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The therapeutic effects of propolis in the livestock farming

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Abstract: This article review presents the studies on the therapeutic effects of propolis in the livestock industry. It promotes the creation of new holistic agricultural models combining apiculture and livestock husbandry and promoting research studies for farming development.

Key words: *Apiculture, propolis, livestock*

Introduction

In the developing countries, apiculture represents an important source of income for the rural small holders. Bee keeping is a relatively inexpensive activity that provides not only nutritious commodities but earnings from honey production. In addition, bees produce other highly marketable products such as wax, royal jelly, pollen, bee-venom and propolis. However, most of the honey producing regions in the tropics and sub tropics have not yet been exploited to the fullest. Several projects have been carried out to support the traditional apiculture in poor countries following an integrated and holistic approach in agri-

culture. This is based on the fact that human nutrition depends on agriculture, breeding and fishing, the constraints of which are well known in poor countries.

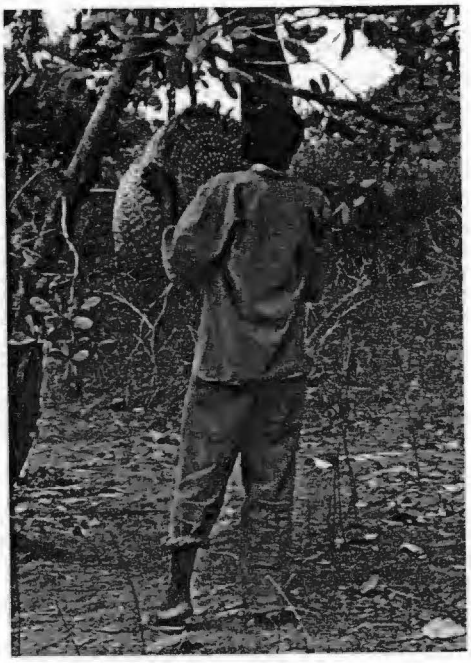
Among these initiatives is the *Bio Village Project* being implemented by International Centre of Insect Physiology and Ecology (ICIPE) which is an attempt to develop an integrated community development model through a set of development intervantions involving plants humans, animals and environmental health. In this programme, particular attention is given to income-generating activities.

Apiculture as a source of off-farm income

The case of the Ethiopian *Bio Village* studied by ICIPE involves an initiative to exploit the existing potential for income generation within the responsibilities of Ethiopian beekeeping farmers tending vegetable gardens. The project seeks to improve the traditional methods of bee keeping, cultivation of vegetables, livestock rearing for income generation and improving human health and nutrition, thus creating wealth at the farms (Jones R., 1999; Raina S.K., 2000).

Similar studies, following the integrated agricultural approach, have been developed with nomadic pastoral people and traditional bee keeping farmers in Kenya. The nomads have a way of life based on nine months field work depending on the rare rainfed agriculture practised by the local groups. This agricultural strategies are developed around managing seasonally, comparing between a dry or drought year and a normal or rainy year (Reckers U., 1997). The impact of income generation of beekeeping has also been studied in the Mediterranean basin such as in Algeria, Libya and, in particular, Tunisia where the annual honey production was calculated to be about 250 tons, a quarter of domestic consumption (Popa A., 1980). Pilot stations for the production of swarm and honey have been built under an FAO/UNDP project in Tunisia to support the development of the national industry. The Food Production and Rural Development Department of the Commonwealth Secretariat reported the importance of the International Bee Research Organization in supporting apiculture co-operation projects among Commonwealth countries such as: Nigeria, Kenya, Ghana, Malta, Tanzania, Uganda, Botswana, India, Sri Lanka, Papua New Guinea, Belize, Guyana, and Panama. Apiculture could be a source of valuable food and rural earnings. Honey is a much prized food both locally and abroad. There is also a great demand

Apiculture in Casamance, Senegal - PRIMQCA Project (Photo F. Ambrosini)



Apiculture in Casamance, Senegal - PRIMOCA Project (Photo F. Ambrosini)

for the well-priced bee wax. In addition, apiculture by-products like the propolis could be a useful manure which contributes to increasing agricultural production in extensive system. In fact, this by-product may serve as fertiliser for agriculture like the most common industrial fertilisers containing nitrogen, phosphorous, and potassium. Apiculture can be undertaken as a rural family venture without significantly interfering with normal farming activities. It can create demand for locally manufactured equipment and thus aiding both the development of appropriate technology and the creation of off-farm employment. For countries with very limited renewable resources, the production and commercialisation of bee products and by-products should be better exploited in order to create new marketing opportunities and sources of earnings (Inouye D.W., 1983; Barth F.G., 1985; Pacini *et al.*, 1995; Felicioli *et al.*, 1997; Jones R., 1999). Raising bees also results to ecological benefits through increased pollination and production of tropical crops.

Pharmacological promise of propolis

Propolis is a resinous material collected by bees from leaves and buds of certain trees. It is a multifunctional material used by bees in the construction and maintenance of their hives. Greenish-black in color, its gummy consistency makes it a suitable material to to seal beehive cracks and to make it watertight. Bees also use it to glue the top bars to the hive body, to strengthen the thin borders of the honeycomb as well as a material to cover dead hive intruder which they cannot remove from the hive.

Propolis has several antimicrobial and pharmacological properties. Unlike many natural remedies, there is a substantive database on the biological activity and toxicity of propolis indicating antibiotic, antifungal, antiviral and antitumour properties among others attributes. These suggest that it has been used as a chemotherapeutic agent since ancient time (Todorov V. and Genov G., 1973; Burdock *et al.*, 1998).

Though the propolis is recognized both as food and as medical resource, the chemical composition of this valuable biological product is not well known. Advanced analytical procedures have allowed to identify, isolate and assay the compounds present in propolis (Gallo F.R. and Savi G., 1995). Sophisticated chemical analysis allowed to assay the propolis composition of phenolic constituents derivatives by making use of the capacity of different detectors tested. These phenolic contents were analysed by capillary gas chro-

matography using an electron-capture detector. This detector showed a good electron capture response of the compounds, which belongs to the so-called "conjugated electrophores".

Further information on the chemical composition of propolis have been made available by the use of HPLC analysis demonstrating that the flavonoids in monospecific *Eucalyptus* honeys from Australia, could be used as markers. The main difference between the flavonoid profile of Australian and European *Eucalyptus* honeys, is that in the Australian honeys, the propolis-derived flavonoids are seldom found and in much smaller amounts. In order to better determine the botanical origin of *eucalyptus* honey, these studies suggest to further develop investigations on flavonoids analysis. The fact that propolis have been demonstrated to have many functions may explain how diverse can be its chemistry in relation both to the biodiversity of bees and the botanical species (Martos I. *et al.*, 2000).

In human medicine, the use of propolis as therapeuthic has been proven to have diverse effects. Propolis has been used as drug to treat patients operated for goiter, patients with wounds and ulcer that are difficult to heal. The effectiveness of propolis has also been tested as supplementary means in eradicating treatments of *Heliocobacter pylori.* It was found out that the drug can be tolerated very well and with practically no side effects and was highly effective. Preparation of propolis can be successfully used in patients treated for surgical diseases and for dermal infections (Bauer A. *et al.*, 2000).

In the dairy sector, in particular in the cheese industry, propolis has been used to coat cheese blocks. This technique prevents bacterial growth on the surface whether or not the cheese was then coated with plastic or left uncovered. Its antimicrobial effect was comparable to that of the antibiotic Cephradine® on *Lactococcus lactis subsp. Lactis, Lactis subsp.cremoris, Streptoccus salivarius* subsp. *Thermophilus, Escherichia coli, Mocroccus* spp., *Staphyloccus aureus,* and a greater effect was noted on *Bacillus subtilis.* Propolis collected from the cloth showed the greatest antifungal activity and its effect against *Aspergillus versicolor, A. Niger* and *A.flavus* was greater than that of Delvocid® (El-Dieb SM *et al.*, 1997).

In the animals, studies on the properties of propolis have been conducted in farming livestock to improve the productivity and explore the therapeutic effects for health problems. The use of products containing propolis is now increasingly being used as dietary supplement. There has been considerable debate regarding the nutritional benefits of pollen and the propolis produced by

bees as additional food, but most contributions are yet to be proven scientifically (Hartwitch A., *et al.*, 2000). Haro *et al.*, 2000 studied the effects of pollen and propolis on the on the digestive utilisation and metabolism of iron, calcium, phosphorus and magnesium in rats with nutritional ferropenic anaemia. The addition of these products to the diet produced a positive effect on weight gain and as fortifiers, improving the digestive utilisation of iron and the regeneration efficiency of haemoglobin, especially while recovering from an anaemic syndrome. Pollen and propolis also had a positive effect on phosphocalcic metabolism and maintained appropriate level of magnesium metabolism.

The anti-oxidative activity of propolis was evaluated *in vivo* on the basis of ameliorative effects on the oxidative stress induced by vitamin E deficiency in rats (Sun F. *et. al.*, 2000). Propolis was found to have an effect on the plasma vitamin C concentration, as well as on tissue concentrations of vitamin C in the kidney, stomach, small intestine and large intestine. These findings suggested that some components of propolis are absorbed to circulate in the blood and behave as a hydrophilic anti-oxidant that saves vitamin C.

Likewise, studies comparing meat quality of chickens fed with propolis emulsion in water or alcohol showed no difference. Neither was there an effect in yolk pigmentation nor mortality. Chickens given with propolis supplement recorded higher live weight and laying hens fed with propolis meal mixture produced more and heavier eggs (Bonomi *et al.*, 1976; Teterrev I. and Ushakov V., 1992). The toxicity of propolis have been investigated and no effect level (NOEL) has been demonstrated in a study on mice treated with 1400 mg/kg body weight/day. Although reports of allergic reactions are uncommon, propolis is relatively toxic (Hartwitch A. *et al.*, 2000).

The stimulating properties of propolis on the immune system have been investigated in different animal species by several authors. Studies on the immunity response in poultry have been conducted and the beneficial effect of propolis used as vaccine has been demonstrated. Various experiments have been undertaken to investigate on the the efficacy of propolis in treating pathologies such as the Colibacilloses, Maerk's disease, the Infectious Bursal Disease (IBD), the Egg Drop Syndrome (EDS), and the Infectious Bronchitis Virus (IBV) among others (Fa Wei Xing *et al.*, 1997; Chen Shui Long *et al.*, 1999). Propolis have been used by Wang Shou Zhi *et al.* (1997) as adjuvant to elevate cattle antibody titre following inoculation with chicken Infectious Bursal Disease (IBD) Virus and Newcastle Disease Viruse (NDV).

Also, anti-protozoan properties of propolis have been demonstrated, partic-

ularly against infection by intestinal Coccidiosis. The comparative analysis of the action of propolis, sulfaquinoxaline, sulfamethazine and robenidine in rabbits was investigated and it was found that the coccidiostatic effect of propolis was superior compared to that of the traditional drugs (Hollands I. *et al.*, 1984; 1998; Moura LPP de *et al.*, 1998). The trypanocidal activities of ethanol and dimethylsulfoxide propolis extracts were studied *in vitro* and *in vivo* in *Trypanosoma cruzi* infections in rates, with particular attention to the interaction with the host cells; both the extracts were active against the three forms of parasite. The effect was found to be temperature dependent. Treatment of infected peritoneal macrophages and heart muscle with the same solution, strongly inhibited the infection levels (Higashi *et al.*, 1994; Castro *et al.*, 1995).

The use of solutions of propolis as antibiotic was studied in ruminants in the treatment of endometritis and clinical mastitis and some effects in restoring milk yield as well as a drop in bacterial counts in mammary secretion were demonstrated (Mirolyubov MG, Barskow AA., 1980; Jimenez M. *et al.*, 1995; Kegl T. *et al.*, 1995). In *helminths* infections, the effect of propolis has been tested *in vitro* on *Ascaris suum,* in combination with medicinal plants such as *Hirundu medecinalis, Lumbriscus terrestris, Herba thymi, Vaccinum myrtillis,* and *Hiracium pilasella.* It demonstrated a relatively lasting anthelmintic activity of the propolis and plants combinations due to a neurogenous-cholinergic effect (Todorov V. and Genov G., 1973).

Implications

The review studies on the effect of propolis describing its therapeutic activity on various human and animal pathologies demonstrate the importance of continued investigation on the chemical properties of this natural substance.

The possibility to combine farmers and scientists experience to better utilise the apiculture by-products like propolis, for therapeutics, nutritional supplements, alimentary technologies, immunology in the livestock industry, on a scientific basis, would potentially help to enhance the knowledge and the socio-economical level of a poor country.

The creation of new natural products to be sold by small holder bee keeping farmers and micro enterprises at village level would promote employment generation, incomes and new integrated approaches of livestock and agricultural farming systems based on improved natural resources exploitation.

The aim of this article is therefore the mobilisation of the scientific com-

munity to create new holistic agricultural models combining apiculture and livestock husbandry and promoting research studies for farming development.

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