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MEDICINAL PLANT IN ANIMAL FEED

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Abstract

The medicinal plants and herbs have been used for many years in the treatment of various diseases in animals and human beings. Now-a-days, utilization of these medicinal plants is increasing. These are used in animal feed as the growth promoters. Due to prohibition of most of the antimicrobial growth promoters in animal feed because of their residual effects, plant extracts are becoming more popular. They act as antibacterial, antioxidant, anticarcinogenic, antifungal, analgesic, insecticidal, anticoccidial and growth promoters. These plant extracts compete with the synthetic drugs. Majority of medicinal plants do not have the residual effects.

The paper gives a short overview of the most important potential of herbal medicinal materials that have an approved application in human medicine and which can be added to animal feed for use in different animal health disorders.

Key words: Medicinal plant, animal feed, antibacterial, growth promoters.

Introduction

Animal feed has a direct impact on the quality of meat, milk and eggs in a positive and negative sense. Sustainable development is a strategy and principles of sustainable development to be applied to all areas of life and work and even the food for the animals. Over the composition of a meal for animals can manipulate the quality of products of

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animal origin and can be achieved by a variety of nutritional, sensory, chemical, physical and physiological characteristics. Also, through animal feed, various contaminants can be transferred to products of animal origin, ie. to food for people. More and more are ongoing and necessary research and determine the impact of animal feed on the quality of products of animal origin and monitoring the quality of these products depending on the composition of meals consumed by animals (Lević J. et al. 2009).

Improving technologies for sustainable production of animal feed should include different factors. The usage medicines in intensive and extensive farming is a big and risky to the quality of food and thus health. In organic farming of animals is not allowed to use medicines. Because are increasingly looking for natural healing means (Kostadinović Lj. et al. 2010). Medicinal herb provides, in the production of food for animals, a real opportunity to increase value through the use of different functional additions. Plants medicinal ingredients are different chemical nature and show a very wide range of pharmacological effects (sedative, spasmolytic, antibacterial activity, astringent, antiinflammatory, digestion-stimulating, laxative, antidiarrhoeal, choleric, to "stimulate the flow of milk" et al.), so that almost no therapeutics areas where medicinal plants can not be used in prophylaxis or treatment of both human and veterinary medicine (Runjaić-Antić and Milinković D. 1990, Thomson at Montvale 2004, Wichtl M. 2002).

Plants are the oldest friends of mankind. They not only provide food and shelter but also serve humanity by preventing and curing different ailments. Herbs and spices have always been helpful to cure diseases. In modern animal feeding, they are forgotten because of use of antimicrobial growth promoters (AGP). But due to the prohibition of most of AGP, plant extracts have gained interest in animal feed strategies (Charis, 2000). The risk of the presence of antibiotic residues in milk and meat and their harmful effects on human health have led to their prohibition for use in animal feed in the European Union (Cardozo et al., 2004).

The practice of herbal medicine dates back to the very earliest period of known human history. There is evidence of herbs having been used in the treatment of diseases and for revitalising body system in almost all ancient civilizations, the Egyptian, the Chinese and even Greek and Roman civilizations (Aftab and Sial, 1999). Kar et al. (2004) have reported that several plant products are claimed and proved to possess analgesic and antipyretic properties. Majority of herbal plants are safe and economical. Generally, plant extracts have no problem of drug resistance.

In developed countries in Europe is very strong trend of replacing synthetic antibiotic drugs based on medicinal plants (Čabarkapa I. et al., 2009). As herbal feed additives may be used drug (finely divided dry medicinal herbal raw materials), herbal extracts or herbal isolate (eg essential oil). Quality plant materials to ensure compliance with all required standards and legislation (good agricultural practice, good collected practice). Quality Score medicinal herbal raw materials is done by determining the content of active substances and testing health safety.

Medicinal plants, herbal medical products, phytopreparations or phytopharmaca, are medicinal products which contain only herbal drugs as active components or herbal

drugs preparations. Herbal drug is a whole or cut up, dry (occasionally raw) part of a plant, algae, fungi or lichen which is used for its medicinal properties. Apart from plant organs (root, rhizome, crust, flower, fruit, seed etc.), plant exudates are also herbal drugs (tars, gums). Herbal medicinal preparations are products obtained from drugs by special procedures: distillation, extractions etc. Herbal medicinal preparations are: fat oil, essential oil, plant juices, tinctures and extracts (dry, soft, fluid). Medicinal plant medicaments are made of standardized extracts of well known active principles which have doses dependant therapeutic effects. They are used in defined indicative sections and dosis regimes, formed on the base of clinical studies. Traditional medicinal plant medicaments are medicinal plant products, whose efficiency is not clinically confirmed, and the application is based on permanent usage and experience (it is necessary to prove that traditional medicaments have been used at least for 30 years, 15 years among EU and 15 years in the other countries), that it is harmless and it is used for the states which the doctor can not treat.

The paper gives a short overview of the most important potential of herbal medicinal materials that have an approved application in human medicine and which can be added to animal feed for use in different animal health disorders. The use of herbs is more current and all higher, in human and veterinary food industry.

Antimicrobial activity. Earlier studies indicate that many plant extracts have antimicrobial activity. According to Almas (1999), the extracts of *Azadirachta indica* (neem plant) chewing sticks are effective against *Streptococcus mutans* and *Streptococcus faecalis*. Hayat et al. (2004) studied the in vitro antimicrobial activity of *Zizyphus vulgaris* root extract against both gram positive and gram negative organisms using *Staphylococcus aureus* and *Escherichia coli*, respectively. Three different concentrations of the ethanolic extract of the roots were used and the activity compared with the standard antibiotics. All the concentrations showed excellent inhibitory effect on the growth of gram positive and gram negative microorganisms. It is evident, however, that in practice most individual herb or spice extracts must be included at a high concentration to observe effects comparable to those of antibiotics. This is only logical as many extracts contain a multitude of active substances. Among the aromatic plant species from family *Lamiaceae* (*Labiatae*), the genus *Origanum* and *Thymus* occupies a special position. Essential oils these plants are known to exhibit antimicrobial properties against bacteria (Schilcher et al., 2000). These properties are due principally to the major constituents carvacrol and thymol, which have possibilities as preservatives. Biological activity of essential oils depends on their chemical composition which is determined by the genotype and influenced by environmental and agronomic conditions.

Antioxidant properties. Oxygen is one of the most important element for life, growth and metabolism of living organisms. Autooxidation process results in the destruction of important molecules in diet formulations and also damages cellular tissues in living organisms. Therefore, autooxidation results in the formation of reactive oxygen

species and causes different kinds of diseases. Flavonoids and phenolic acids are widely present in higher plants. These compounds are effective against the deleterious effect of reactive oxygen species. According to Middleton and Kandaswami (1993), some compounds found in *Ocimum* plant have been reported to possess strong antioxidant activity. Cinnamon has antioxidant characteristics (Middleton and Kandaswami, 1993). Cinnamon extracts show antioxidant activity which is comparable to synthetic antioxidants, beta hydroxy toluene.

Anticarcinogenic activity. It is reported that leaves of *Ocimum tenuiflorum* possess anticancerous properties. Samresh et al. (2003) found that *Ocimum* suppressed benzo pyrene induced chromosomal aberrations in bone marrow and elevated glutathione (GSH) and glutathione-S-transferase (GST) activities in liver of mice. They also reported a suppressing effect of the plant on chemically induced hepatomas in rats and tumors in the fore-stomach of mice. Studies in mouse have also indicated the presence of flavonoids in *Ocimum* leaf extract. Flavonoid-enriched diet has a preventive effect on cancer, coronary heart disease and strokes. Thus, *Ocimum* can play a definite role in developing a cancer preventive drug.

Analgesic activities. Godhwani and Godhwani (1987) conducted studies by using methanol extract and aqueous suspension of leaves of *Ocimum tenuiflorum* on albino rats. The methanol extract (in doses of 100, 250 and 500 mg/kg) showed analgesic activity in mice as evaluated by the mean time taken to withdraw tail when brought in contact with the hot plate. Methanol extract had more analgesic activity than the aqueous suspension. The analgesic activity was attributed to amino acids resembling creatine and isoleucine, which have been reported to be analgesic.

Digestion-stimulating, laxative and antidiarrhoeal activities

Adstringents are preferentially used for treatment of subacute and chronic conditions. The adstringent action of tormentil rootstock (*Tormentillae rhizoma*) and bilberry fruit (*Myrtilli fructus*) is useful in the treatment of diarrhea (Wichtl M., 2002).

Blackthorn (*Prunus spinosa*), is a much branched, thorny shrub, with very dark coloured bark with sourish and astringent, blue-black spherical fruits. Approved by Commission E. The fruits are used as mild antidiarrhoeic. Blackthorn fruit consists of fruit acids, tannins, monosaccharides and oligosaccharides, while cyanogenic glycosides (amygdalin) are present only in seeds (Wichtl M., 2002; Gorunović M. and Lukić P., 2001; Arsić I. et al., 2007). Caraway (*Carum carvi*), fennel (*Foeniculum vulgare*), Coriander (*Coriandrum sativum*) and anise (*Pimpinella anisum*) have primarily carminative effects. Their savory flavor makes them suitable as a supplementary foodstuff, but they also have substantial medicinal action. Carvi fructus contain volatile oil (*Carvi aetheroleum*) and fatty oil. Caraway is the strongest and most reliable herbal carminative. It exerts spasmolytic action on the smooth muscles of the gastrointestinal tract and is antimicrobial. Tolerance of caraway is excellent: adverse effects have not been reported. Fennel tea is especially useful in dyspepsia and diarrhea (Thomson at Montvale, 2004;

Wichtl M., 2002; Gorunović M. and Lukić P., 2001).

Gingetol (*Potentilla erecta*)-Tormentl has high tannin content. *Tormentillae rhizoma* can be used in all types of diarrhea. The use of tormentil is especially beneficial in acute and subacute enteritis and enterocolitis. It is also helpful in summer diarrhea and, to some extent, in diarrhea of functional origin (Thomson at Montvale, 2004; Wichtl M., 2002; Gorunović M. and Lukić P., 2001). Bilberry leaves (*Myrtilli folium*) and berries (*Myrtilli fructus*) are used in medicine. Only the berries have antidiarrheal action. The bilberry has also proved to be an effective remedy for dyspepsia and diarrhea. Bilbery has also adstringent, antiseptic and absorptive action.

Oak bark (*Quercus cortex*) contains tannins and flavonoids, such as quercetin. Since oak contains astringent and antiphlogistic constituents oak bark can be used in therapy of diarrhea (Thomson at Montvale, 2004; Wichtl M., 2002; Gorunović M. and Lukić P., 2001).

Linseed is high in roughage materials, such as hemicellulose, cellulose, lignin and fatty oils. It also contains proteins as well as linustatin and linamarin. Linseed gruel is a good bulk laxative that increases the volume of the stool mass, causing a stretch reflex that stimulates intestinal peristalsis. These properties can be used for the treatment of animals in gravidity (Kostadinović Lj. et al. 2010)

Anticoccidial activity. The herbs especially *Azadirachta indica*, *Hobrrhena antidysenterica*, *Barberis aristata*, *Embelia ribes*, *Acorus calamus* and *Artemisia annua* have strong anticoccidial activity. Tipu et al. (2002) compared the anticoccidial efficacy of salinomycin sodium and neem fruit in broilers. They concluded that the addition of 0.3% ground neem fruit in boiler feed has tremendous efficiency in combating coccidiosis as compared to salinomycin sodium. They reported that neem fruit had compound margosate, responsible for the break down of Eimeria life cycle. Similarly, Allen et al. (1997) investigated the effect of feeding dried *Artemisia annua* leaves and its components to birds infected with Eimeria *acervulina*, *E. tenella* or *E. maxima*. When fed at a dose rate of 1% for 5 weeks prior to infection, significant protection was noted for both *E. tenella* and *E. acervulina*. Artemesia contains artemisinin which protected weight gains and reduced oocyst yields for both *E. tenella* and *E. acervulina*.

Weight gain and feed consumption. Previous literature shows that use of herbs in animal feed improved the weight gain of animals. These can be used simultaneously for treating parasitic diseases as well as increasing the weight gain and act as growth promoters.

Oregano (*Origanum vulgare L.*) belongs to the family *Lamiaceae*. In addition to other ingredients, it contains more than 4% essential oil which is mostly composed of two phenols: thymol and carvacrol in variable quantity. In addition to basic biological effects, such as antibacterial and impact of an increase in appetite, essential oil of oregano can be used as an alternative to antibiotic growth promoters in chickens (Tsinas C. and Spais B., 1999), pigs (Tsinas et al., 1998) and turkeys (Bampidis et al., 2005).

Conclusions

Using the experience of traditional and modern phytotherapy manufacturers of animal feed can improve animal health and thus the quality of food for humanity. Substitution synthetic antimicrobial and anti-inflammatory medications, and natural resources-medicinal and aromatic plant raw materials, based on scientific base. Medicinal plants compete with the synthetic drugs. As the world is becoming more advanced, new diseases are emerging in animals and human beings by irrational use of antibiotics and antimicrobial growth promoters (Tipu et al., 2006).

Given the ubiquitous tendency to "return to nature" in all spheres of life today, especially in the field of health (prevention and treatment), products with medicinal herbs with the right to occupy a leading place in modern phytotherapy. The usage herbs in the food industry is all more current and more, both in human and in veterinary practice.

References

1. Arsić I., Tadić V., Đorđević S. (2007): Plod trnjine kao potencijalni sastojak funkcionalne hrane, I Kongres o dijetetskim suplementima sa međunarodnim učešćem, Beograd, Knjiga apstrakata, 124-125.
2. Aftab K. and Sial A. A. (1999): Phytomedicine: New and old approach. *Hamdard Medicus*, 42(2), pp. 11-15.
3. Allen, P. C., Lydon J. and Danforth H. D. (1997): Effects of components of *Artemisia annua* on coccidian infections in chickens. *Poultry Sci.*, 76(8), pp. 1156-1163.
4. Almas, K. (1999): The antimicrobial effects of extracts of *Azadirachta indica* (Neem) and *Salvadora persica* (arak) chewing sticks. *Indian J. Dental Res.*, 10(1), pp. 18-19.
5. Bampidis, V. A., Christodoulou, V., Florou-Paneri, P., Christaki, E., Chatzopoulou P. S., Tsiligianni T., Spais A. B. (2005): Effect of dietary dried oregano leaves on growth performance, carcass characteristics, and serum cholesterol female early-maturing turkeys. *British Poultry Science*, 46, 5, pp. 595-601.
6. Cardozo P. W., Calsamiglia S., Ferret A. and Kamel C. (2004): Effect of natural plant extracts on ruminal protein degradation and fermentation profiles in continuous culture. *J. Anim. Sci.*, 82, pp. 3230-3236.
7. Charis K. (2000): A novel look at a classical approach of plant extracts. *Feed Mix* (special issue on Nutraceuticals), 19-21.
8. Čabarkapa I., Lević J., Pavkov S., Kokić B., Šarić Lj. (2009): Evaluation of natural alternatives for antibiotics. Book of Abstracts 3rd International FEED SAFETY conference, Wageningen, 'Netherlands, 6-7 october, p. 111.
9. Godhwani S. and Godhwani J. L. (1987): Analgesic and antipyretic activity of *Ocimum* in mice. *J. Ethanopharmacol.*, 21, p. 153.
10. Gorunović M., Lukić P. (2001): Osnovi farmakognozije, Momčilo Gorunović, Beograd.
11. Hayat M. M., Ansari S. H., Ali M. and Naved T. (2004): Antimicrobial activity of

- Zizyphus vulgaris* roots. *Hamdard Medicus*, 47(2), pp. 30-34.
12. Kar D. M., Nanda B. K., D. Pradhan, S. K. Sahu, G. K. Dash (2004): Analgesic and antipyretic activity of fruits of *Martynia annua* Linn. *Hamdard, Medicus*, 47(1), pp. 32-35.
 13. Kostadinović Lj., Lević J., Pavkov S., Dozet G., Galonja-Coghill T. (2010): Effect of *Mentae piperitae* on antioxidative status in broiler chickens, *Savremena poljoprivreda*, Vol. 59 (3-4), pp. 55-61.
 14. Lević J., Čolović R., Sredanović S., Pavkov S., Kostadinović Lj. (2009): Effect of diet supplementation with ground herbs on performance of broiler chickens. Book of Abstracts 3rd International Feed Safety conference, Wageingen, Netherlands, p. 111.
 15. Middleton E. Jr. and C. Kandaswami (1993): The flavonoids: Advances in Research Since 1986. Harborne, J. B. (Ed.), Chapman and Hall, London, UK.
 16. Runjaić-Antić D., Milinković D. (1990): Biljna pomoćna lekovita sredstva. *Arhiv za farmaciju*, god.40, No6,
 17. Samresh D., A. Srivastava, V. Singh and A. Sharma (2003): An overview of *Ocimum* chemistry and pharmacological profile. *Hamdard Medicus*, 46(4), p 43.
 18. Schilcher H., Kammerer S., Leitfaden (2000): *Phytotherapie: Urban and Fischer, München.*
 19. Thomson at Montvall (2004): *PDR for Herbal Medicines*, 3rd edition.
 20. Tipu, M. A., T. N. Pasha and Z. Ali (2002): Comparative efficacy of salinomycin sodium and Neem fruit (*Azadiracht indica*) as feed additive anticoccidials in broilers. *Int. J. Poult. Sci.*, 1(4), pp. 91-93.
 21. Tipu M. A., Akhtar M. S., Anjum M. I., Raja M. L. (2006): New dimension of medicinal plants as animal feed, *Pakistan Vet. J.*, 26 (3), pp.144-148.
 22. Tsinas A. C., Giannakopoulos, C. G., Papasteriades, A., Alexopoulos, C., mavromatis J., Kyriakis, S. C. (1998): Use of *Origanum* essential oils as growth promoters in pigs In: proceedings of the 15th IPVS Congress, Birmingham, UK, 221 (abstract).
 23. Tsinas A. C., Spais, A. B. (1999): Use of *Origanum* essential oils in diets for poultry. In: Proceedings of the 8th Hellenic Veterinary Congress, Athens, Greece, 43 (abstract).
 24. Wichtl M. (2002) *Teedrogen und phytopharmaca: Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart.*