

## BEE PROPOLIS: A Comprehensive Review

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**ABSTRACT:** Propolis is a honey bee hive product collected by honey bees it is not collected by all the species of honey bees only some i.e., *Apis Dorsata*, *Apis Mellifera* in India are capable of collecting or collects Propolis, it is a resinous material which is sticky in its nature and characteristic in its odor, it gets hard and brittle after kept in a cold condition and gets soft, supple and sticky after getting warm. Bee propolis and its uses dates back its roots from 300 B.C to till date. Many of its therapeutic properties as well as its chemical constituents are still unexplored. Propolis is the only product which contains nearly about 350-500 chemical constituents in a single product, it can be used as Anti-inflammatory, Analgesic, Anti-pyretic, Anti-microbial, Anti-fungal in therapy but it has vast therapeutic properties. Further research and further studies are needed to explore Bee propolis and its therapeutic actions.

**KEYWORDS:** Propolis- Bee product- Indian propolis- Therapeutic uses.

### I. INTRODUCTION

[71] Propolis is generic name for a strongly adhesive mucilaginous material gathered by Honey bees (*Apis Mellifera*. L) from various plant. [72] "Bee Glue" characteristically propolis is a lipophilic material that is hard and brittle when kept in cold, but soft, supple and sticky when kept in warm. Hence, the name bee glue. Propolis is the result of the team efforts made by Honey bees, [30] A bee colony produces from 150 to 200 gm propolis in a single year. The use of propolis dates back at least to 300 B.C, Helfenberg in the year 1908 mentioned that bees obtained propolis from the Boughs, Leaves and Buds of the Birch, Ash, Elm and balsam trees. [36] Propolis the name was first coined by Aristotle (384-322 B.C) it is a Greek term means Pro(before) and Polis (for the city) means "Before the city" (here city means bee colony) or the "Defense of the hive". [1] Propolis consists of 50% plant resin, balsams, plant latex and vegetable glue, 30% wax, 10% essential and

aromatic oils, 5% pollen and 5% various other substances such as Polyphenolic substances (organic phenols, flavonoids and ketones) and organic debris. [2] More than 300 chemical components of propolis have been identified.[4] There are many methods of extraction of propolis, but three main methods are Traditional Maceration Extraction method, Ultrasound Extraction (UE) method and Microwave Assisted extraction (MAE) method, but from these methods Ultrasound Extraction Method or MAE was shown to be the Most efficient method based on yield, extraction time and selectivity.

### II. HISTORY OF PROPOLIS

Propolis has a deep history because, Propolis is as old as honey, and it has been used by man for ages. [73] There are many records suggesting that the use of propolis by Ancient Egyptians, The Persians and The Romans. [74][75] Aristotle in his book "HISTORIA ANIMALIUM" (history of animals) is divided into ten of books, of which the book IV discusses animals without blood and in the book V, chapter XVIII, Aristotle makes a number of remarkable Notes and observations about bees, in that book he wrote and named the substance as "Propolis".

[76] Hippocrates had used Propolis to cure wounds and ulcers, both internal and external. [77] Pedanios Dioscorides, who used to around 50 A.D, described the medicinal uses of propolis, he often mentioned honey, wax and various honey wines as in medicine. [78] In the first century A.D, Aulus Cornelius Celsus (c.25 BC to c. 50AD), wrote about propolis as "A Drug for promoting suppuration, for opening wounds, and for treatment of abscesses". In the manuscripts of Persians propolis is described as a drug against eczemas, myalgia and rheumatism. [79] In the 11<sup>th</sup> century Ustsoro Karabadi (A peerless handbook) and the 13<sup>th</sup> century Tsigni Saakimoy (A doctoring book) in these books describing medical applications of propolis claim the efficacy of bee propolis. [80]

John Gerard (1564-1637) an English Jesuit Priest in his popular herbal book "The History of Plants (1597)" makes reference to the use of "The resin or clammy substance of the black poplar tree buds" for ointments in healing. The ointment that is made of the (poplar) buds, is good against all inflammations. [81] Nicholas Culpeper (1616-1654) an English Botanist, Physician, Herbalist and an Astrologer in his complete herbal work under the heading "The Poplar Tree" states that "the ointment called Populneon, which is made of this poplar, is singularly good for all heat and inflammations in any part of the body and it alleviate the heat of wounds".

In the beginning of the 19<sup>th</sup> century propolis was studied and described by Prof. Nicolas Louis Vauquein (1763-1829) a French Pharmacist and a Chemist, [82] In his writings he notes that propolis or bee mastic is collected by the bees, it is a resinous, ductile, odorant substance of a reddish brown and dark brown color, "In the mass it is blackish but it is semitransparent when in thin plates, it is more tenacious", It has an aromatic odor. One of the earliest reports is that of Eugen Dieterich and Helfenberg in which they present their different extraction methods in which they separated propolis constituents in alcohol,

chloroform and ether. [83] In 1976 Dr. Karl Aagaard (1889-1968), a Danish Biologist awarded with the name "Dr Propolis" for his exploits of over 20 years of bee propolis collection and research, after observing the therapeutic effects of propolis on more than 50,000 patients in Scandinavia (subregion in northern Europe) and concluded that the field of influence of bee propolis is extremely broad, it includes various therapeutic actions and in the year 1976 Dr Karl Aagaard had patented a method for purifying and separating Bee propolis derived from beehives. The following method included the steps of quick freezing untreated propolis repeatedly at temperature below  $-20^{\circ}\text{C}$  and then mashing the treated propolis to smaller particles at a temperature below  $10^{\circ}\text{C}$  and then the particles were separated to a number of fractions containing most impurities were dissolved and filtered in a fluid filter for utilization of all propolis present. [30] The London Pharmacopoeia listed propolis as an official drug in the Seventeenth Century. At the time of World War II propolis was used on a large scale for the cure of wounds, cuts and some bacterial infections by the Soviet soldiers, [84] So propolis are also known as "Russian Penicillin" at that time. As same there is a vast history of bee propolis in different parts of the world.

### III. PROPOLIS IN INDIA



**Figure 1: - Bee Propolis (Apis Mellifera) in India**

As per estimates of National Bee Board (NBB), [85] India has the potential to maintain about 200 million bee colonies which can create employment for over 6 million rural and tribal families. [2] India has all types of honey bees, which includes Apis Dorsata (giant honey bee), Apis Cerana Indica (Indian honey bee), Apis Florea (dwarf honey bee), Apis Mellifera (European honey bee). From this Apis Mellifera is not native to India and was launched from the year 1983 in

beekeeping sector of India. But, amongst these species only Apis Dorsata and Apis Mellifera are capable of making propolis or makes propolis. The color of Apis Dorsata honey bee propolis varies from brown to light red and the color of Apis Mellifera honey bee propolis is Dark brown in color and smells characteristic.

### IV. CHEMICAL CONSTITUENTS PRESENT IN PROPOLIS

There are over 300 different compounds have been identified in propolis so far, some of them are: -

**Table 1: - Chemical Constituents present in Propolis**

SR.NO	CHEMICAL CONSTITUENTS	THERAPEUTIC ACTIONS	REFERENCES
1	Galangin	Anti-Bacterial.	1,4,6,8,14,17,19,34,36,45,56,61,64.
2	Pinocembrin	Anti-Bacterial, Antioxidant.	1,3,4,6,8,13,14,17,19,28,45,50,56,61,64.
3	Pinobanksin	Anti-Bacterial.	1,14,17,19,45,61,64.
4	Quercetin	Anti-Inflammatory, Marker for Quantitation.	1,3,14,15,23,34,36,41,48,50,56,61,64,70.
5	Apigenin	Anti-Inflammatory.	1,3,14,50,56,61.
6	Caffeic acid	Antioxidant, Anti-Inflammatory, Anti-cancer.	1,8,17,34,41,43,48,64.
7	Caffeic acid phenylethyl ester	Antioxidant, Anti-Inflammatory.	1,8,34,41,43,50,54,56,61,64,70.
8	Chrysin	Anti-Inflammatory.	1,3,14,34,36,50,61,64.
9	Naringenin	Anti-Inflammatory.	1,34,41.
10	P-coumaric acid	Antioxidant, Anti-cancer.	1,3,48,61,64.
11	Ferulic acid	Antioxidant.	1,3,5,8,56,61,64.
12	Cinnamic acid	Anti-Microbial.	1,5,50,56.
13	Isoliquiritigenin	Anti-cancer.	1.
14	Medicarpin	Anti-Inflammatory, Anti-cancer.	1.
15	Biochanin-A	Antioxidant.	1.
16	Artepinin-C	Antioxidant, Anti-cancer.	1,3,48,50,64.
17	Drupanin	Anti-cancer.	1.
18	Bacharin	Stress release.	1.
19	Kaempferol	Antioxidant, Anti-cancer.	3,34,48,61,64,70.
20	Tectochrysin	Anti-cancer.	3,6.
21	Pinostrobin	Anti-Viral.	3,28,36,61.
22	Cinnamic acid	Anti-Bacterial, Anti-Fungal.	3,5,8,52,64.
23	Benzoic acid	Anti-Fungal.	3,5,8.
24	Salicylic acid	Anti-Fungal.	3,5,8,56.
25	Terpineol	Antioxidant, Anti-Ulcer.	3.
26	Geraniol	Anti-cancer.	3.
27	Camphor	Pain-Relieving.	3.
28	Nerol	Perfumery.	3.
29	Farnesol	Perfumery.	3.
30	Gallic acid	Antioxidant, Anti-Inflammatory.	6,8,50,56.
31	Pinocembrin-7-Methyl ether	Anti-cancer.	6.
32	Phenolic compounds	Antioxidant.	8, 12, 24.
33	Terpenes	Treat Rheumatoid Diseases.	8, 12.
34	Steroids	Treat Rheumatoid Diseases.	12.
35	Proteins	Anti-Coagulant.	12.
36	Amino-acids	Immune function.	12,41,56,57.
37	Flavonoids	Antioxidant.	8,12,13,14,19,23,24,36,41,45,49,52,54.
38	Flavones	Antioxidant	14,15,36.
39	Isoflavones	Antioxidant.	15,48.

40	Flavonones	Antioxidant.	15,23,36,57.
41	Anthocyanins	Antioxidant.	15.
42	Catechin	Antioxidant.	15.
43	Iso catechin	Antioxidant.	15.
44	Polyphenols	Antioxidant.	23,24,32,57.
45	Rutin	Anti-Inflammatory, Anti-Microbial.	34,70.
46	Acacetin	Anti-Inflammatory.	36.
47	Kaempferide	Antioxidant, Anti-Inflammatory.	36.
48	Rhamnocitrin	Antioxidant, Anti-Inflammatory.	36.
49	Isovanillin	Antioxidant, Anti-Inflammatory.	36.
50	Glycosides	Antioxidant, Anti-Inflammatory.	41.
51	Aglycones	Antioxidant, Anti-Inflammatory.	41.
52	Aliphatic acids	Antioxidant, Anti-Inflammatory.	41,57.
53	Esters	Antioxidant, Anti-Inflammatory.	41.
54	Aromatic acids	Antioxidant, Anti-Inflammatory.	41,57.
55	Fatty acids	Antioxidant, Anti-Inflammatory.	41.
56	Carbohydrates	Antioxidant, Anti-Inflammatory.	41.
57	Aldehydes	Antioxidant, Anti-Inflammatory.	41,57.
58	Ketones	Anti-Inflammatory.	41,54,57.
59	Chalcones	Antioxidant.	41,57.
60	Dihydrochalcones	Antioxidant.	41,57.
61	Terpenoids	Antioxidant.	41,52,54,57.
62	Vitamins	Antioxidant.	41,52.
63	Phenethyl ester	Antioxidant.	43.
64	Phenilic acid	Antioxidant, Anti-cancer.	48.
65	Medicarpin	Anti-Inflammatory, Anti-Microbial.	48.
66	Vestitol	Anti-Inflammatory, Anti-Microbial.	48.
67	Formononetin	Anti-Inflammatory, Anti-Microbial.	48.
68	Isoliquiritigenin	Anti-Inflammatory, Anti-Microbial.	48.
69	Benzophenones	Anti-Inflammatory, Anti-Microbial.	48.
70	Nemerosone	Anti-Inflammatory, Anti-Microbial.	48.
71	Germanicol	Anti-Inflammatory, Anti-Microbial.	48.
72	Poly-metoxilated flavonoids	Anti-Inflammatory, Anti-Microbial.	48.
73	Lanosterol	Anti-Inflammatory, Anti-Microbial.	48.
74	Lupeol	Skin Cancer.	48.
75	Cycloartenol	Anti-cancer.	48.
76	Astetine	Anti-cancer.	50.
77	Polysaccharides	Anti-Inflammatory, Anti-cancer.	52.
78	Phenyl Propane	Anti-Inflammatory.	54.
79	Isoferulic acid	Anti-Inflammatory.	61,64.
80	Sakuranetin	Anti-Inflammatory.	61.
81	Myricetin	Anti-Inflammatory.	70.
82	Propofol	Antioxidant, Anti-Microbial.	50.

83	Glantine	Anti-Inflammatory.	50.
84	Coumaric acid	Anti-Inflammatory.	50.

### V. THERAPEUTIC USES OF PROPOLIS

Propolis has vast Therapeutic/ Biological uses. It can be used as an: -

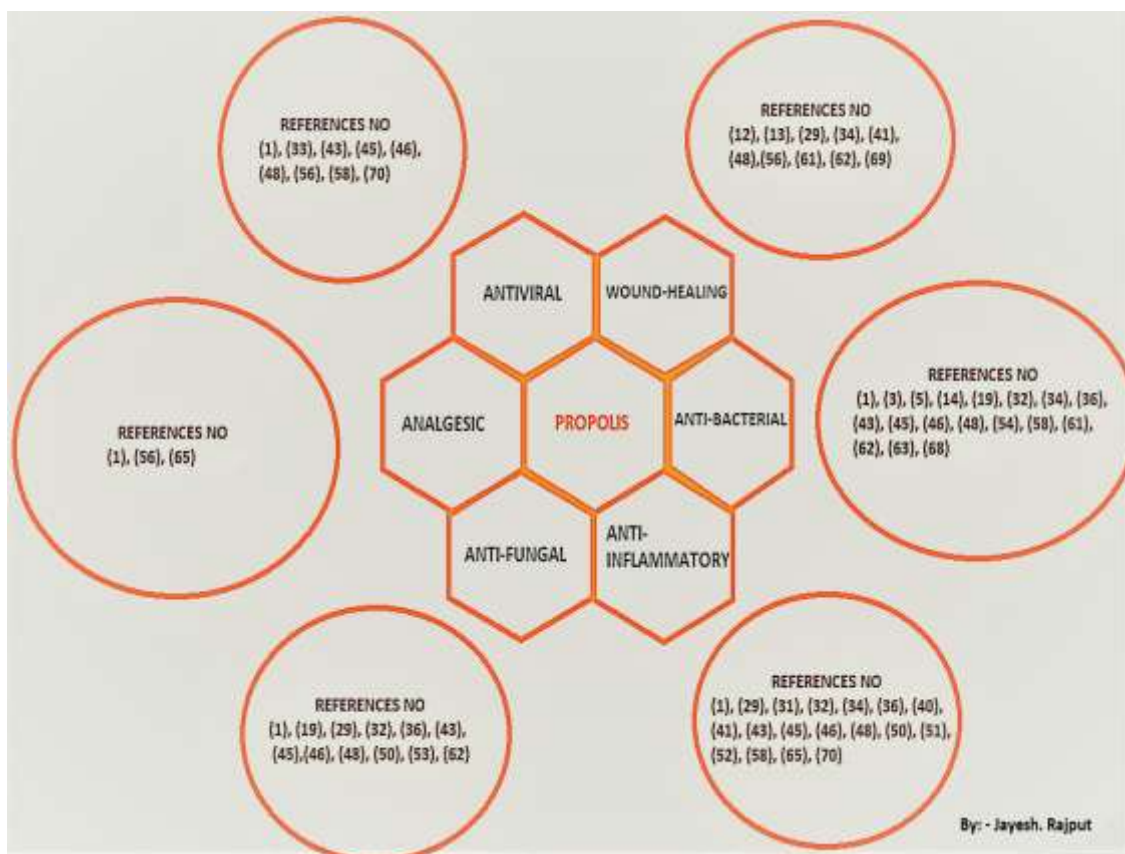


Figure 2: - Propolis Therapeutic Activities

And its chemical constituents can also be used as therapeutic agents as: -

SR.NO.	THERAPEUTIC ACTIVITY	REFERENCES (from reference article no)/ (author(s))
1	ANALGESIC	(1), (56), (65).
2	ANTI-INFLAMMATORY	(1), (29), (31), (32), (34), (36), (40), (41), (43), (45), (46), (48), (50), (51), (52), (58), (65), (70).
3	ANTI-CARCINOGENIC	(1), (29), (58).
4	ANTI-PROTOZOAN	(1).
5	ANTI-OXIDANT	(1), (6), (8), (10), (19), (24), (28), (29), (32), (34), (42), (43), (45), (46), (50), (51), (58), (66), (69), (70).
6	IMMUNE-STIMULATING	(1).
7	ANTI-VIRAL	(1), (33), (43), (45), (46), (48), (56), (58), (70).
8	ANTI-DIABETIC	(1).
9	ANTI-TUMOR	(1), (43), (48).
10	HEPATO-PROTECTIVE	(1), (31), (48).
11	ANTI-TUBERCULAR	(1), (36).

12	<b>ANTI-FUNGAL</b>	(1), (19), (29), (32), (36), (43), (45), (46), (48), (50), (53), (62).
13	<b>ANTI-BACTERIAL</b>	(1), (3), (5), (14), (19), (32), (34), (36), (43), (45), (46), (48), (54), (58), (61), (62), (63), (68).
14	<b>ANTI-CANCER</b>	(6), (15), (28), (32), (34), (50), (58), (62), (70).
15	<b>ANTI-ULCEROGENIC</b>	(11), (32), (62).
16	<b>WOUND HEALING</b>	(12), (13), (29), (34), (41), (48), (56), (61), (62), (69).
17	<b>ANTI-MICROBIAL</b>	(17), (18), (19), (25), (31), (34), (39), (43), (45), (48), (49), (50), (51), (58), (70).
18	<b>HEPATO-PROTECTIVE</b>	(19), (43), (45), (70).
19	<b>OCULAR DISEASE</b>	(26).
20	<b>ANTIBIOTIC</b>	(29).
21	<b>ANESTHETIC</b>	(29), (36).
22	<b>IMMUNO-MODULATORY</b>	(29), (32), (48), (54), (60), (62), (70).
23	<b>ANTI-TUMOUR</b>	(31), (45), (46), (50).
24	<b>ANTI-SEPTIC</b>	(32), (36).
25	<b>ANTI-MYCOTIC</b>	(32), (62).
26	<b>DENTISTRY/ ORAL HEALTH</b>	(34), (62).
27	<b>CARDIO-PROTECTIVE</b>	(34).
28	<b>ANTI-PROLIFERATIVE</b>	(34).
29	<b>DERMATOLOGY</b>	(36), (61), (62).
30	<b>ANTI-PARASITIC</b>	(48).
31	<b>ANTI-METASTATIC</b>	(54).
32	<b>IMMUNO-STIMULATORY</b>	(58), (60), (62).
33	<b>ANTI-PYRETIC</b>	(61).
34	<b>ANTINOCICEPTIVE</b>	(65).
35	<b>(SARS-COVID-19) AND (SARS COV-2)</b>	(70).

## VI. CONCLUSION

Propolis is as old as honey, but till date it has not been fully explored many of the Chemical Constituents today are also yet to be explored from propolis, many authors has claimed that nearly 350 chemical constituents has been identified till date, but many authors and researchers has claimed presence of nearly 500 chemical compounds in propolis, many of the claims made about the pharmacological actions and chemical constituents of propolis have not been well confirmed but, propolis is a substance which has nearly 350-500 different chemical constituents present in single product. It is abundantly clear that it will have to be studied much more before it can properly be considered for therapeutic purposes, because its constitution is largely unknown. Since, a considerable number of people seems to be using

propolis and any of its preparation (s), further research into its pharmacological properties is justified, and it is hoped that this review will provide some of the basis for such investigations.

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