has the ability to activate white blood cells to produce active substances that can regulate B, T, or natural functions. killer cells.[37] Other compounds such as galangin, cardanol, nemolozone and chrysin are involved in preventing rapid division of tumor cells. Using propolis for 3 days increased the cytotoxic activity of natural killer (NK) cells against mouse lymphoma.

**ANTI-PROTOZOAL ACTIVITY OF PROPOLIS –** Propolis activity has been reported against many protozoa that cause disease in humans and other animals. B. Giardiasis (38),

Chagas disease, leishmaniasis[39], trichomoniasis, toxoplasmosis.[40] However, propolis showed antiprotozoal activity against Leishmania donovani, Trypanosoma cruzi, Giardia lamblia, Trichomonas vaginalis, Toxoplasma gondii and G. duodenalis.[41] Some 11 components of propolis have shown antibacterial activity, such as caffeic acid, chrysin, moronic acid, protocatechuic acid, p-coumaric acid, apigenin, and other components such as terpenoids, esters, and phenols. , shows superior activity (coccidostatic) against Chilomonas paramecium.[42] Dimethylsulfoxide extract and ethanolic propolis extract were more effective against Trypanosoma cruzi and showed killing effect against Trichomonas vaginalis. (2001) 2,2-dimethyl-6- carboxyethenyl-2H-1-benzopyran, 3,5-diprenyl-4-hydroxycinnamic acid, 3-(2,2- 8-prenylbenzopyran-6-yl ) propenoic acid and 3,5-diprenyl-4-hydroxycinnamic acid exhibit antibacterial activity against Trypanosoma cruzi.[43]

**ANTI-INFLAMMATORY ACTIVITY OF PROPOLIS –** These compounds work by inhibiting leukocyte production of leukotrienes and prostaglandins[44], and by inhibiting myeloperoxidase activity, ornithine decarboxylase, protein tyrosine kinases, and NADPH oxidase.[45] CAPE and galangin, both components of poplar propolis, exhibit anti-inflammatory properties and suppress inflammation in carrageenan pleurisy, carrageenan edema, and useful arthritis in rats.[46] Effects of Brazilian propolis and Chinese propolis on the pathogenesis of collagen-induced arthritis in mice have also been reported. Propolis modulates inflammatory substances produced intracellularly as a result of pressure, toxins, or pathogenicity.[47]

**HEPATOPROTECTIVE ACTIVITY OF PROPOLIS**

Propolis acts as a hepatoprotectant.[48] Increases glutathione levels and stops lipid peroxidation and oxidized glutathione levels. As a result, propolis enhances antioxidant activity against mercury-induced toxicity and acts as a hepatoprotectant. Studies have also shown that propolis extract plays a protective role against hepato-renal oxidative stress and damage resulting from CCL4 curl.[49]

**DENTAL ACTION OF PROPOLIS –** Ethanolic propolis extracts from four different regions of Brazil and Turkey revealed by agar plates Actinomyces naeslundii, Porphyromonas gingivalis, Fusobacterium nucleatum, Veillonella parvula, Lactobacillus acidophilus, Peptostreptococcus anaerobius, Peptostreptococcus micros, Prevotella oralis, It was used against various anaerobic bacterial strains such as Prevotella melaninogenica. Dilution method Low inhibitory activity and low bactericidal activity. Due to the presence of

flavonoids and aromatic acids such as galangin, chrysin, pinavancin, quercetin, naringenin and galangin in propolis, it is more effective against oral disorders (especially dental diseases). It played an important role in pulpal repair.[50] Combining ethanolic propolis extract with mouthwash and toothpaste improved the prevention of microbial infections and the treatment of gingivitis.[51] 13 Anti-oxidant activity of propolis – Propolis, such as vanillin and phenolic acids, had the ability to penetrate both the epidermis and dermis and protect them from free radicals generated by radiation and aging skin cell maturation.[52] The mechanism of propolis' antioxidant properties is based on phenolic compounds that donate hydrogen ions to free radicals to protect cells from oxidative reactions and food stores from oxidation and poisoning. and the ability to scavenge free radicals that are the main cause of protein oxidation.[53] Portuguese propolis has antioxidant properties and prevented lipid peroxidation in human red blood cells.[54]

**ANTI-VIRAL ACTIVITY OF PROPOLIS –** Propolis is known to exhibit antiviral activity by inhibiting viral entry into cells[55], disrupting viral replication leading to disruption of RNA before and after (RNA) release within cells. Causes.[56] Among other things, propolis has shown antiviral ability against genital herpes infection (HSV-2). Flavonoids, including kaempferol, acacetin, quercetin, galangin, and chrysin, have been described as cytotoxic. Several other researchers have suggested that a compound called 3- methyl-but-2-enyl-caffeate, isolated from poplar propolis, inhibits herpes simplex virus titration and DNA synthesis (type 1) ex vivo. Reported. Another compound called isopentyl ferulated showed ex vivo activity against Honey Kong A1 influenza virus (H3N2). Propolis has shown antiviral activity against avian 14 influenza virus, Rift Valley fever virus, Heidi-Newcastle disease virus, herpes bursa virus, and influenza virus.[57]

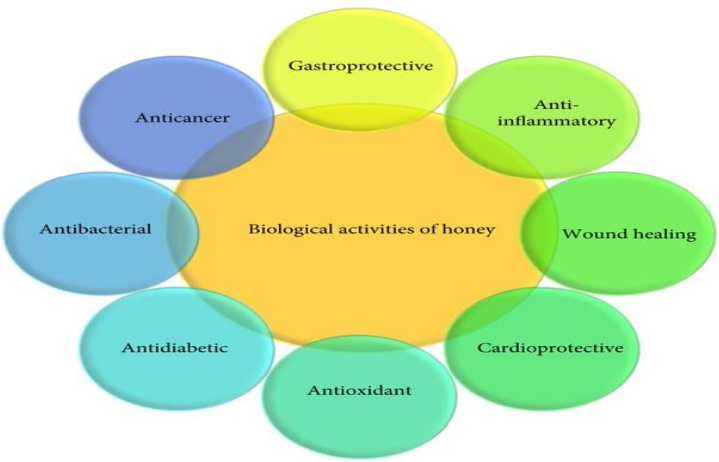


**Fig 4: Biological Activities Of Propolis.**

**WOUND HEALING ACTIVITY OF PROPOLIS –** The components of propolis also have therapeutic abilities of propolis for tissue repair and wound healing.[58] These are due to its immunomodulatory, antiinflammatory, and antibacterial properties.[59] Propolis has also been found to reduce the amount of free radicals in inflammatory damage and promote the development of collagen and its components.[60] The presence of this mineral promotes various enzymatic reactions, cell metabolism, blood circulation, and the formation of collagen fibers.

## IMPORTANT TRENDS AND DEVELOPMENTS IN RECENT PROPOLIS

### Biological Studies Performed with Chemically Characterized Samples

An increasing number of publications combine chemical analysis of tested propolis samples with antibacterial and other biological studies.The most commonly used technique for chemical analysis is gas chromatography-mass spectrometry (GC -MS)[61] and high performance liquid chromatography (HPLC).[62] In a recent study, qualitative chemical characterization of samples tested for antimicrobial activity was combined with quantification of the main groups of bioactive substances in the corresponding samples. The use of chemically characterized propolis samples for biological experiments is the onlyA Useful Method for Studying the Biological and Pharmacological Activities of Early 3rd Millennium Honeybee Glue.

## MUSICAL INSTRUMENTS

Propolis is used as a raw material in varnishes by some manufacturers of stringed instruments (violins, violas, cellos, basses).[63] A tincture of propolis can be used to seal the surface of newly-made fiddle bridges and can be used to repair holes in panpipe his tubes. Claims that Antonio Stradivari used propolis in the lacquer of his musical instruments were refuted in 2009.[64]

## CHEMICAL COMPOSITION

The chemical composition of bee glue is very complex and depends on the flora of the collection area. In temperate zones, including Europe, Asia and North America, bud exudates from various poplar buds are the most important chemical evidence, including comparisons of propolis samples and plant material. Temperate Propolis Sources The first studies on the analysis of propolis based on chemical evidence appeared in the 70's.Lavie[65] in France and Popravko.[66] in Russia analyzed the flavonoid composition of propolis and compared it with the exudates of poplar and birch buds, respectively. Many more publications followed, and it

is now generally accepted that it has been chemically proven that in temperate zones the bud exudates of poplar species and their hybrids are the main source of honeybees. Applies to Europe[67], North America[68], and non-tropical regions of Asia.[69] The introduced poplar species is also the parent 18 plant of New Zealand.[70] However, in Russia, especially in its north, birch buds (Betula verrucosa) provide valuable glue for bees.[71] 2.3. Plant Sources for Tropical Propolis With no poplars or birches in the tropics, bees must find new plant sources for bee glue. Martos et al. We identified the most important propolis flavonoids in samples from near-tropical 'frontier regions' where poplar is not always available.[72] found leaf exudates of certain cistus species. To be a botanical source of propolis in Tunisia. Similarly, in the Sonoran Desert, Ambrosia deltoidea was the plant source.[73] Polyprenylated benzophenone isolated from a propolis sample from tropical Venezuela by Tomas-Barberan et al.[74] These compounds are major constituents of the resin exuded from the flowers of some of his Clusia species, and through chromatographic comparisons, the authors conclude that Clusia major and Clusia minor (Guttiferae) are propolis in the region in question. shown to be the main source of 5 pairsSource of propolis. Samples from these regions are characterized by a similar chemical composition with phenol as the main component.Flavonoid aglycones, aromatic acids and their esters.[75] The numbers in bold below represent the composition of the new propolis. Markham et al.[76] identified a common 'poplar' phenol (derived from imported poplar) in samples from New Zealand, along with two new compounds.5-phenyltrans,trans-2,4-pentadienoic acid 1 and 5-phenyl-trans-3-pentenoic acid 2. In Egyptian propolis samples, esters of caffeic acid and long-chain fatty alcohols 19 (dodecanol, tetradecanol, tetradecenol, hexadecanol) were detected in addition to components of poplar buds.[77]

## CONCLUSION

Such comparative studies are of great value for the standardization and therapeutic application of propolis. We hope that the number will increase significantly in the near future. This allows scientists to associate specific chemical types of propolis with specific types of biological activity and to make recommendations for practitioners. This allows the general public to associate propolis with CAM. It may help you use the beneficial properties of more efficiently. Propolis; a beehive product with broad pharmacological potential, including antibacterial, antifungal, antiprotozoan, hepatoprotective, antioxidant, anti-inflammatory, antiviral, anticancer, and antitumor properties. Furthermore, the addition of ethanolic propolis extracts to mouthwash and toothpaste compositions improves the prevention of microbial

infections and is effective in treating gingivitis. In addition, the presence of bioflavonoids, arginine, vitamin C, provitamin A and B complexes and some minerals improve wound healing as they have wound healing properties. Instead of individual components, combined effects can occur, resulting in propolis exhibiting diverse biological performances. Finally, the development of new propolis compounds from propolis of various geographical origins. are important in the fight against various pathogenic diseases. A current literature review suggests that propolis can be further investigated for its potential properties against human pathogens.

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