



Editorial: Plant Derived Products to Combat Bacterial, Fungal and Parasitic Pathogens

Valentina Virginia Ebani^{1,2*}, Abd El Nasser Gaber El Gendy³ and Francesca Mancianti^{1,2}

¹ Department of Veterinary Sciences, University of Pisa, Pisa, Italy, ² Interdepartmental Research Center "Nutraceuticals and Food for Health", University of Pisa, Pisa, Italy, ³ Medicinal and Aromatic Plants Research Department, National Research Center, Giza, Egypt

Keywords: bacteria, fungi, parasites, plant derived products, antimicrobial activity

Editorial on the Research Topic

Plant Derived Products to Combat Bacterial, Fungal and Parasitic Pathogens

The livestock sector has a significant role in the global economies, mostly in the developing countries, providing energy, food, raw materials, and manure for crops. Wherefore, animal pathogens can determine serious social, economic, and environmental damage, as well as they can be cause of human diseases. In particular, several animal and human pathologies are caused by bacteria, fungi, and parasites.

In recent years, several conventional drugs have lost much of their effectiveness with consequent relevant side effects. The extensive use of antibiotics in veterinary medicine to treat bacterial infections, as well as for auxinic purpose, has strongly determined the spreading of antibiotic-resistant bacterial strains.

Fungal pathogens, mainly opportunistic, environmental species, show a decreased sensitivity to antimycotic drugs, probably due to the large use of fungicides in farming. Furthermore, the use of antibiotics and antimycotic conventional drugs may be cause of environmental contamination and presence of residues in food of animal origin (meat and poultry, milk and dairy products, eggs, fish and seafood, honey).

Moreover, endo and ectoparasites may have different degrees of resistance to conventional drugs, treatments may be frequently toxic and not always allowed in the treatment of production animals.

All these concerns may impact on human health, also. In view of this situation, the use of natural alternatives for livestock managing is welcome. Plant derived products have been suggested to have activity against bacterial, fungal, and parasitic pathogens. For this reason, they could be employed not only for therapeutic treatments, but also environmental hygiene and food preservation.

The present Research Topic shows the results of some studies which demonstrate the effectiveness of different natural products against pathogens responsible for diseases and lesions in farm and pet animals.

OPEN ACCESS

Edited by:

Michael Kogut,
United States Department of
Agriculture, United States

Reviewed by:

Kenneth James Genovese,
United States Department of
Agriculture, United States

*Correspondence:

Valentina Virginia Ebani
valentina.virginia.ebani@unipi.it

Specialty section:

This article was submitted to
Veterinary Infectious Diseases,
a section of the journal
Frontiers in Veterinary Science

Received: 08 June 2020

Accepted: 30 September 2020

Published: 27 October 2020

Citation:

Ebani VV, El Gendy AENG and
Mancianti F (2020) Editorial: Plant
Derived Products to Combat
Bacterial, Fungal and Parasitic
Pathogens. *Front. Vet. Sci.* 7:570613.
doi: 10.3389/fvets.2020.570613

Propolis is a complex, resinous, and balsamic product produced by bees during the collection of resins from shoots, exudates, and other plant tissues. It contains additives such as salivary secretions, wax, and pollen (1). Several compounds have been identified in propolis: aliphatic acids and esters, aldehydes and aromatic esters, sugars, alcohols, fatty acids, amino acids, steroids, ketones, chalcones, flavonoids, terpenes, lignans, polyphenols, proteins, vitamins, and minerals (2). Several biological and pharmacological properties have been attributed to propolis, related to its chemical composition: antibacterial (3), antifungal (4), antiviral (5), antiparasitic (6), anti-inflammatory (7), healing (8), analgesic (9), immunomodulatory (10), hepatoprotective (11), antiulcerogenic (12), anticarcinogenic (6), and antioxidant (6).

Kalil et al. found the *in vitro* anti-biofilm and bactericide activity of a green propolis extract against *Corynebacterium pseudotuberculosis*. This agent is a bacterium frequently causing caseous lymphadenitis in sheep, a pathology for which surgical treatment is necessary. The authors have suggested to employ this extract in the post-surgical treatment of caseous lymphadenitis due to its positive effects on surgical wound healing, hair recovery, inhibition of wound contamination and bacterial growth (Kalil et al.).

Propolis has been demonstrated to have activity against fungi, too. In particular, Brazilian green, red, and brown propolis resulted *in vitro* effective against clinical isolates of *Malassezia pachydermatis*, a yeast frequently involved in cases of canine otitis and dermatitis (Deegan et al.).

Different plant derived products are supposed to have therapeutic activity. Essential oils obtained from plants are frequently employed for food flavoring and preservation as well as in cosmetic and pharmaceutical industries. Furthermore, they are largely used in folk medicine. Their antimicrobial properties against bacteria, virus, and fungi have been investigated and demonstrated for a long time (13).

The Amazonian plant *Libidibia ferrea* is commonly used in traditional medicine to treat inflammations, infections, and hyperglycemia. Formulations containing alcoholic extract of this plant resulted to have a beneficial activity on the wound healing in dogs. Américo et al. in fact, demonstrated the antimicrobial activity of this extract against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Candida krusei*. Moreover, a good dermal wound healing through wound fibroplasia was observed by the authors after treatment of dogs with this phytotherapeutic formulation.

Different natural products have showed antiparasitic activity, too. Tedesco et al. found Tomatine and 2',4'-Dihydroxychalcone, two plant-derived compounds, as effective against the fish pathogens *Saprolegnia* spp. (Oomycota) and *Amyloodinium ocellatum* (Dinophyceae), which cause important losses in freshwater and marine aquaculture industry, respectively. The use of these natural compounds in the hatchery could be cost effective and safe for workers and environment, representing a good option to replace synthetic products in the control of these parasites. Even though *in vivo* investigations should be arranged to select doses of these compounds which can be effective against *A. ocellatum* and *Saprolegnia* spp, Tomatine and 2',4'-Dihydroxychalcone could be a promising alternative active against the parasites but non-toxic for their marine or freshwater hosts, the environment and consumer.

Further plant derived products are available; for most of them studies have performed to determine their potential therapeutical properties. However, investigations to discover new compounds and verify their possible applications are necessary to find natural alternative for managing environmental hygiene, food preservation, and therapeutic treatments.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

REFERENCES

1. Brazil. Ministry of Agriculture. *Normative Instruction n° 3 – Attachment VI – Regulamento Técnico Para Fixação de Identidade e Qualidade de Propolis [Technical Regulation for Propolis Identity and Quality Determination]*. Diário Oficial da União (2001).
2. Park YK, Alencar SM, Aguiar CL. Botanical origin and chemical composition of Brazilian propolis. *J Agric Food Chem.* (2002) 50:2502–6. doi: 10.1021/jf011432b
3. Cardoso JG, Iorio NLP, Rodrigues LE, Couri MLB, Farah A, Maia LC, et al. Influence of a Brazilian wild green propolis on the enamel mineral loss and *Streptococcus mutans* count in dental biofilm. *Arch Oral Biol.* (2016) 65:77–81. doi: 10.1016/j.archoralbio.2016.02.001
4. das Neves MVM, da Silva TMS, de Oliveira Lima E, da Cunha EVL, de Jesus Oliveira E. Isoflavone formononetin from red propolis acts as a fungicide against *Candida* sp. *Braz J Microbiol.* (2016) 47:159–66. doi: 10.1016/j.bjm.2015.11.009
5. Ito J, Chang FR, Wang HK, Park YK, Ikegaki M, Kilgore N, et al. Anti-aids agents. Anti-HIV activity of moronic acid derivatives and the new mellifore-related triterpenoid isolated from Brazilian propolis. *J Nat Prod.* (2001) 64:1278–81. doi: 10.1021/np010211x
6. Silva RPD, Machado BAS, de Abreu Barreto G, Costa SS, Andrade LN, Amaral RG, et al. Antioxidant, antimicrobial, antiparasitic, and cytotoxic properties of various Brazilian propolis extracts. *PLoS ONE.* (2017) 12:e0172585. doi: 10.1371/journal.pone.0172585
7. Franchin M, Colón DF, da Cunha MG, Castanheira FV, Saraiva AL, Bueno-Silva B, et al. Neovestitol, an isoflavonoid isolated from Brazilian red propolis, reduces acute and chronic inflammation: involvement of nitric oxide and IL-6. *Sci Rep.* (2016) 6:3640. doi: 10.1038/srep36401
8. Batista LLV, Campesatto EA, de Assis MLB, Barbosa APF, Grillo LAM, Dornelas CB. Comparative study of topical green and red propolis in the repair of wounds induced in rats. *J Braz Coll Surg.* (2012) 39:515–20. doi: 10.1590/S0100-6991201200060012
9. Paulino N, Teixeira C, Martins R, Scremin A, Dirsch VM, Vollmar AM, et al. Evaluation of the analgesic and anti-inflammatory effects of a Brazilian green propolis. *Planta Med.* (2006) 72:899–906. doi: 10.1055/s-2006-947185
10. Orsi RO, Funari SRC, Soares AMVC, Calvi SA, Oliveira SL, Sforzin JM, et al. Immunomodulatory action of propolis on macrophage activation. *J Venom Anim Toxins.* (2000) 6:205–19. doi: 10.1590/S0104-7930200000020006

11. Nna VU, Bakar ABA, Mohamed M. Malaysian propolis, metformin and their combination, exert hepatoprotective effect in streptozotocin-induced diabetic rats. *Life Sci.* (2018) 211:40–50. doi: 10.1016/j.lfs.2018.09.018
12. de Barros MP, Lemos M, Maistro EL, Leite MF, Sousa JPB, Bastos J, et al. Evaluation of antiulcer activity of the main phenolic acids found in Brazilian Green Propolis. *J Ethnopharmacol.* (2008) 120:372–7. doi: 10.1016/j.jep.2008.09.015
13. El Gendy AN, Leonardi M, Mugnaini L, Bertelloni F, Ebani VV, Nardoni S, et al. Chemical composition and antimicrobial activity of essential oil of wild and cultivated *Origanum syriacum* plants grown in Sinai, Egypt. *Ind Crops Prod.* (2015) 67: 201–7. doi: 10.1016/j.indcrop.2015.01.038

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2020 Ebani, El Gendy and Mancianti. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.