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MEDICINAL PLANTS USED IN TRADITIONAL VETERINARY MEDICINE TO TREAT RUMINANTS IN THE CURVATURE SUBCARPATHIANS AREA, ROMANIA

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Abstract

Medicinal plants have been used since the earliest times to treat different disorders of humans and animals. The aim of this study was to identify the plant, mineral and animal remedies used in the treatment of cattle diseases traditionally raised, in the submontane area of the Curvature Carpathians. Relevant information has been collected from 237 interviewed subjects on the treatments used to control diarrhoea, mastitis, external mammary gland injuries, mammary papillomatosis, indigestion, acute meteorism and respiratory disorders, foot injuries/ infections, external and internal parasite infections. There have been identified 56 plants, 8 mineral substances and 6 substances of animal origin used in the treatment of the aforementioned disorders. According to the answers of the interviewees, the most frequently used plants belong to the Asteraceae family (32.35%), followed by Rosaceae (17.64%), Aliaceae, Betulacea and Fabaceae (8.82%), and the most frequently used species were Robinia pseudoacacia, Artemisia absinthium and Sempervivum tectorum.

Key words*: ethno-veterinary, traditional knowledge, cattle disease, Romania.*

INTRODUCTION

In the modern era, traditional veterinary medicine is practiced throughout the entire world, usually in rural areas, where the economical situation is precarious and veterinary services are difficult to access. Traditional medicine is based mainly on rural wisdom, its practice being cheap, secure, tested throughout the centuries, from generation to generation (Confessor et al., 2009; Phondani et al., 2010).

In the last decade, numerous studies published in developed or developing countries prove that the practices of ethno-veterinary medicine are now returning to a new level through the scientific approach. A major factor in the return of this therapeutic approach is the progress of organic farming. If in 1999 the agricultural area occupied 11 million hectares, in 2017 it reached 70 million hectares, with a turnover of 97 billion US dollars (Chakraborty & Pal, 2012; Willer & Lernoud, 2019).

The increasing emergence of resistance to antimicrobial and antiparasitic molecules is another major factor boosting the research of phyto-therapeutic principles (Mayer et al., 2014).

In Europe, there are few ethno-veterinary studies, the most numerous being in Asia and Africa, where the use of medicinal plants has a continuous tradition.

In Romania, such studies are emerging, although the potential of our country is very high and the medicinal plants have been used since the earliest times. Romania's flora registers over 4000 species of plants, of which 800 have therapeutic properties, properties confirmed by scientific studies for over 50% of them (Segneanu et al., 2019).

Dioscorides (a Greek physician, pharmacologist, botanist in roman army) gives the earliest description of medicinal plants used in different treatments on Romania's territory in his book "De Materia Medica". He emphasised that the medicinal plants are widely used in Dacia. Of the 600 species of plants he describes in his work, 40 originate from the Dacian territory: this is the oldest evidence of phytotherapy practice in our country (Fierascu et al., 2017; Segneanu et al., 2019).

Knowledge of veterinary practices has been preserved and passed on to nowadays in mountainous and sub-mountainous areas, these human communities being more conservative. One such territory is the submontane area of the Curvature Carpathians, the area where this study was conducted.

The aim of the study was to identify the medicinal plants used by farmers from the area of the Curvature Sub-Carpathians, in the treatment of cattle. The therapy based on natural resources (plants, animals, minerals), often associated with ancient religious practices and rituals, still remains an alternative in the treatment of various conditions. This knowledge is oral transmitted, from generation to generation, but will gradually disappear due to socio-economic and cultural environment evolution: the reduction of the number of micro-farms or the development of technology.

MATERIALS AND METHODS

The studied area

The research has been carried out in 25 villages belonging to 8 administrative communes (Bisoca, Gura Teghii, Mânzălești, Lopătari, Bătrâni, Poseşti, Jitia and Vintileasca) located in the submontane area of the Curvature Carpathians, in the counties of Buzău, Prahova and Vrancea (Figure 1)

Figure 1: Map of the study sites in Sub Carpathian area, Romania. Image adapted from Google Maps (https://www.google.com/maps)

Data collection and analysis

The research was carried out between April and October 2019. The interviewees was selected randomly, being recorded only the relevant answers on the therapies based on natural resources, used in the treatment of ruminants. There have been recorded 237 interviews.

The questions referred to the following conditions: diarrhea, indigestion, acute meteorism, mastitis, superficial mammary wounds, breast papillomatosis, pododermatitis, respiratory disorders, ectoparasites and endoparasites. The requested information was about the type of these natural resources (of vegetable, animal or mineral origin), data on the formulation and posology (administration and how long).

Conservation and taxonomic identification of plants

The plants were harvested and conditioned in a herbarium and subsequently identified at the University of Medicine and Pharmacy of Bucharest "Carol Davila", Faculty of Pharmacy, discipline of Pharmacognosy. Where harvesting was not possible, the identification of the plants was done with the help of the botanical atlas “The Illustrated Flora of Romania. Pteridophyta et Spermatophyta” (Ciocârlan, 2000) and specialized websites.

Classification of plants and statistical analysis of the data obtained

According to the classification made by Lans et al (2007), the plants were grouped into four categories, depending on the therapeutic properties, supported or not by the scientific data, categories designated by the letters A, B, C and D, as follows:

- A: high level of confidence, the plant is considered effective if the ethno botanical and pharmacological data from the literature are consistent;
- B: medium level, if there is pharmacological and phytochemical information that certifies the use of the plant in the treatment of different diseases;
- C: low level, if the plant (or plants of the same genus) is used for the same type of diseases in other areas, but there is no pharmacological information to confirm their effectiveness;
- D: minimum level if no information has been identified that can confirm the effectiveness of the plants, and they could be inactive.

It was also noted the frequence of each plant species (U) and the frequency of occurrences expressed as a percentage (F), based on the total number of the considered interviews. The

frequency is as higher as the number of citations of the plant is higher (Parthiban et al., 2016).

RESULTS AND DISCUSSIONS

Ethnobotanical knowledge

Most often, concrete information was obtained from people aged over 60 years (most of them being breeders who practice or have practiced subsistence farming).

For people aged under 40, the presence of the veterinarian is required to control the most of conditions, diarrhea being the only condition that is sometimes treated with the phyto-therapeutic remedies.

There were identified 56 plants, out of 34 families (Table 1), the largest representation being of the *Asteraceae* family (32.35%), succeded by *Rosaceae* (17.64%), *Aliaceae*, *Betulaceae* and *Fabaceae* (8.82%).

The frequency of the other nominated families was below 5.89%.

A study carried on ethno-veterinary medicine in Europe identified 590 plant species from 102 different families, used in animal treatment (Mayer et al., 2014). Relevant families were *Asteraceae, Fabaceae* and *Laminaceae*, while Bartha et al. (2015) in Covasna, a county located inner of the Curvature Carpathians, reported a number of 26 plants, 2 remedies of animal origin and 17 of other origin.

Parts of plants used and the formulation

As other ethno-veterinary studies, it was noted that the most commonly used are the aerial parts of plants, especially leaves (Figure 2), being easier to harvest and available throughout a wider period of the year, unlike fruits and flowers (El-Mahdi, 2019; Parthiban et al., 2016; Verma, 2014).

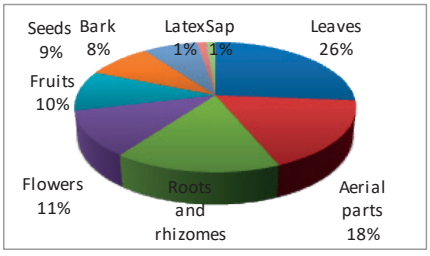

Figure 2. Percentage of parts of plants utilized

The plants are used in fresh form, given in ration, in the form of infusion, decoction, alcoholic macerate, poultices, ointments or oil infusion. Similar modes of administration are found worldwide.

Alcoholic extracts are prepared using the traditional drink, obtained from the alcoholic fermentation of plums, ţuica, with an alcoholic strength of 37-42°. For the cold season, animal breeders cultivate the plants, condition them properly and use them if necessary (Miara et al., 2019; Verma, 2014).

Treated pathologies and pharmacological records

Information was collected on 135 herbal remedies, of mineral or animal origin, used to treat 15 cattle diseases: the diarrhoea is the first one, followed by mastitis, internal and external parasitoses, acute meteorism, foot infections, respiratory diseases, indigestion, superficial mammary wounds and papillomatosis. For the treatment of haemorrhages, anemia, eye disease or skin wounds, only two remedies have been reported (Table 2). Most often, these remedies are delivered in alcohol (*ţuica*), in sunflower oil or in vinegar, and various empirical recipes are proposed.

Among the conditions listed above, diarrhea is the most commonly treated with herbal medicines, using either fresh herbs administered in the ration or as an infusion, decoction, alcoholic maceration. The antidiarrheal effect of the used plants is due to their antimicrobial, astringent, antispastic and antihelmintic action.

Gentiana lutea is the most widely used plant, especially in adult bovine diarrhea (cited 45 times). The root and the rizome of the plant are used, less often the leaves and the flower. It is given as an alcoholic extract, macerated or decocted. The European Medicines Agency conducted a study recognizing the effectiveness of *Gentiana lutea* especially in digestive disorders. Numerous studies have also demonstrated its antimicrobial action (Šavikin et al., 2009; Scarlattilaan, 2018).

Šavikin et al. (2009) have tested the action of the plant's compounds, gentiopicrin, mangiferin and isogentisin, which separately do not play an important antibacterial role, but their synergistic action in the methanolic extract of leaves and flowers proves to be effective against Gram-positive, Gram-negative bacteria and *Candida albicans*).

Table 1. Plants used in ethno-veterinary medicine in Subcarpathians'Curvature

Binomial name/ family	Parts used	Medicinal value (condition, formulation, posology)	U*	F (%)**	Classi-fication
Achillea millefolium *Asteraceae*	flower	diarrhea/infusion/oral ocular disease/infusion/topical	4	1.68	A***
Aesculus hippocastanum *Sapindaceae*	seed	diarrhea, indigestion/decoction, maceration in alcohol, baked seeds/oral	50	21.09	A
Allium ascalonicum *Alliaceae*	bulb	interdigital dermatitis/ raw/topical	6	2.53	A
Allium cepa *Alliaceae*	bulb	antihelmintic/juice/oral indigestion/ 4-5 bulbs (pasta) with 0,5 l oil, 0,25 l *ţuică* and 2 ground paper tablespoon/ oral teat papillomatosis/juice/topical	22	9.28	A
Allium sativum *Alliaceae*	bulb	diarrhea/ pasta with eggs and vinegar/oral mastitis and antihelmintic/with alcohol/oral ruminal meteorism/pasta with petroleum/oral teat papillomatosis/juice/topical	18	7.59	A
Alnus glutinosa *Betulaceae*	bark	diarheea/decoction/oral	1	0.4	A
Armoracia rusticana *Brassicaceae*	root	respiratory diseases/raw/oral	11	4.64	A
Artemisia absinthium *Asteraceae*	aerial parts	diarheea/infusion/oral indigestion/infusion or raw with salt and vinegar/oral respiratory diseases , antihelmintic/decoction/oral external parasites/ decoction with *Canabis sativa* leaves/washes foot disease, skin injuries/decoction/topical	114	48.1	A
Atropa belladonna *Solanaceae*	leaves, root fruit	mastitis and immunomodulator/leaves or root raw/oral external parasites/row/oral	10	4.21	B***
Asarum europaeum *Aristolochiaceae*	leaves	mastitis/raw/oral	4	1.68	B
Betula pendula *Betulaceae*	bark sap	diarrhea/decoction/oral antianemic/raw/oral	4	1.68	B
Calendula officinalis *Asteraceae*	flowers	diarrhea/infusion/oral mamary injuries/ cream/ topical	17	7.17	A
Cannabis sativa *Cannabaceae*	leaves	external parasites/decoction/washes	5	2.1	A
Chamomilla recutita *Asteraceae*	aerial parts	foot disease, skin injuries/ infusion/ washes digestiv/ with oil/oral	7	2.95	A
Chelidonium majus *Papaveraceae*	aerial parts latex	external parasites/decoction/washes skin injuries/cream with Callendula flower/topical teat papillomatosis/latex/topical	37	15.61	A
Cornus mas *Cornaceae*	fruits	diarrhea/decoction or alcoholic macerate/oral	6	2.53	C***
Corylus avellana *Betulaceae*	leaves fruits	mastitis/raw/oral mamary injuries/ cream/topical	3	1.26	B
Curcubita maxima/pepo *Cucurbitaceae*	seed	antihelmintic/raw/oral	8	3.37	A
Equisetum arvense *Equisetaceae*	aerial parts	antihemoragic/decoction/compresses external parasites/decoction/washes	5	2.10	A
Fragaria vesca *Rosaceae*	leaves	diarrhea/infusion/oral	4	1.68	A
Gentiana lutea *Gentianaceae*	root, rhizome, leaves, flowers	diarrhea/decoction or alcoholic macerate/oral	45	18.98	A
Heleborum niger *Ranunculaceae*	root leaves	antihelmintic, immunomodulator, respiratory disease/ transcutaneous implantation on the ear mastitis/50g dry leaves/oral	32	13.5	A
Helianthus annuus *Asteraceae*	seed oil	indigestion, acute meteorism/with eggs, milk or alcohol/oral antihelmintic/with vinegar/oral	67	28.27	B
Hylotelephium telephium/spectabile *Crassulaceae*	aerial parts rhizomes	mastitis/raw or alcoholic macerat/oral	54	22.78	B
Hypericum perforatum *Hypericaceae*	aerial parts	diarrhea/infusion/oral mamary injuries/ oil macerate/topical	15	6.32	A
Inula britannica *Asteraceae*	flowers	diarrhea/infusion/oral	45	18.98	A
Inula helenium	root	diarrhea/infusion/oral	18	7.59	A

Fam Asteraceae	rhizomes leaves flowers	mastitis, antihelmintic/decoction/oral respiratory diseases/raw leaves/oral			
Juglans regia *Juglandaceae*	leaves pericarp seed	diarrhea/decoction/oral papillomatosis/cream/topical external parasites/decoction/washes antihelmintic/decoction/oral respiratory diseases/with *ţuică*/oral	8	3.37	A
Lathraea squamaria *Orobanchaceae*	rhizomes	mastitis/raw or alcoholic macerate/oral	32	13.5	D***
Levisticum officinale *Apiaceae*	leaves root	diarrhea, antihelmintic/leaves infusion or root decoction/oral mastitis/root decoction with *ţuică*/oral	85	35.86	B
Linum usitatissimum *Linaceae*	seed	indigestion/ acut meteorism/decoction/oral	2	0.84	A
Medicago sativa *Fabaceae*	aerial parts	respiratory diseases/infusion/oral	2	0.84	B
Mentha piperita *Laminaceae*	leaves	diarrhea/infusion/oral	79	33.33	A
Nicotiana tabacum *Solanaceae*	leaves	external parasites/decoction/washes	12	5.06	A
Phaseolus vulgaris *Fabaceae*	seed	mastitis/ baked seeds/oral	3	1.26	D
Plantago lanceolata *Plantaginaceae*	leaves	diarrhea/infusion/oral	6	2.53	A
Potentilla reptans *Rosaceae*	leaves flowers	diarrhea, induce oestrus/infusion/oral	1	0.42	B
Primula officinalis *Primulaceae*	flowers	respiratory diseases/infusion/oral	3	1.26	B
Prunus domestica *Rosaceaea*	leaves	diarrhea/raw/oral	21	8.86	B
Prunus persica *Rosaceae*	leaves	diarrhea, antihelmintic/raw or infusion/oral	2	0.84	B
Prunus spinosa *Rosaceaea*	fruits	diarrhea/decoction/oral	7	2.95	A
Quercus robur *Fam. Fagaceae*	bark	diarrhea/decoction with *Sallix spp* and *Robinia pseudoacacia* /oral	29	12.23	A
Robinia pseudoacacia *Fabaceae*	bark leaves fruits	diarrhea, antihelmintic/decoction/oral diarrhea/raw/oral indigestion/decoction/oral	115	48.52	A
Rubus fruticosus *Rosaceae*	aerial parts	indigestion/decoction/oral	5	2.1	A
Rumex alpines *Poligonaceae*	root seed	diarrhea, acute meteorism/ decoction or alcoholic macerate/oral	24	10.12	C
Tanacetum vulgare *Asteraceae*	flowers leaves	diarrhea/infusion/oral	17	7.17	A
Taraxacum officinale *Asteraceae*	root	diarrhea/decoction/oral	1	0.42	A
Tilia spp. *Tiliaceae*	flowers	diarrhea, respiratory diseases /infusion/oral foot disease/infusion/ washes	8	3.37	B
Salix alba, Salix capreae *Salicaceae*	leaves, bark young twigs	diarrhea, antihelmintic /decoction or raw/oral	34	14.34	A
Sambucus nigra *Adoxaceae*	bark	diarrhea/decoction/oral	1	0.42	B
Satureja hortensis *Laminaceae*	aerial parts	diarrhea/infusion/oral	7	2.95	A
Sempervivum tectorum *Crasulaceae*	leaves	mastitis, acute meteorism/decoction, alcoholic macerate, raw/oral	102	43.03	B
Ulmus montana *Ulmaceae*	leaves	diarrhea/infusion or raw/oral	2	0.84	B
Vaccinium myrtillus *Ericaceae*	fruits aerial parts	diarrhea/raw/oral diarrhea/infusion/oral	5	2.1	A
Veratrum album *Melanthiaceae*	aerial parts root	external parasites, foot disease /decoction/washes	31	13.08	B
Xanthium spinosum *Asteraceae*	aerial parts	diarrhea, antihelmintic/decoction/oral	17	7.12	A

*(U) absolute value of frequence of each plant species; ** (F) frequency (as a percentage); ***according to Lans et al. (2007)

Table 2. Cattle conditions and origin of ethno-veterinary remedies used to treat them

Disease	Remedy origin			Total
	vegetal	mineral	animal	
Diarrhea	34	2	1	37
Mastitis	12	2	2	16
Internal parasites	10	3	-	13
External parasites	8	3	-	11
Acute meteorism	6	3	3	15
Foot disorders	5	4	-	9
Respiratory disorders	9	-	-	9
Indigestion	7	-	-	7
Superficial mammary wounds	4	-	2	6
Papillomatosis	4	-	-	4
Skin wounds	2	-	-	2
Imunomodulator	2	-	-	2
Eye disease	1	1	-	2
Anti- haemorrhage	1	-	-	1
Anti-anemic	1	-	-	1
	109	**18**	**8**	**135**

The aqueous extract of *Inula britannica* flowers, administered for 3-4 days to sick animals is found in all villages, also frequently used in the treatment of diarrhea in humans. From the same family, *Inula helenium* is also used, as root decoction, aqueous extract of the plant or the leaves administered in a fresh state (the plant is also used to treat mastitis). *Inula* genus has been used since ancient times in all corners of the world, from the writings of ancient Greek and Roman doctors, to traditional Chinese, Egyptian, Tibetan or Ayurvedic medicine. *Inula britannica* and *Inula helenium* are noted for their antibacterial, anti-inflammatory, anti-tumor, cytotoxic, hepatoprotective and anthelmintic action. (Amin et al., 2013; Diguta et al., 2014; Khan, 2010). Alcohol extract from the root of *Inula helenium* (harvested from Romania) had significant activity against pathogenic bacteria of animal origin and dermatophyte fungi (Diguta et al., 2014).

In the treatment of diarrhea, there are also used young willow branches and willow leaves (*Salix alba*) administered alone or together with leaves of acacia (*Robinia pseudoacacia*) or in the form of decoction. Willow can also be combined with oak leaves and bark (*Quercus robur*) or with elm leaves (*Ulmus* spp.), and acacia can be combined with lime blossoms (*Tilia flores*).

Another remedy used is a decoction made from a mixture of alder tree bark, sessile oak bark and birch tree bark, or a decoction made from peach tree bark and elderflower. Willow is known for its high salicin content, over 80% of it is absorbed and metabolized into different salicylate derivatives, it also contains polyphenols and flavonoids. Therefore, it has numerous therapeutic properties: anti-inflammatory, antipyretic, antioxidant, reduces oxidative stress, it is a cardiovascular protector, it is antimicrobial, analgesic, astringent (Amel et al., 2018; El-Mahdi, 2019).

Oak bark has antibacterial, astringent, antiseptic, anti-inflammatory effect on the skin and oral mucosa and it is recommended by EMEA for the control of light diarrhea in ruminants, horses, pigs and chickens (Deryabin & Tolmacheva, 2015; EMA, 2009). Elm contains mucilages and tannin, and is used to treat inflammation and gastrointestinal ulcers, convalescence, colitis and diarrhea (Wynn & Fougere, 2006).

Xanthium spinosum decoction, garden mint (*Mentha piperita*) or wild mint (*Mentha longifolia*) infusion, plantain (*Plantago* spp.), thyme (*Thymus vulgare*), wormwood (*Artemisia absinthum*) or marigold (*Calendula officinalis*) are often encountered in the treatment of gastrointestinal disorders of calves. *Xanthium spinosum* together with fruits of *Prunus spinosa* and *Allinum sativum* (garlic), are used in the production of an alcoholic extract that is administered in small quantities along with various herbal infusions. *Xantinum spinosum* is effective against Gram-positive bacteria (including MSSA and MRSA), and less effective against Gram-negative bacteria. In addition to its antimicrobial role, it has been demonstrated to have anti-inflammatory, antioxidant, anthelmintic and antifungal properties (Devkota & Kumari, 2015; Ginesta-Peris et al., 1994; Rad, 2013). The use of *Plantago* spp. and *Calendula officinalis* in diarrhea can be scientifically supported due to their antibacterial, antifungal and anti-inflammatory effects (Monjd Abd Razik et al., 2012; Parente et al., 2012; Shah & Williamson, 2015)

Artemisia absinthum, the plant that is used in 7 of the 14 diseases studied, is recognized by the entire medical world. Numerous *in vivo* and *in vitro* studies have been performed that prove its internal and external antiparasitic, antibacterial, anti-inflammatory, antifungal, antispastic,

antiviral, antineoplastic effectiveness. Its anti-parasitic properties are given by sesquiterpene lactones, flavonoids and artemisinin, and it is effective against *Haemoncus, Fasciola, Trypanosoma, Eimeria, Trichostrongylus, Ascaris*. In a study carried out on sheep, the efficacy of aqueous and alcoholic extract of *Artemisia absinthum* against *Haemoncus contortus* is comparable to that of albendazole (Ferreira, 2009; Moslemi et al., 2012; Tariq et al., 2009).

Externally, wormwood extract used in pig farms significantly reduced the number of *Sarcoptes scabiei* parasites in the first week after treatment, and in ruminants it was shown to be effective against *Riphicephalus microplus* (Mägi et al., 2006; Parveen et al., 2014). Wormwood extract used in the treatment of surgical wounds infected with *S. aureus* in rats has a strong antibacterial effect). *Artemisia absinthum* is mainly effective against Gram-positive bacteria (Moghaddam et al., 2016; Moslemi et al., 2012).

Highly appreciated in the treatment of diarrhea is also *Rumex alpinus*, most commonly used is the aqueous extract of the seeds, sometimes the plant as such or in the form of alcoholic extract taken from its root. Plants belonging to the *Rumex* genus are also used in other localities in Romania or in traditional medicine in Turkey to treat diarrhea, constipation and eczema (Ozturk & Ozturk, 2007; Bartha et al., 2015).

Decoction and alcoholic extract are also obtained from *Cornus mas* or *Aesculus hippocastanum* (chestnuts), which are frequently used in the treatment of diarrhea in humans. Aqueous extract from the plant or root of *Levisticum officinale* is used both for the treatment of diarrhea, mastitis, but also as an ascaricide, sometimes combined with walnut leaves (*Juglans regia*) and glass flowers (*Tanacetum vulgare*). *Levisticum officinale* essential oil obtained from leaves, flowers or fruits contains over 190 organic compounds. It has antiparasitic, antibacterial, antifungal, antiviral, antioxidant and antimicrobial action. It inhibits the development of the *Mycobacterium tuberculosis* bacterium, and the plant extract moderately inhibits the growth of *Pseudomonas aeruginosa, Acinetobacter baumannii, Escherichia coli, Salmonella enteritidis* and *Staphylococcus epidermitis*, also having a synergistic action with ciprofloxacin (Ebrahimi et al., 2016; Mirjalili et al., 2010).

The use of walnut (*Juglans regia*) in the treatment of digestive and respiratory disorders may be due to the intense antibacterial activity of all the components, leaves, bark, fruits and pericarp, having a wide spectrum of action against Gram-positive and Gram-negative bacteria. The internal antiparasitic activity is supported by many studies, comparative with that of albendazole, in vitro it is effective against the embryo eggs of *Ascaris suum*, of the larvae of *Trichostrongylus colubriformis* and of the helminths *Fasciola* spp. and *Haemonchus contortus* . It is also used as an antiviral, antifungal, hepatic and renal protector, antidiabetic, anticancer, antide-pressant, antioxidant, antirheumatic (Marhaba & Haniloo, 2018; Tajamul et al., 2014; Urban et al., 2008).

In the treatment of respiratory diseases, the fresh root of *Armoraciae rusticana*, adminis-tered in ration, or infusions of *Artemisia absinthium*, flowers of *Primula officinalis*, *Tillia* spp. and *Medicago sativa* are administered orally. It is also a common practice to place a root of *Heleborum niger* in the ear or necklace for a maximum of 24 hours. Animals have demonstrated a nonspecific immune response following the administration of *Heleborum niger* rizome or root extract. The immunomodulatory effect is based on lecocytosis, granulocytosis, increased macrophage number and neutrophil phagocytosis. The use of *Heleborum niger* in respiratory diseases in cattle is found in traditional veterinary medicine in many European countries. A root extract of *Heleborus bocconei* was tested for antimicrobial efficacy against ten bacterial strains responsible for respiratory diseases in cattle, with very good results against *Streptococcus pneumonia, Moraxella catarrhalis* and *Haemophilus influenzae* (Davidović et al., 2017; Bartha et al., 2015).

Plants of the genus *Allium* (*Allium sativum, Allium cepa* and *Allium ascalonicum*) in the form of aqueous extract, tincture or fresh form, are used for their anthelmintic, antiseptic, antifungal, antibacterial, antioxidant, anticoagulant, anti-cancer, hepatoprotective and immunomodulatory action. They are some

of the most studied plants in the world, information about their use in therapy has been found since 5000 years ago, in Sanskrit writings (Londhe et al., 2011; Shari-Rad et al., 2016; Sonia et al., 2018).

The present study revelead their use in the treatment of interdigital dermatitis, mammary papillomatosis, indigestion, tympanism, mastitis or for their anthelmintic effect.

For the treatment of mastitis, 13 plants were identified, of which four plants are found in all the investigated areas.

Sempervivum tectorum is cultivated by humans on the roof of animal shelters, being used especially in the treatment of mastitis. It is administered in a raw state or as an alcoholic extract. It is a plant used throughout the Balkan area, but still insufficiently studied. In other ethno-veterinary studies it is used as ruminative and digestive in cows, and in human medicine it is used in the treatment of otitis, insect bites, burns and ulcers. The aqueous extract has proved to be effective against antibiotic resistant *E. coli strains,* an action due to polyphenols that oxidize and/or hydrolyze the bacterial cell wall and their plasma membrane (Di Sanzo et al., 2013; Muselin et al., 2014; Rovcanin et al., 2015). *Lathraea squamaria* is the most prized and praised by farmers, who assign it miraculous powers. During the spring they go into the mountains to collect it, and use it exclusively in the treatment of mastitis. It is administered 2-3 rhizomes in a raw or dry state, for 3-4 days. In the literature there is no data to confirm the effectiveness of the plant, but we cannot doubt its activity without scientific support.

Hylotelephium spectabile and *Hylotelephium telephium* are two other plants that are frequently used to treat mastitis. In traditional medicine it is also used in Spain for the treatment of infected wounds and inflammation of the skin and in Serbia for the treatment of diphtheria, intestinal worms, scurvy and various skin conditions. The *Hylotelephium spectabile* extract has moderate antibacterial activity against *P. aeruginosa, S. aureus, Bacillus subtilis* and *Salmonella typhimurium* (Stojanovic et al., 2014), but without in vitro and in vivo studies the efficacy of the two plants in treating mastitis cannot be questioned.

To remedy superficial mammary wounds, ointments prepared according to different recipes are used, most of them are based on medicinal plants to which fir resin, wax, honey or eggs are added in varying proportions, and as excipients lard, sheep/goat fat or butter are used. *Callendula officinale* is a plant that appears in all ointment recipes, along with the addition of *Artemisia absinthum* leaves, walnut leaves (*Juglans regia*), *Chelidonium majus, Hypericum perforatum* or hazel kernels (*Corylus avellana*). The creams that have the composition of *Chelidonium majus* or *Juglans regia* leaves are also used to treat mammary papillomatosis.

For the control of external parasites, the animals are bathed using decoctions made from *Nicotiana tabacum* (tabacco), *Cannabis sativa* (hemp), *Atropa belladona, Chelidonium majus, Eqiusetum arvense* or *Veratrum album*. An in vivo study demonstrated the strong effect of *Nicotiana tabacum* in rabbits infested with *Sarcoptes scabiei*. The rabbits were treated locally by applying a decoction on the affected areas, leading to the complete healing of the lesions; also for a month and a half no reinfestations were observed. Tabacco extract is effective against ticks *Rhipicephalus sanguineus* and *Rhipicephalus appendiculatus*, but has a reduced action against lice (Nouri et al., 2014; Schorderet Weber et al., 2019). The decoction from the dried root of the *Veratrum album* in combination with the leaves of *Brassica oleracea* is used against lice in small ruminants (El Mahdy et al., 2017). *Veratrum album* is also used as anthelmintic, anti-inflammatory, antiseptic, or antipyretic (Grobosch et al., 2008). Fresh leaves of *Chelidonium majus* or dry plant powder are applied to lesions in the treatment of scabies in cattle.

In addition to the external antiparasitic effect, *Chelidonium majus* is also used as an anthelmintic, antibacterial, antifungal, antiviral, antiprotozoal, hepatoprotective, immunomodulatory, anti-inflammatory (Chakraborty & Kanti Pal, 2012; El Mahdy et al., 2017). The extract of *Atropa belladonna* at a concentration of 20% was lethal to the ticks *Rhipicephalus microplus*, and against the larvae it was effective at a concentration of 10% (Godara et al., 2014). All plants used as treatment for external parasites are toxic to

ruminants if the therapeutic doses are exceeded, and animal breeders, aware of this fact, usually only allow certain people with experience to perform treatments.

Statistical data analysis

Of the total number of plants identified in this study, according to the classification made by Lans et al., 2007, the majority were classified in categories A and B (Figure 3), in the specialized literature, there being sufficient information regarding their chemical composition and their therapeutic efficacy.

Only about *Lathraea squamaria* and *Phaseolus vulgaris* used to treat mastitis pharmacologically relevant information has not been found, but without in-depth studies the therapeutic effect cannot be questioned.

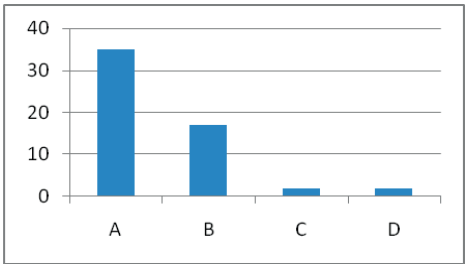

Figure 3. Classification of the plants (according to Lans et al., 2007)

The plants with the highest frequency of occurrences in all the investigated area were acacia (*Robinia pseudoacacia*) used to treat diarrhea, indigestion or anthelmintic effect, with 115 occurrences (48%), followed by pelin (*Artemisia absinthium*) with 114 occurrences used in most of the conditions investigated (diarrhea, indigestion, skin wounds and foot disorders, internal and external parasites) and *Sempervivum tectorum*, identified 102 times, used to treat mastitis and acute meteorism.

Other remedies

In addition to the plants analyzed above, there are also a number of remedies of mineral or animal origin. Some of them, such as fine powdered sugar administered intraocular, are found to be a common practice in the treatment of eye disorders in many countries of the world, others, such as hedgehog or badger skin pig or bear bile administered in mastitis appear to be a part of ancient local rituals.

CONCLUSIONS

The area of the Curvature Subcarpathians remains an inexhaustible source for documentation on ethno-veterinary medicine and a very important source of medicinal plants. The investigation carried out in this study highlighted the ethnotherapeutic use of 135 herbal remedies, both of mineral and animal origin.

Gentiana lutea was the most widely used plant, mainly the root and the rhizome, in adult bovine diarrhea, formulated as an alcoholic extract, macerated or decocted. His effectiveness is scientifically proved.

Alcohol extract from the root of *Inula helenium* is used in the treatment of diarrhoea, in mixture with *Salix alba* young branches and leaves, administered alone or together with leaves of *Robinia pseudoacacia,* or in the form of decoction.

The plants with the most frequent use in the investigated area were: *Robinia pseudoacacia* (acacia) used to treat diarrhoea, indigestion or internal parasites (48%), *Artemisia absinthium* to treat diarrhoea, indigestion, skin wounds and foot disorders, internal and external parasites (48,1%) and *Sempervivum tectorum* used to treat mastitis and acute meteorism (43.03%)

For the treatment of mastitis, 13 plants were identified, of which four plants are found in all the investigated areas. *Sempervivum tectorum*, *Lathraea squamaria*, *Hylotelephium spectabile* and *Hylotelephium telephium* are the plants frequently used to treat mastitis, but there are no scientific studies to support their therapeutic efficacy.

Ethno-medicine, beyond remaining an alternative for small farmers who practice traditional agriculture or for the farmers who practice organic farming, can provide the solution to balance the abuse of antibiotics.

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