



ISSN: 2395-5775

Available Online at <http://www.journalijcir.com>

International Journal of Current Innovation Research
Vol. 4, Issue, 4(A), pp. 1137-1140, April, 2018

**International Journal of
Current Innovation
Research**

DOI: 10.24327/IJCIR

Review Article

OPPORTUNITIES OF THE USE OF PROPOLIS IN ANIMAL BREEDING

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ARTICLE INFO

Article History:

Received 14th January, 2018

Received in revised form 8th

February, 2018

Accepted 05th March, 2018

Published online 28th April, 2018

Key words:

Propolis, Honey bee, Apis Mellifera

ABSTRACT

The propolis used as appropriate for a variety of purposes inside the hive is a mixture of wax gathered from flowers and buds of the plants by honeybees, and it is among the frequently used natural products. Propolis with its inclusion of flavonoids and caffeic acid esters having bactericidal, antiviral and antifungal properties is used for different purposes in pharmaceutical, cosmetic and food industries and apitherapy centres in addition to its use inside the hive. Propolis that is composed of resin and balsam of plant (50%), wax (30%), essential oils (10%), pollen (5%), and other various materials (5%) can be in a different colour changing from yellow to dark brown. It is considered that propolis suggested for a variety of purposes can create new fields of application for the treatment of many diseases.

In the previous studies, it has been reported that propolis is used as a natural disinfectant for incubating eggs and as a nutritional supplement or a functional food component for preventing aluminium toxicity while protecting ducks against typhoid fever and healing their wounds. Moreover, it has been stated that propolis has a reducing effect on mortality in broilers; a positive effect on live weight increase, feed consumption, and utilisation from feed in animals; a hindering effect on bacterial cell division against mastitis pathogens in cows; and a stimulant effect on phagocytes during bacterial infection.

Due to its various features, propolis is a matter needed to be studied in terms of both organic animal breeding and animal health and sustainability. In the present review, information about the opportunities to use propolis, gaining importance day by day, in the field of animal breeding was given.

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INTRODUCTION

Properties of Propolis

Propolis (bee glue) is a resin like material obtained from the nectar of the growing parts of trees such as leaves, buds, branches, and sprouts. This nectar is collected and brought to the hive by worker bees; it undergoes biochemical changes through pollen and various enzymes excreted by the bees; and this resin like material is created. This mixture, which is collected in a pouch called Corbiculae after being shredded of plant juices and resin by the bees, is used to polish the hive chambers, cover the cracks and tears on the hive and disinfect it. Propolis consisting which consists of 50% resin and plant balsam, 30% wax, 10% essential oils, 5% pollen, and 5% other materials can be in different colors varying from yellow to dark brown (Mlagan and Sulimanovic 1982; Greenavvay *et al.* 1988; Bianchi 1995; Yılmaz *et al.* 2004; Seven *et al.* 2007; Valle 2000).

Propolis has anticarcinogen, antioxidant, antibacterial, antifungal, and many other properties, and it also contains vitamins B1, B2, B6, and E along with the elements such as Mg, Ca, I, K, Na, Cu, Zn, Mn and Fe (Seven *et al.* 2007; Doğan and Hayoğlu 2012). Chemical properties of vary in accordance with the region and flora of that region from where it is obtained. This situation can change the pharmacological effects of propolis, too (Er and Özkan 2017). In the study carried out by YongKun *et al.* (2000), where physiological

activities of 12 groups of propolis collected from three different regions of Brazil were analyzed, it has been found out that the physiological activities of propolis are variable depending on the geographical region where they are collected and it is because the compound of propolis depends on the compounds of the plants.

In order to heal immune system and fight against pathogens in human and animal life, prebiotic, probiotic and natural products have started to be used instead of antibiotics. Unlike antibiotics, these products do not have adverse effects and they are very beneficial in food chain. Therefore, alternatives for antibiotics are quite significant for poultry. One of these alternatives can be propolis (Valle 2000).

The propolis collected from the hive is raw and 96% ethanol is the most suitable solvent for propolis. The solution soluted in 70% ethanol is used for medical purposes and 99% ethanol solution is used for analysis for chemical purposes (Pietta *et al.* 2002).

Opportunities of Use of Propolis in Animal Breeding

Antibacterial effect of propolis has been detected especially on gram (+) cocco and gram (-) bacillus. It has been identified that synergic interaction, which is created by propolis to increase the effect of antibiotics and extend the effectiveness period in feed yard, decreases the amount of antibiotics that is needed to be given to create MIC value (minimal inhibitor concentration) (Heşşen *et al.* 1996).

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1.0, 1.5, 2.0, and 3.0 g/kg of propolis additions to broiler chick feed have increased the amount of body weight and growing parameters such as feed intake and healed the rates of broiler chick deaths significantly ($P < 0.05$) (Khodanazary *et al.* 2013). Denli *et al.* (2005) stated that propolis as a natural feed additive can be used in poultry feeding as an alternative to antibiotics. Bozbay *et al.* (2016) stated that although propolis application to air sac in ovo increases the hatching rate, it tends to decrease the chick rate.

Çetin *et al.* (2010) stated in a study on laying hen that when 3g/kg propolis is added to chicken feed, it concludes with an increase in IgG and IgM levels ($p < 0,05$). (Amr Salah Morsy Amine Selem, Effect of Brazilian Red Propolis Supplementation on Milk Yield, Composition, and Lamb Performance of Santa Ines Ewes". 2012. PhD Thesis)

Seven and Seven (2008) stated that propolis stimulates the immune system in broilers and decreases mortality by improving the immunity. They suggested propolis assistance in feeding as an alternative to antibiotics.

Trial result, where the in ovo quality was protected best, in quail eggs which were subjected to 5 weeks of storage process by being treated with propolis extract with different concentrations (0%: group I, 5%: group II, 10%: group III, 15%: group IV, and 70% ethyl alcohol: group V) were obtained from the eggs which were covered with 10% and 15% propolis extract (Akpınar *et al.* 2015). Shahein and Sedeek (2014) stated that the use of 14% propolis as a disinfectant for hatching eggs could be an effective, safe, and non toxic natural protective substance while storing.

In the study where the effects of propolis on egg weight loss, hatchability, and the control of the microbial activity on egg shells were analysed, five test groups (1st group: 70% ethyl alcohol, 2nd group: benzalkonium chloride, 3rd group: 5% propolis, 4th group: 10% propolis, and 5th group 15% propolis) were created, and it was detected that the loss of weigh was lower in the eggs treated with propolis ($P < 0.001$). Bacterial activity decreased significantly in all of the eggs with propolis application. It was found out that there was not a significant difference among the groups in terms of hatchability and embryonic deaths (Aygün *et al.* 2012).

Being assisted of eggs with antioxidants (Vit C + propolis) eases the oxidative damage due to heat stress. These positive effects have been proved by the increase in the thickness of the egg shells, growing performance, and digestibility and the improvements in egg weight when compared to the chickens which were not assisted with Vit C + propolis (Seven 2008). Propolis+Vit C assistance to broiler feed helps overcoming depression due to heat stress, and when mortality rates were analyzed, it was stated that 10% mortality rate in control group decreased to 4.17% in the group where EEP was added (Seven *et al.* 2008).

Yambayamba and Mpandamwike (2017) stated that Aloe Vera and propolis (ALOEPROP) addition has positive effects on the production of egg; however, it does not have an effect on the size of egg. It has been confirmed that various amounts (250, 500, 1000 mg/propolis/kg) of propolis use in laying hen feed enhance the egg production of hen and hematological parameters (Abel-Kareem and El-Sheikh 2017).

It was confirmed that feeding Santa Ines sheep with Brazilian Red Propolis assistance increases the amount of milk

efficiency, milk fat rate, milk protein, and lactose ($p < 0,05$), the number of somatic cells (SCC) decreases via propolis treatment ($p < 0,05$), there is no significant difference in the other milk proteins and pH values ($pH > 0,05$). The use of propolis does not affect the body weight of sheep (BW) ($p > 0,05$), whereas it increases the body condition score (BCS) ($p < 0,05$). It was also reported that Brazilian Red Propolis acts as an anti-stress substance that can be used as a feed additive during critical periods such as flushing period, additionally, and it is effective in sheep on the control of helminth (Amr Salah Morsy Amine Selem, Effect of Brazilian Red Propolis Supplementation on Milk Yield, Composition, and Lamb Performance of Santa Ines Ewes". 2012. PhD Thesis).

Wang *et al.* (2016) expressed that propolis of China origin is effective for mastitis pathogens and it can be used for the control of mastitis. Öztürk *et al.* (2010) stated that propolis can be a preservative to be used for improving ruminal nitrogen utilization and for decreasing ruminal ammonia production. Betancourt *et al.* (2015) reported that propolis is used as an ointment for milk cows in mastitis cases and propolis is used as a prophylactic agent for respiratory and gastrointestinal diseases when 5% propolis is added to milk in pig herds. Additionally, it is used as a stimulator for the development of growing rams, pigs, and calf. Moreover, there are studies indicating that it is effective for healing the wounds and protecting against typhoid fever for ducks (Bogdanov 2014).

Kupczyński *et al.* (2012) stated that 2 and 4 ml EEP/day of propolis supplement to calves is an effective practice to improve the health conditions of calves, and daily weight gain increases after the application of 4 ml dose of propolis in a day. In many of the studies where propolis is used as a feed additive, a lot of useful properties of propolis such as flavonoids, antioxidants, antimicrobial, and flavor enhancers have indicated positive effects on live weigh increase, feed consumption, and feed conversion (Şahin *et al.* 2003; Denli *et al.* 2005).

When Ethanol Extract of Propolis (EEP) is added to drinking water of rabbits, which have chronic diarrhea, improvements in quick healing (the decrease in the duration of diarrhea), feed consumption, and final body weight have been detected. Also, EEP indicates an explicit hepatoprotective effect. These results mean that EEP may have a positive effect on well-being and reproduction of the rabbits (Kupczynski *et al.* 2016).

In a study carried out on mice, it has been found out that propolis is effective for tooth cavity and it can stop the formation of tooth cavity in early stages. Additionally, it is used for the treatment of endometritis of cows and typhoid fever of chickens, and it prevents the enzymatic activity of urease. It is also stated that propolis heals the problems of skin and foot of domestic pets. Unlike synthetic antibiotics, the use of propolis for long periods does not create a resistance in harmful bacteria, and it also does not affect beneficial bacteria negatively (Doğan and Hayoğlu 2012).

In a study carried out with rats infected with T. Evansi 100-400 mg/kg of propolis was applied for 10 days orally. It has been found out that rats treated with the highest dose live twice longer than the rats treated with the lowest dose. It has also deducted that propolis extract can extend the lives of rats infected with protozoon (Betancourt *et al.* 2015).

In the study that Türkez *et al.* (2010) studied on the genetic and liver damages on rat livers caused by aluminum, it has been stated that propolis can be suggested as a feed supplement or a

functional feed compound in order to prevent aluminum toxicity.

Okonenko (1988) has stated that pathologic changes experienced after Salmonella infection decrease after the use of propolis in mice. Munox (1989) has stated that foot decay decreases in aries, and Gubicza and Molnar (1987) stated diarrhea problems while feeding the calves on milk decrease with the use of propolis.

Er and Özcan (2017) has stated that propolis prepared with various concentrations is used as a hand cleaning solution in surgery, it prevents bacterial cell division, and it stimulates phagocytes during bacterial infections by ruining cell wall and cytoplasm.

CONCLUSION

Our country has rich biological resources. Even though it has a huge potential related to honey and other bee products, these products cannot be used effectively. Apiculture should be evaluated as a branch of agriculture that includes not only the production of honey, but also the production of various products such as pollination, wax, propolis, royal jelly, bee venom, and queen. Propolis is a subject that should be studied further due to its properties in terms of organic breeding, animal welfare, and sustainability.

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How to cite this article:

Günnur Peşmen (2018) 'Opportunities of The Use of Propolis in Animal Breeding', *International Journal of Current Innovation Research*, 4(4), pp. 1137-1140.
