

HERBS IN A SUSTAINABLE ANIMAL NUTRITION

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Review paper

Abstract: Animal has a direct impact on the quality of meat, milk and eggs in a positive and negative sense. Over the composition of a meal for animals can manipulate the quality of products of animal origin and can be achieved by a variety of nutritional, sensory, chemical, physical and physiological characteristics. The use of medicine 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 resources. Herbs provides, in the manufacture of animal feed, a real opportunity to increase value through the use of different functional additions. Addition food for animals, really can improve its functionality in terms of a physiological effect. In developed countries in Europe is very strong trend of replacing synthetic antibiotic drugs based on medicinal herbal preparations. As herbal feed additives may be used drug (finely divided dry medicinal herbal raw materials), herbal extracts or herbal isolate (e.g. essential oil). The paper gives a short overview of the most important potential of herbal medicinal materials with antibacterial activity, anti-inflammatory, digestion-stimulating, laxative, antidiarrhoeal, choleric etc. activities 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.

Key words: herbs in a sustainable animal nutrition, antibacterial activity, veterinary food industry.

Introduction

Animal 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 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 et al., 2009*).

Improving technologies for sustainable production of animal feed should include different factors. The use of 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 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, anti-inflammatory, 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 (*Runjajić-Antić and Milinković, 1990; Thomson and Montvale, 2004; Wichtl, 2002*).

Addition food for animals, really can improve its functionality in terms of a physiological effect.

The use of medicinal plants in prevention and healing of different diseases dates from the ancient times. The art of healing by medical plants has been carried orally or in writing from generation to generation through centuries, from the oldest written traces in China and writings inside the old Egyptian pyramids, Hindoo holy books „Materieie medicé“, Greek military doctor Dioscorid, Hodos collection, Hilandar Medicinals Codex, trough Zaharije Stefanović, Josif Pančić and Sava Petrović, to Risto Gostuški and Jovan Tucakov (*Gorunović and Lukić 2001; Sarić et al., 1989*). Medicinal plant medicaments comprise raw material originated from plants. On the other hand, a lot of compounds with high therapeutic effect, extracted from plants, still have application in medicine or represent a model for making a great number of synthetic medicaments with improved or modified effect (*Weiss and Fintelmann, 2000*).

As a complementary part of pharmacotherapy, phytotherapy has an important position in modern medicine. Rational phytotherapy presents the application of medicinal plant medicaments which has standardized quality and quantity composition. Medicinal plant medicaments are used as self-medications, after the patient's own decision or if a doctor or pharmacist suggests it (they make 30-40% of OTC-over the counter, products in Europe). Their therapeutic effects occur after some time of application and they are supposed to exhibit effect in chronic and subacute states and diseases. Rarely they are used for acute states (*Schilcher et al., 2000; Schulz et al., 2001*).

In developed countries in Europe trend of replacing synthetic antibiotic drugs based on medicinal plants is very strong (*Čabarkapa et al., 2009*). As herbal feed additives may be used drug (finely divided dry medicinal herbal raw materials), herbal extracts or herbal isolate (e.g. essential oil). Quality plant materials must ensure compliance with all required standards and legislation (good agricultural practice, good collected practice). Quality Score of 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 exudats 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 doses 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 use of 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.

According to the principles of rational phytotherapy, monocompounds preparations are mostly used. If phyto-preparations are combined it is necessary to prove that each component of medicament improves its total effect.

In most countries, members of EU, medical plants medicaments present one subgroup of medicaments. In our country, phyto-preparations have been registered as additional medicinal remedy, from 1987 to 2004. From year 2004, according to the latest Law on medicines and medicinal devices (Official journal RS 84/2004) which was brought into accord with the regulations in EU, medicinal products on the basis of plant raw material have been joined to the group of medicaments. As in a case of conventional medicaments, medicinal plant medicaments are registered and put into circulation on the basis of certified pharmaceutical quality, therapeutics efficiency and harmless use of. Medicinal plant medicament should be made of good quality raw material. Making of medicinal plants is realised according to demands of Good Manufacturing Practice, GMP. For the purpose of providing high quality raw materials it is necessary to

carry out Good Agricultural practice GAP and good practice of collecting. Raw material, semi-products, final products and packing are controlled.

Parameters of general and specific quality of official plants raw material (drugs and drug preparations), are quoted in Ph Eur 6, and national pharmacopoeia respectively (DAB, Helv, Ph. Jug. etc.). In case of nonofficial drugs and drug preparations, requests of other standard qualities (JUS, ISO) or Internal Standard of producers are considered relevant (*ESCOMP, 2003*).

Commission E presents an expert group formed by German National Health Agency in 1978. The group is formed of respected doctors, pharmacists, toxicologists, representatives of the Legislation, for evaluation of efficacy and activity of phyto-preparations (*Blumenthal et al., 2000*).

Peppermint (*Menthae piperitae folium*, *Mentha piperita*) is one of the oldest medicinal herbs. The primary active constituents of peppermint are the volatile oil, tannins and bitters. Peppermint exerts a spasmolytic action on the smooth muscles of the gastrointestinal tract. It also has a holagogic and carminative action. Antibacterial action has also been reported. Peppermint is a natural compound drug that is mainly used in functional-spastic upper abdominal syndrome (*Wichtl, 2002; Runjaić-Antić and Savin, 1998; Ristić et al., 2006; Psodorov et al., 2006*).

Leaves lemon balm-*Melissae folium* (*Melissa officinalis*). Balm leaves (approved by Commission E and ESCOP monographs) have mild sedative, carminative, spasmolytic and antibacterial effects (*Wichtl, 2002*).

The marshmallow (*Althea officinalis*) is a typical demulcent cough remedy. The drug is exclusively derived from the root (*Altheae radix*) and leaves (*Altheae folium*), containing mucilage, starch, pectin, and cane sugar. The flowers of hollyhock (*A. rosea*, *Malvae arboreae flos*) and the flowers and the leaves of high mallow (*Malva sylvestris.*, *Malvae flos* and *Malve folium*) are potent demulcents, as well. The coltsfoot (*Tussilago farfara*) leaves, *Farfarae folium*, are used in medicine. Besides mucilage, coltsfoot also contains a bitter principle, and tannin. Due to its bitter content, coltsfoot has an added tonicizing effect and makes the herb an ideal remedy for chronic bronchitis. Although coltsfoot contains pyrrolizidine alkaloids, its value as cough remedy has not been decreased. Nonetheless, the drug should be prescribed only for limited periods of time, two to three weeks.

Demulcents used to reduce irritations caused by acute inflammation. The primary herbal demulcents are Mallow leaves (*Malvae folium*), Sage leaves (*Salviae folium*) and Marschmallow root (*Altheae radix*).

Linseed (*Lini semen*) are used as a mucilaginous agent (subacute and chronic gastritis and enteritis) (*Wichtl, 2002*).

Antiphlogistic herbs are also used to treat acute inflammation. Chamomile and preparations made from it have three main actions: antiphlogistic, spasmolytic

and carminative. The bacteriostatic and fungistatic effect of its also well documented. The primary constituents of chamomile are a volatile oil, flavonoids and mucilage. Compound chamomile gargle is a very useful remedy prepared using equal parts of chamomile and sage fluid extract (Wichtl, 2002; Arsić et al., 2003).

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, 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 antidiarrhoic. Blackthorn fruit consists of fruit acids, tannins, monosaccharides and oligosaccharides, while cyanogenic glycosides (amygdalin) are present only in seeds (Wichtl, 2002; Gorunović and Lukić, 2001; Arsić 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 and Montvale, 2004; Wichtl, 2002; Gorunović and Lukić, 2001).

It is particularly important as drug use tannin category of young animals.

Ginquitoil (*Potentilla erecta*)-Tormentil 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 and Montvale 2004; Wichtl, 2002; Gorunović and Lukić, 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. Bilberry 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 and Montvale 2004; Wichtl, 2002; Gorunović and Lukić, 2001).

The bark of the alder buckthorn (*Frangulae cortex*) is used medicinally. *Frangula* bark contains various naphthoquinones and bitter principles. Fresh *frangula* bark has an emetic effect. *Frangula* bark is a mild to moderate laxative. Unlike senna, its irritant

effect in the intestines is not severe (*Thomson and Montvale 2004; Wichtl, 2002; Gorunović and Lukić, 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 et al.2010*).

Milk Thistle (*Silybum marianum*) is one of the few herbal drugs whose excellent pharmacological profile readily lends itself to proof of clinical efficacy. The therapeutic action of silymarin or silibinin its primary active constituent has three main points of action: stimulates the regenerative capacity of the liver, stabilizes the lipid structures in the hepatocellular membrane and due to its antiperoxidative effects they can also be classified as an interceptor of free radicals. One of the best known constituents of the artichoke (*Cynara scolymus*) is cynaropicrin a sesquiterpene lactone. The foliage leaves (*Cynare folium*) are used as the drug. In the current research data, artichoke leaf is reported to have cholagogue, antioxidant and antilipemic action. Artichoke extract have a pronounced cholaretic effect, which has been confirmed in clinical double-blind studies. Yarrow (*Achillea millefolium*) has antiphlogistic, antiinflammatory, carminative and spasmolytic effect. But, yarrow is primarily a bitter tonic, it can also be used to treat atonic forms of stomach disease (*Thomson and Montvale 2004; Wichtl, 2002; Gorunović and Lukić, 2001*).

Medicinal and biological properties of vitamin and mineral drugs are especially recommended as a supplement to feed animals at an early age (breastfeeding).

Some medicinal plants are important source of vitamins Dog Rose-*Rosa canina*, Sea buckthorn-*Hippophae rhamnoides*, Black Currant-*Ribes nigrum*), and mineral substances, especially those containing iron. Therefore, the application of nettle (*Urtica dioica*), common horsetail (*Equisetum arvense*), Greek mountain tea (*Sideritis scardica*), and fenugreek (*Trigonella foenum graecum*) is highly recommended and appreciate in the prevention and elevation of disorders caused by nutritive anemia (*Cupara.et al., 2007*).

The use of Greek mountain tea, infuse or decoct has long record in traditional medicine in South Europe. Mountain tea conatins essential oil, terpne, triterpenic saponins, flavonol glycosides, polifenolic compounds, tanins and considerable amount of Fe. Gastroprotective and anti-inflammatory effect of ethanolic plant extract is mostly due to the content of flavonoids. Rose hips (*Cynosbati fructus*) are fruits of rose. Vitamin C is essential constituents (0.3-1.7%). Besides, the fruits are rich in vitamin E, fatty oil (8-10%), tannins, sugars (monosaccharides/oligisaccharides), pectins, fruit acids (malic, citric acid),

carotenoids (rubixanthin, lycopene, β -carotene), traces of flavonoids and anthocyanins. The drug usually offered as refreshing tea, without medicinal indications, but often is applied as constituents of vitamin tea for prevention and treatment of colds, chills and influenza-type infections, for the prevention and the treatment of vitamin C deficiencies, as adjuvant preparation in anemia (increases the bioavailability of Fe), in urological and diuretic preparations (*Thomson and Montvale 2004; Wichtl, 2002; Gorunović and Lukić, 2001*).

Sea buckthorn is the plant has been extensively studied because of its active components. Fresh ripe fruits are commonly used as well as fatty oil from fruits and seeds. It contains liposoluble vitamins A, D and E (having over 200 mg% which is more than soya beans, corn or sunflower seeds contain), vit.F (essential fatty acids) and carotenoids. Fatty oil is used both externally and internally due to its pharmacological properties. Internally it is used in GI ulcer, cardiovascular diseases, for prevention of diseases caused by immune deficiencies, as well as a hepatoprotecting agent, tonic and antioxidant. Externally it found application in skin burns, infections or wounds, and other skin diseases of different etiology.

Rosemary's leaves (*Rosmarini folium*) contain at least 1.2% volatile oil, tannin, bitter substances and resins. The primary constituent of the drug is the volatile oil which also contains camphor. Rosemary has a general tonizing effect on the circulation and nervous system, especially the vascular nerve system (*Gorunović and Lukić, 2001*).

Tests have confirmed the antimicrobial and antioxidant properties.

Ribwort plantain herb (*Plantaginis lanceolatae herba*, originated from *Plantago lanceolata*) is used as the drug. In addition to mucilage, the drug contains iridoid glycosides, including aucubin and catalpol, as well as tannins, and significant quantities of silicic acid. Therefore the drug represents the combination of demulcents and silicic acid-containing drugs. Although it contains sugar, ribwort plantain syrup does not become moldy when stored for extended period due to presence of substances similar to the antibiotics in quantity that does not provide the therapeutic effect, but these substances might partly be responsible for the therapeutic effect of ribwort plantain in bronchitis. The preparation was especially effective in alleviating dry cough. Mucilage and bitter principles are the active ingredients of the drug lichen islandicus (*Cetraria islandica*). The bitter principles have a tonic effect. It is recommended as a remedy for chronic bronchial catarrh with recurrent, acute bouts of coughing (*Thomson and Montvale 2004; Wichtl, 2002; Gorunović and Lukić, 2001*).

Anise (*Pimpinella anisum*) is a mild cough remedy with a calming effect, and rounds off the taste of many cough and bronchial medicines. Although first application of anise is carminative, it is recommended for treatments of dry bronchitis and tracheobronchitis.

Medicinal plants in the family *Asteraceae*, *Apiaceae*, *Lamiaceae* and *Lauraceae* are commonly used as antimicrobial devices, anthelmintics and antiparasitic. The main active principles are volatile oils. The antimicrobial and anthelmintic effect results from sesquiterpene lactones from the: elecampane (*Inula helenium*), wormseed (*Artemisia cina*), mugwort (*Artemisia vulgaris*) and other oregano (*Origanum vulgare*), thyme (*Thymus vulgaris*) and wild thyme (*Thymus serpyllum*) is commonly used as herbal antiseptics.

The main constituents of bearberry (*Arctostaphylos uva-ursi*) is hydroquinone derivatives, flavonoids, tannins, organic acids and monotropein. The drug is leaves (*Uvae ursi folium*). Arbutin is believed to be responsible for the plant urinary disinfectant action. This hydroquinone glycoside develops the effect after metabolic conjugation with glucuronic and sulfuric acid in alkaline media (pH 8.0). Because of significant quantity of tannins to avoid severe stomach irritation, uva ursi leaf preparations are best suited for short-term use. Uva ursi leaf is indicated for treatment of all inflammatory diseases of the efferent urinary passages, especially unspecific urinary tract infections and those that present minimal symptoms (Thomson and Montvale 2004; Wichtl, 2002; Gorunović and Lukić, 2001).

Juniper, *Juniperus communis* primarily found its application in treatment of chronic arthroses, chronic gout, and a large group of neuralgic and muscular forms of rheumatism, including tendopathies and myogeloses. The drug used in the medicine of lovage (*Levisticum officinale*) is dried root (*Levistici radix*) which has spasmolytic effect on the smooth muscles. Normally is included as the main ingredient of diuretic tea mixtures. Parsley (*Petroselinum crispum*) is excellent aquaretic and can be recommended in all cases where potent stimulation of urinary excretion is desired. The drug consists of the dried leaves and roots (*Petroselini herba et radix*). The root of the spiny restharrow, *Ononis spinosa* is used as the drug. Containing isoflavonoids, flavonoids and volatile oil. Its aquaretic effect is not very potent. Horstail (*Equisetum arvense*) has high silica content; the silicates are largely water soluble and occur in colloidal form. The drug is herb (*Equiseti herba*). To limited extent, the drug could be classified as an aquaretic. Its certain, but nor significant aquaretic effect cannot be attributed to silicic acid. As the drug does not contain saponins in detectable amounts, they cannot be the cause of this effect (Wichtl, 2002).

Herbal drugs, such as goldenrod (*Solidago virgaurea*), spiny restharrow (*Ononis spinosa*) and orthosiphon are indicated for prevention or prevention of recurrence of urolithiasis. Selected herbal drugs are helpful in flushing small calculi out of the renal pelvis or ureter. Dandelion (*Taraxacum officinale*) is a particularly effective one. The colicky pain associated with the passage of urinary stones can be treated effectively with another herbal drug, butterbur (Wichtl, 2002).

Shepherd's purse (*Capsella bursa pastoris*) has not very potent hemostyptic action. The whole herb is the drug containing flavonoids and relatively large quantities of potassium salts. The Commission E accepted the use of the drug for treatment of menorrhagia and metrorrhagia. Common smartweed (*Polygonum hydropiper*) has been reported to have hemostyptic action and is recommended for treatment of atonic postpartum bleeding, abortive and menopausal bleeding. The plant part used in medicine is herb .

This is shown most potential medicinal plant raw material with antimicrobial, anti-inflammatory, antidiarrhoeal etc. activities that have an approved application in human medicine and which can be added to animal feed for use in different animal health disorders (*Stojanović et al., 2005; Arsić et al.2003; Arsić et al., 2004*).

Conclusion

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. On market have placed a number of phytopreparations used to mitigate various problems, but the more current production of functional food (48). Chemical characterization of drug contributed to the standardization of relevant extracts of medicinal herbs and creating the ability to create stable, dosed herbal medicines, dietary supplements and functional foods. Modern pharmacological research that determines conditionality biological / pharmacological effects and chemical composition of herbs contributed to their rational and safe use. 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 rightfully occupy a leading place in modern phytotherapy. The herbs used in the food industry is all more current and more, both in human and in veterinary practice.

Biljke u održivoj ishrani životinja

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Rezime

Životinja ima direktni uticaj na kvalitet mesa, mleka i jaja, bilo pozitivan ili negativan. Preko sastava oborka za životinje može se uticati na kvalitet proizvoda

životinjskog porekla i mogu se postići različite nutritivne, organoleptičke, hemijske, fizičke i fiziološke karakteristike. Korišćenje lekova u intenzivnom i ekstenzivnom stočarstvu je rizično po kvalitet proizvoda i time na zdravlje ljudi. U organskom stočarstvu nije dozvoljeno korišćenje lekova. Zbog toga se intenzivno traže prirodna lekovita sredstva i resursi. U proizvodnji stočne hrane, biljke obezbeđuju realnu mogućnost da se poveća vrednost hrane korišćenjem različitih funkcionalnih dodataka. Dodaci u hrani za životinje mogu da poboljšaju funkcionalnost u smislu fiziološkog efekta. U razvijenim evropskim zemljama veoma je snažan trend zamene sintetičkih antibiotskih preparata lekovitim biljnim preparatima. Kao biljni aditivi u hrani mogu se koristiti lekovi (sušene lekovite biljke kao sirovina), biljni ekstrakti ili biljni izolati (npr. esencijalna ulja). U ovom radu se daje kratak pregled najvažnijih potencijalnih biljnih lekovitih supstanci koje imaju antibakterijsku aktivnost, antiinflamatornu aktivnost, stimulišu digestiju, laksativnu aktivnost, antidiaroičnu aktivnost, holeretičnu, itd. koje se već koriste u ljudskoj medicini i koje se mogu dodati u stočnu hranu u tretmanu različitih poremećaja zdravlja životinja.

References

- ARSIĆ I., ĐORĐEVIĆ S., RUNJAIĆ-ANTIĆ D., RISTIĆ M. (2004): Funkcionalnom hranom protiv tegoba anemije, Zbornik radova sa 10. Naučno-stručnog skupa Ishrana i zdravlje: Minerali, vitamini, drugi dodaci hrani i njihov zdravstveni značaj, Naučnoistraživački centar Užice, 17.3.-20.3. 3D Grafika, 56-60.
- ARSIĆ I., ISAILOVIĆ G., RISTIĆ M., VULETA G. (2003): Liposomal O/W cream with Chamomile flower extract -investigation of its anti-inflammatory activity, 8th National Symposium "Medicinal Plants-Present and Perspectives" Piatra Neamt, August 28-29. 2003. Proceedings, 133-135
- ARSIĆ I., TADIĆ V., ĐORĐEVIĆ S. (2007) Plod trnjine kao potencijalni sastojak funkcionalne hrane, I Kongres o dijetetskim suplementima sa međunarodnim učešćem, Beograd, 15.-17. mart Knjiga apstrakata, 124-125.
- ARSIĆ I., TAMBURIĆ S., SAVIĆ S., HOMŠEK I., VULETA G. (2004): The effect of chamomile extract on skin hydration and TEWL: is it more effective when encapsulated in liposomes, Euro Cosmetics, 2, 12-17
- ARSIĆ I., ĐORĐEVIĆ S., RISTIĆ M., RUNJAIĆ-ANTIĆ D. (2003): Lekovito bilje u proizvodnji funkcionalne hrane, Lekovite sirovine, No. 23, 15-22.
- BLUMENTHAL M, BUSSE WR, GOLDBERG A, GRUENWALD J, HALL T, RIGGINS CW, RISTER RS, (Eds) (1998). The Complete German Commission E Monographs, Austin: American Botanical Council.

- BLUMENTHAL M, GOLDBERG A, BRINCKMANN J, (Eds) (2000): Herbal Medicine, Expanded Commission E Monographs, Austin: American Botanical Council.
- BLUMENTHAL M., HALL T., GOLDBERG A., KUNZ T., DINDA K., (Eds). (2003): The ABC Clinical Guide to Herbs. Austin: American Botanical Council.
- CUPARA S., TADIĆ V., ARSIĆ I., ĐORĐEVIĆ S., ŠOBAJIĆ S. (2007): Prikaz sastava komercijalnih uzoraka masnog ulja ploda pasjeg trna, I Kongres o dijetetskim suplementima sa međunarodnim učešćem, Beograd, 15.-17. mart, Knjiga apstrakata, 89-91.
- 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, 111.
- ESCOPE (2003): European Scientific Cooperative on Phytotherapy Stuttgart: Georg Thieme Verlag.
- EUROPEAN PHARMACOPOEIA 6th Edition (2008): Council of Europe, Strasbourg.
- GORUNOVIĆ M., LUKIĆ P. (2001): Osnovi farmakognozije, Momčilo Gorunović, Beograd.
- KOSTADINOVIĆ LJ., LEVIĆ J., PAVKOV S., DOZET G. GALONJA-COGHILL T. (2010): Effect of *Mentae piperitae* on antioxidative status in broiler chickens, Savremena poljoprivreda, 59 (3-4).
- LEVIĆ J., ČOLOVIĆ R., SREDANOVIĆ S., PAVKOV S., KOSTADINOVIĆ, LJ. (2009): Effect of diet supplementation with ground herbs on performace of broiler chickens. Book of Abstracts 3rd International FEED SAFETY conference, Wageningen, 'Netherlands, 6-7 october, 111
- PSODOROV Đ., ŠIMURINA O., ARSIĆ I., ĐORĐEVIĆ S., RUNJAIĆ-ANTIĆ D., RISTIĆ M., BODROŽA-SOLAROV I.M., FILIPČEV V.B. (2006): [Effect of herbal mixture "Gastroherb®" on the quality of pizza crusts](#). Proceedings from the Fourth Conference on Medicinal and Aromatic Plants of Southeast European Countries (IV CMAPSEEC), Iași (Romania), May 28-31, 2006, 494-498.
- RISTIĆ M., ĐORĐEVIĆ S., ARSIĆ I., RUNJAIĆ-ANTIĆ D., VILD A.S. (2006): [Gas chromatographic estimation of aromatic herbal drug content in their mixtures](#). Proceedings from the Fourth Conference on Medicinal and Aromatic Plants of Southeast European Countries (IV CMAPSEEC), Iași (Romania), May 28-31, 2006, 505-510.
- RUNJAIĆ-ANTIĆ D., MILINKOVIĆ D. (1990): Biljna pomoćna lekovita sredstva. Arhiv za farmaciju, 40, 6.
- RUNJAIĆ-ANTIĆ D., SAVIN K. (1998): Farmakološka svojstva nane, Monografija "Pitoma nana (*Mentha x piperita* L.) i druge vrste roda *Mentha* L.". Institut za proučavanje lekovitog bilja "Dr Josif Pančić", Beograd, 215-221.

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- STOJANOVIĆ D., RUNJAIĆ-ANTIĆ D., PAVLOVIĆ S. (2005): The most common anti-inflammatory phytopreparations in Serbia. The IX International Congress "Actual problems of creation of new medicinal preparations of natural origin", Phytopharm 2005, St.-Petersburg, June 22-25, 2005, 714-716.
- SARIĆ M., RUNJAIĆ-ANTIĆ D. et al. (1989): Lekovite biljke SR Srbije, Beograd: SANU; (1989) (In Serbian).
- SCHILCHER H., KAMMERER S., LEITFADE N. (2000): Phytotherapie: Urban and Fischer, München.
- SCHULZ V., HANSEL R., TYLER V.E. (2001): Rational Phytotherapy: Springer-Verlag, Berlin.
- THOMSON A.T. MONTVAL L. (2004): PDR for Herbal Medicines, Third edition.
- WEISS R.F., FINTELMANN V. (2000): Herbal Medicine: Thieme, Stuttgart-New York.
- WHO MONOGRAPHS ON SELECTED MEDICINAL PLANTS (2002): Vol. 2, World Health Organization, Geneva.
- WHO MONOGRAPHS ON SELECTED MEDICINAL PLANTS (1999): Vol. 1, World Health Organization, Geneva.
- WICHTL M. (2002): Teedrogen und phytopharmaca: Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart.

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