



Review Article

The therapeutic benefits of bee venom

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The insect population is easily among the most resilient species in the world. They have survived famines, droughts, disasters both manmade and natural and continue to remain among the most unperturbed species in the world. While insects are commonly considered pests and a large part of man's efforts are extended towards eradicating them, some insects have been counted as mankind's friend. The honeybee and its associated products have been used since time immemorial for its many therapeutic benefits. This article attempts to explore apitherapy and in particular, the therapeutic benefits of bee venom.

Introduction

The insect population is easily among the most resilient species in the world. They have survived famines, droughts, disasters both manmade and natural and continue to remain among the most unperturbed species in the world. While insects are commonly considered pests and a large part of man's efforts are extended towards eradicating them, some insects have been counted as mankind's friend. The honeybee is one such animal which by virtue of being a pollinator helps among other pollinators to cross pollinate and help at least 30% of the

world's crops and 90% of our wild plants to survive (Chavarria, 1999–2000).

In addition to maintaining the flora of the world, honeybees and their associated products have been of medicinal use to mankind since ancient times.

Apitherapy involves making use of bee acupuncture, bee products and the comprehensive natural factors of bee activities and apiaries to provide human beings with healthcare (Zhu and Wongsiri, 2008).

The main bee products used for apitherapy are pollen, honey, bee bread, apilarnil, royal jelly, propolis, bee's wax and bee venom.

Honey is a sweet, semi-fluid, viscous substance made from nectar. Its composition includes sugars (sucrose, fructose, glucose, maltose, etc.), minerals (Fe, Ca, Mg, etc.), organic acids (acetic, butyric, gluconic, citric, formic, lactic, maleic, malic, oxalic, pyroglutamic, succinic, glycolic, 2,3 phosphoglyceric, alpha ceto-glutaric, piruvic and tartaric), vitamins (B1, B2, B3, B5, B6, B9, B12, C, provitamin A, D, E, and K), pigments, aromatic substances, antibiotics (inhibine), antigerminative factors, enzymes (distase, invertase, sucrase, catalase, alpha and beta amylase, peroxydase, superoxid dismutase, superoxid oxydoreductase, alpha and beta glucosidase, tyrosinase), hormones, amino-acids (lysine, hystidine, treonine, arginine, valine, serine, methionine, glutamic acid, phenylalanine, tryptophane, prolyne, glycine, tyrosine and norleucine), fatty acids (palmitic, stearic, linoleic, oleic, lauric, miristoleic and linolenic).

Royal jelly is a product of the glands of worker bees and is a complex mixture of secretion of the glands and honey with a ratio of 1:1 (Meier and White, 1995). Its chemical composition includes: proteins, glucides, gammaglobulin, gelatine, 10-hydroxi-2-decenoic acid with anti-tumoral properties, 9-hydroxidecenoic acid, formic, tartaric, citric, acetic, butyric acid, hydrosoluble and liposoluble vitamins. It also contains all the minerals found in pollen and honey, enzymes, hormones, antibiotic, bactericidal and antiviral substances. It stimulates cellular regeneration, the enzyme system and hematopoiesis; it also has antioxidant, immunomodulating, hepatoprotective, remineralizing, anti-anemic, anti-leucemic and anti-tumoral properties.

Apilarnil is a triturate of drone larvae which includes the specific food content of the larvae cells (honey, bee bread, glandular secretions of the nurse bees). Apliarnil contains proteins (9–12%), glucides, lipids, hydrosoluble and liposoluble vitamins, minerals, enzymes, hormones and antiviral substances. It has anti-anemic, anti-leucemic, biostimulant, immunomodulating, energizing properties and stimulates cell regeneration (Andritoiu and Andritoiu, 2004).

Pollen is the male element of the flower. It contains enzymes, hormones, growth factors, reducing sugars (polein, fructose), non-reducing sugars, azotate compounds (xantine, hypoxantine, geranine, trimethylamine), lipids, organic acids (citric, tartaric, malic, malonic, succinic, acetic, fumaric and alpha ceto-glutamic), proteins, essential amino-acids, liposoluble vitamins (A, D, E and K), B vitamins complex, C vitamin, minerals (calcium iron, magnesium and zync), ribose, dezoxyribose, pectine, pigments (rutine, which increases the resistance of the capillaries), inositol, enzymes (amylase, invertase, protease, lipase, phosphatase, catalase and lactase). It stimulates cellular regeneration, hematopoiesis and has antioxidant, anti-anemic and anti-leucemic effects.

Bee bread has therapeutic value ten times higher than pollen. It is an outstanding biostimulant (Andritoiu, 2005).

Propolis is the resinous substance collected by bees from plants and trees and is used to coat the inside of the hive and the honeycomb cells with an antiseptic layer. It is a combination between plant substance and bee glandular secretions. It contains resins and balms, volatile oils, aliphatic acids, aliphatic acid sterols, vitamins, minerals, amino-acids, enzymes and flavonoids.

It has antioxidant, phosphorilating, anti-tumoral, anti-leucemic, anti-anemic and immunostimulating properties (Andritoiu and Andritoiu, 2004; Andritoiu, 2005). While these myriad products of the honeybee are of many therapeutic benefits, we will focus on the uses of the honey bee venom in different conditions. Bee venom called apitoxin is a mixture of proteins: melittin (main component 52%), apamin, adolapin, phospholipase A2, hyaluronidase, histamine, dopamine and protease inhibitor. It is a bitter, colorless liquid of density 1.1313g/cm³ and pH 5.0–5.5 (Hye *et al.*, 2004).

It has been used for at least 22 centuries, especially in Eastern Asia (Kwon *et al.*, 2002). A honeybee (*Apis mellifera* L.) can inject 0.012–0.1 mg of venom via its stinger.

The main component is melittin comprising 52% of venom peptides (Hye *et al.*, 2004; Meier and White, 1995). Apamin is a mild neurotoxin in that it selectively blocks SK channels, a type of Ca²⁺ activated K⁺ channel expressed in the central nervous system. Dry bee venom consists of 2–3% of apamin (Son *et al.*, 2007).

Adolapin comprising 2–5% of the peptides acts as an anti-inflammatory and analgesic agent because it blocks cyclo oxygenase. The most destructive component of apitoxin is phospholipase A2 (10–12%), because it degrades the phospholipids, which cellular membranes are made of. It also decreases blood pressure and inhibits coagulation of blood. Hyaluronidase comprising 1–3% of peptides dilates the capillaries causing the spread of inflammation. Histamine (0.5–2%) is involved in the allergic response elicited by bee venom. Dopamine and noradrenaline (1–2%) increase pulse rate and protease inhibitors (2%) act as anti-inflammatory

agents and stop bleeding (Habermann, 1984; Robergs *et al.*, 2004).

Therapeutic application of bee venom include their use in the management of arthritis, bursitis, tendonitis, dissolving scar tissue, in the management of post-herpetic neuralgia, Lyme disease, rheumatoid arthritis, osteoarthritis, multiple sclerosis, TMDs and more.

Studies in rats early in 2002 have found honeybee venom to suppress arthritis inflammation (Seong Soo Kang *et al.*, 2002). Human studies have shown bee venom to be immensely beneficial in rheumatoid arthritis patients and possess anti-inflammatory and antioxidant activity (Abdel-Rahman *et al.*, 2013). The anti-arthritic activity of bee venom may be attributed to its adrenal stimulatory effect (Zurier *et al.*, 1973).

Bee venom has also been found to be effective in the treatment of localised plaques of psoriasis with minimal tolerable side effects. Intradermal bee venom, propolis ointment in Vaseline base and oral propolis capsule have all found to be effective, either alone or in combination (Hegazi *et al.*, 2013). Bee venom with its excellent nociceptive and anti-inflammatory property has been found to be effective in reducing pain associated with post-herpetic neuralgia (Lee *et al.*, 2014).

Lyme disease is a bacterial infection caused by a *Spirochete*, *Borrelia burgdorferi*, which is passed to the patient by a tick bite. Lyme disease has become, after AIDS, probably the fastest spreading infectious disease. Honeybee venom has been found to be effective in the management of this disease. Research proved that one of the peptides in bee venom, melittin, has a strong inhibitory effect on the Lyme spirochete at very low doses (Lubke and Garon, 1997).

Topical application of bee venom ointment provides excellent therapeutic effects: it reduces muscular tonus and muscle pain intensity and gives better relief to the patient. Hence it can be used as an effective treatment modality for conditions caused due to excessive muscle contraction such as those involving the temporomandibular joint (Aleksandra *et al.*, 2014). While it is clear that a potentially toxic material like bee venom has been found to have many therapeutic benefits, it is venom at the end of the day and has to be used with caution.

Cases of trigeminal neuralgia being triggered by bee sting have been reported (Kahilogullari *et al.*, 2010). Some unusual neurological complications such as myasthenia gravis, encephalomyelitis, optic neuritis, cerebral infarction, parkinsonism, pontine hematoma, thalamic and mesencephalic hemorrhages as well as the Guillain- Barre syndrome related to stings have been also reported (Ashworth, 1964; Boz *et al.*, 2003; Brumlik, 1976; Crawley, 1999; Goldstein, 1964; Maltzman *et al.*, 2000; Remes-Troche *et al.*, 2003; Riggs *et al.*, 1993; Schiffman *et al.*, 2004; Starr *et al.*, 1977).

It must be avoided in pregnancy and lactation. Since it has an immunomodulatory effect, it should be used with caution in patients with auto-immune diseases since the possibility exists of the condition exacerbating. Given all these precautions, bee venom, often considered a bane could well hold the treatment key to many conditions which have hereto with been difficult to treat and could be the answer to many a disease, but utmost caution must be exercised in its use.

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