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Some bee products as antiparasitic remedies

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Abstract
Honeybee gives people one of the most valuable and healthy foods. These are honey, propolis, royal jelly, bee pollen, bee venom, wax. The healing properties of bee products are described in manuscripts discovered in ancient Egypt, Greece and China. Many of them are widely used in medicine for the treatment of bacterial and viral infections, to enhance the immunity of organism, for treatment of poorly healing wounds, in a variety of tumor diseases, in the gastro-intestinal diseases, promote the potency and fertility. Bee products have comparable healing properties to established drugs but they have fewer side effects. In this work we present some of the experiments that explore the impact of bee products to different parasites.
Keywords: parasites, bee products, honey, propolis, bee venom, antiparasitic properties.

Introduction

Parasitic diseases are among the most prevalent infections worldwide. Human parasitic diseases can be classified into two principal groups: those caused by protozoa and those caused by helminths. Although helminths are probably the most widespread of human parasites, most are relatively benign, and treatable with relatively straight forward regimens of modern drugs. Of course traditional medicines are still used, and are valuable especially for those who do not have access to such drugs.

However, the most lethal parasitic diseases, to which modern medicine has yet to find optimal treatments, are the blood and tissue protozoa, namely malaria, trypanosomiases and leishmaniases [8]. According to Centre for Host-Parasite Interactions, Institute of Parasitology, Quebec, Canada (2012) infections by parasitic protozoa and helminths cause considerable death, suffering and economic loss both in developing and developed countries. Malaria infection is one of the

most prevalent and debilitating diseases in developing countries with 300–500 million clinical cases each year and 1–2 million deaths, mostly in children under 5 years of age. More insidiously, malaria reduces economic growth in Africa alone by 1,3 % per annum (p.a.). Parasites also threaten animal productivity and food production. Over 500 million large ruminants are infected with parasitic worms resulting in economic losses of over $3 billion p.a. worldwide. It has recently been estimated that production of meat and milk in South Eastern Asia alone will need to grow by 3 % p.a. over the next 2 decades to avoid a food crisis by 2020.

The widely use of chemical drugs to combat with parasites in animals and humans has resulted in a growing resistance to them. On the other hand a large part of the used drugs have a number of side effects to host or to environment. This requires searching and studying the new, most effective, unexpensive and harmless to hosts of the parasites remedies. In the literature there is evidence for some anti-parasitic properties of bee products – honey, propolis and bee venom. In this paper we present some of the latest experiments that explore the impact of bee products on some social and economic actual parasitoses.

Honey

The aqueous extract of natural sweeteners, including honey, has been investigated for anthelmintic activity using earthworms (*Pheretima posthuma*), tapeworms (*Raillietina spiralis*) and roundworms (*Ascaridia galli*) by Prasad et al. [6]. Various concentrations (100–300 mg/ml) of sweeteners extract have been tested in the bioassay. Piperazine citrate (10 mg/ml) has been used as reference standard drug whereas distilled water as control. Determination of paralysis time and death time of the worms have been recorded. Extract of honey has exhibited high significant anthelmintic activity at highest concentration of 300 mg/ml. The result has shown that aqueous extract possesses vermicidal activity and has found to be effective as an anthelmintic. Higher concentration of extract has produced paralytic effect much earlier and the time to death has been shorter for all worms. Aqueous extract has showed anthelmintic activity in dose-dependent manner giving shortest time of paralysis and death with 300 mg/ml concentration, for all three types of worms. Extract has exhibited more potent activity at lower concentration (100 mg/ml) against roundworm (*Ascaridia galli*). Honey has showed less paralytic time and death time when compared to Cane jaggery and Palm jaggery. The orders of anthelmintic activity of natural sweetening agents have been as follows: Honey > Palm Jaggery > Cane Jaggery. The authors explain that acidic pH level of natural sweeteners prevents the growth of many helminthes and that natural sweeteners have a saturated mixture of monosaccharides. This mixture has a low water activity; most of the water molecules are associated with the sugars and few remain available for helminthes, so it is a poor environment for their growth.

Sajid and Kamran Azim [7] have examined the effect of natural honey on model nematode *Caenorhabditis elegans* and analyzed the honey components responsible for nematicidal activity. Characterization of honey-treated *C. elegans* has done using fluorescence and phase contrast microscopy. Egg-laying and egg-hatching defects of honey-treated *C. elegans* have been studied. For identification of nematicidal components, bioactivity-directed fractionation of honey samples has been carried out using dialysis, ultrafiltration, chromatographic, and spectroscopic techniques. Natural honeys of different floral sources have showed nematicidal activity against different developmental stages of *C. elegans*. The nematicidal components of honey have induced cell death in intestinal lumen and gonads of *C.*

elegans as revealed by microscopy. The nematicidal action of honey has been found to due to reproductive anomaly as manifested by defects in egg-laying and hatching by *C. elegans*. Honey with concentration as low as 0,03 % has exerted profound egg-laying defects, whereas 6 % honey has showed defects in egg hatching. The major sugar components of honey have not been involved in observed nematicidal activity. The bioactive components responsible for anti-*C. elegans* activity have been found in the 2–10 kDa fraction of honey, which has been resolved into ~25 peaks by reverse phase HPLC. LC-MS followed by further spectroscopic characterization have revealed a glycoconjugate with the molecular mass of 5511 as the major nematicidal component of honey.

Propolis

Duran et al. [3] have investigated antileishmanial activities of «Bursa» and «Hatay» propolis samples against *Leishmania infantum* and *Leishmania tropica* strains. Propolis samples have been analysed with the gas chromatography-mass spectrometry technique. Promastigotes have been incubated in the absence and presence of several concentrations (50, 100, 250, 500, 750, and 1,000 μg/mL) of each propolis sample. The viability and cell morphology of promastigotes in each concentration have been examined after 24, 48, 72, and 96 h of incubation. The growth of leishmania parasites has been significantly suppressed in the presence of 500, 750, and 1,000 μg/mL of «Hatay» propolis. «Bursa» propolis has found to be efficient in inhibiting the growth of leishmania promastigotes in culture media at these concentrations, 250, 500, 750, and 1,000 μg/mL. Thus, the in vitro results have showed that the «Hatay» and «Bursa» propolis samples have decreased significantly the proliferation of *L. infantum* and *L. tropica* parasites, however «Bursa» propolis has found to be more effective than «Hatay» propolis against leishmania promastigotes. According to the authors these two natural products may be useful agents in the prevention of leishmanial infections.

Brazilian red propolis was administered orally to Santa Inês ewes, and evaluation was made of general health and hematological, biochemical, and parasitic responses during and after flushing [5]. Thirty mature, nonlactating, nonpregnant ewes have been grazing tropical pasture and, as flushing after synchronization, have been supplemented with a concentrate-roughage mixture at a rate of 4 % body weight (BW). Ewes have been divided according to BW and fecal egg count (FEC) into two groups: control and propolis that have received propolis ethanolic extract at rates of, respectively, 0 and 3 g/ewe/day. The treatments have lasted 21 days until the end of flushing period. BW and body condition score (BCS) have been recorded, and blood and fecal samples have been taken weekly for 8 weeks. Mean values of BW and BCS have not been affected by propolis administration. Propolis has increased total leukocytes, but no significant differences have been observed for other hematological parameters. Propolis has increased total protein and globulin concentrations and decreased triglycerides, glutamate oxaloacetate transaminase, and glutamate pyruvate transaminase. Propolis decreased FEC. The authors have made the conclusion that propolis administration had good impact on ewe health and may be a promising feed additive during critical periods such as flushing.

Bee venom

Aiming to avoid adverse effects of metronidazole which is used for trichomoniasis treatment Kim et al. [4] have studied antiparasitic effect of bee venom on *Trichomonas vaginalis.* In this investigation, bee venom effectively has inhibited *T. vaginalis* growth in a concentration-dependent manner.

In their study Adade at al. [1] have demonstrated that bee venom can affect the growth, viability and ultrastructure of all *Trypanosoma cruzi* developmental forms, including intracellular amastigotes, at concentrations 15- to 100- fold lower than those required to cause toxic effects in mammalian cells. The ultrastructural changes induced by the venom in the different developmental forms have led authors to hypothesize the occurrence of different programmed cell death pathways. They have established that the main death mechanism in epimastigotes is autophagic cell death, characterized by the presence of autophagosomes-like organelles and a strong monodansyl cadaverine labelling. In contrast, increased TUNEL staining, abnormal nuclear chromatin condensation and kDNA disorganization has been observed in venom-treated trypomastigotes, suggesting cell death by an apoptotic mechanism. The same authors group has found that the influence of bee venom is due to effect of the antimicrobial peptide melittin, which comprises 40–50 % of the dry weight of it [2]. Findings of the authors have confirmed the great potential of *A. mellifera* venom as a source for the development of new drugs for the treatment of neglected diseases such as Chagas disease.

Conclusion

The present review on the influence of some bee products on helminthoses and protozoan diseases showed promising results about the use of honey, propolis and bee venom in the fight against parasitic diseases.

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Продукты пчеловодства как противопаразитарные средства

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Резюме

Пчела медоносная дает людям различные ценные и здоровые продукты. Это - мед, прополис, королевское желе, пыльца пчелы, пчелиный яд, воск. Продукты пчеловодства имеющие заживающие свойства описаны в рукописях, обнаруженных в древнем Египте, Греции и Китае. Многие из них широко используются в медицине как лекарства для лечения бактериальных и вирусных инфекций, для повышения иммунного статуса организма, для обработки плохого заживающих ран, при множестве различных болезней: опухоли различной этиологии, желудочно-кишечные заболевания, повышение потенции и т.д. У продуктов пчеловодства установлены целебные свойства, что относит их лекарственным средствам, но они имеют и побочные эффекты. В этой работе мы представляем некоторые из экспериментов, в которых исследовалось влияние и воздействие продуктов пчеловодства на паразитов.

Ключевые слова: паразиты, продукты пчеловодства, мед, прополис, пчелиный яд, противопаразитарные средства.