Chapter 26

# Benefits of Veterinary Phytotherapy in Animal Health and Welfare

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**ABSTRACT**

Worldwide, the use of medicinal plants has a long historical history. Currently, to the ancestral empirical knowledge about the healing properties of plants, we add those generated from scientific methodologies, which expand the understanding of the forms of use, the spectrum of action and the active substances present in different plants, such as foundation of Medicinal Herbalism or Phytotherapy. The basis of its application is in the metabolic compounds produced by plants; among others, phenols, flavonoids, phytosteroids, tannins and polyphenols represent active ingredients that give plants their therapeutic action. The options available in each region depend on the diversity of endemic and exotic plants available, and the variants in the active ingredients, determined by the geographical, climatic and soil conditions that influence the metabolism of the plants. Phytotherapy is not limited to livestock species; it also includes farm animals (fish and crustaceans) and companion animals. The benefits that veterinary phytotherapy brings to animal health and well-being are extended to the environment, by using medicines made from non-polluting natural materials.

**KEYWORDS**
Veterinary phytotherapy, Animal welfare, Animal health, Plant extracts, Bioactive compounds

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## INTRODUCTION

Throughout history, the use of natural treatments based on medicinal plants appears as a common denominator in all times, regions and cultures. Ancestral empirical knowledge about the healing properties of plants increases with that generated under different scientific methodologies, as the foundation of current Medicinal Herbalism or Phytotherapy. Thus, from the administration of infusions, juices, plasters, poultices, among others, made with whole plants, we have moved on to the use of dosages of extracts obtained from specific parts of the plants, due to the knowledge about the active compounds they present and the benefits they provide for well-being and health (Altemimi et al., 2017; Martínez and Jiménez, 2017).

The botanical diversity existing on the planet offers countless therapeutic options, both for humans and animals. In humans, since the 90's, the World Health Organization (WHO) has identified medicinal plants as an invaluable treasure for health. They associate this assessment with the abundance and therapeutic active ingredients of plants, their low costs, accessibility, as well as the wide use estimated in about 80% of the world population (Akerele, 1993).

Although there is no explicit recognition by the World Organization for Animal Health (WHO), the truth is that for decades veterinary phytotherapy has been part of the alternative medicine used in animals, based on the forms of use and spectrum. of action of its active substances, with the purpose of preventing, controlling or curing diseases in favor of animal well-being (García, 2008).

### Bioactive Compounds of Plants and Therapeutic Properties

Plant metabolism involves two different processes. Primary metabolism, which is responsible for generating the metabolites that are, involved in the growth, development and reproduction processes of plants. Secondary metabolism, on the other hand, produces metabolites that allow plants to develop defense mechanisms against environmental stress and their predators. Unlike the rest of living beings that only have primary metabolism; as an adaptation mechanism, plants develop a second metabolism in which they use a significant amount of the carbon they assimilate, in the production of metabolites for their defense: secondary metabolites (Ávalos and Pérez-Urria, 2009).

The basis of phytotherapy is the use of these metabolites, «natural products» or «bioactive compounds». Unlike veterinary homeopathy, which uses plant resources (in addition to those of animal and mineral origin), to activate the immune response of the sick animal; Veterinary Phytotherapy makes use of these compounds to directly combat infectious agents and parasites that cause diseases, organic disorders and other conditions in animals (García, 2008).

The type and amount of active compounds vary in their proportion and concentration, between a plant, between one portion and another (root, stem, bark, leaves, flowers, fruit) and even in the same species of plant that grows in different places. Climatic and geographical conditions and particularly the nutrient contents in the soil are determining factors in these differences. Likewise, the type of extractions carried out usually introduces variations in performance, regarding the amount of metabolites obtained and the effectiveness of the extract. (Degaïchia et al. 2022), carried out the extraction on leaves of two *Cupressus* species originating from Algeria (*C. siempervirens* and *C. arizonica*) using solvents of different polarities, chloroform (low), petroleum ether (intermediate) and aqueous methanol (high). They found that with the hydroalcoholic methanol solution, a greater number of secondary metabolites were extracted in both species (9/11), gallic tannins and saponosides were not extracted. In ether extraction, there were differences between species. For *C. arizonica* 2/11 (saponosides and triterpenes) and for *C. siempervirens* (4/11) in addition to those obtained in the other species, leucoanthocyanins (flavonoid) and steroids. While with chloroform 2/11 and 3/11, respectively. However, the yield of phenolic extracts was higher in chloroform extractions with 52,27% for *C. arizonica* and 61,23% for *C. siempervirens*. The yields for methanol were very close for both species (33,55 and 33,22%) and for ether; they turned out to be minimal, 1,29 and 0,39%, respectively. In the comparison of effects against *Pseudomonas aeruginosa*, they determined that methanolic extractions induced a strong sensitivity, while, with ether and chloroform extracts, the sensitivity was weak.

The number of bioactive compounds identified in different plant species is usually variable. Table 1, integrates some of these compounds identified in plants for veterinary use. The information shows that no two plants are similar in their bioactive compounds. Some, such as phenolic acid, whitanoids, phlobatanins and anthraquinones, occur exclusively in some plant species with different geographical origins (Eguale and Giday, 2009; Moya and Escudero, 2015; Nair et al., 2016; Mumed et al., 2022).

**Table 1:** Bioactive compounds present in plants for veterinary use

| PLANT | Chlorogenic | Phenolicacid | Paracoumeric acid | Alkaloids | Anthraquinonones | Carbohydrates | Coumarin | Phytosteroids | Flavonoids | Phlobatannins | Glycosides | Lignins | Monoterpenes | Polyphenoles | Saponins | Tannins | Terpenoids | Triterpenes | Whitanoids | REFERENCE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Allium sativum* (Garlic) | | | | | | | | | * | | | | | | * | | | | | (Moya and Escudero, 2015) |
| *Aloe vera* (Sabil) | | | | | | | | | | | | * | | | * | | | | | (Rojas et al., 2017) |
| *Alocasia indica* (Gianttaro) | | | | * | | | | * | * | | | | | * | * | * | | * | | (Islam et al., 2015) |
| *Ananas sativus* (Pineapple) | | | | * | | * | | * | * | | | | | * | * | * | | * | | (Islam et al., 2015) |
| *Artemisia absinthium* (Wormwood) | * | * | * | | | | | | * | | | | * | | | * | | | | (Moya and Escudero, 2015) |
| *Chenopodium ambrosioides* (Epazote) | | | | | | | | | | | * | | * | * | * | | | | | (Ketzis et al., 2002; Eguale and Giday, 2009) |
| *Croton macrostachyus* (Croton) | | | | | | | * | | * | | * | * | | | | * | | | | (Mumed et al., 2022) |
| *Curcuma longa* (Turmeric) | | | | | | | | | | | | | | * | | | | | | (Mesa et al., 2000; Al-Khafaf et al., 2023) |
| *Dennetia tripetala* (Pepper fruit) | | | | * | | * | | | * | | * | | | * | * | | | | | (Solomon et al., 2013) |
| *Echeveria elegans* (Alabaster rose) | | | | * | * | | | * | * | | * | | | | * | * | | * | | (Nair et al., 2016) |
| *Erythrina variegate* (Coral tree) | | | | * | | | | * | * | | | | | * | * | * | | * | | (Islam et al., 2015) |
| *Jatropha curcas* (Tempate pine nut) | | | | | | | | | | | | | | * | | | | | | (Eguale and Giday, 2009) |
| *Lawsonia inermis* (Henna) | | | | | | | | * | * | | * | | | * | | | | | * | (Eguale and Giday, 2009) |
| *Lippia graveolans* (Oregan) | * | | * | | | | | | * | | | | | | | | * | | | (Barahona, 2016) |
| *Nicotiana tabacum* (Tobacco) | | | | * | | | * | | * | | | * | | | | * | | | | (Mumed et al., 2022) |
| *Silybum marianum* (Marian thistle) | | | | | | | | | * | | | | | | | | | | | (Moya and Escudero, 2015) |
| *Zingiber officinale* (Ginger) | | | | * | | | | * | * | * | | | | | * | * | * | | | (Mumed et al., 2022) |

**Source**: Own elaboration with case in the cited references.

The most common are flavonoids, saponins, polyphenols and tannins. Its form of action is different, such as tannins that participate in the capture of free radicals or saponins that reduce cholesterol levels. Despite this differentiation, both flavonoids, lignin and tannins are phenolic compounds, which prevent oxidative damage. For some plants, it has been possible to make a more specific characterization of these bioactive compounds, as well as their properties. Such is the case of curcumin (polyphenol) in turmeric or the flavonoids of oregano (apigenin and luteolin), garlic (apigenin and myricetin) or wormwood (artemisetin and artemetin). These compounds confer different therapeutic properties to plants (Solomon et al., 2013; Islam et al., 2015; Barahona, 2016; Rojas et al., 2017). Table 2 shows some therapeutic properties of plants, listing some of the associated species.

**Table 2:** Therapeutic properties of plants used in veterinary phytotherapy

| Therapeutic property | Plants | Reference(s) |
|---|---|---|
| Anti-stress | *Ambrosia cumanensis* | (Villalobos, 2006) |
| Anthelmintic | *Allium sativum*, *Artemisia ansinthium*, *Aspidosperma quebracho-blanco*, *Azadirachta indica*, *Baccharis coridifolia*, *Chenopodium ambrosioides*, *Cydista aequinoctialis*, *Croton macrostachyus*, *Drimys winteri*, *Flaveria bidentis*, *Foeniculum vulgare*, *Heliotropium indicum*, *Juglans regia*, *Kalanchoe daigremontiana*, *Lupinus albus*, *Momordica charantia*, *Nicotiana tabacum*, *Otholobium glandulosum*, *Peumus boldus*, *Punica granatum*, *Ruta chalepensis*, *Tecoma stans*, *Thymus vulgaris*, *Vallesia glabra*, *Zanthoxylum coco* | (Avello et al., 2006; García, 2008; Mayer et al., 2014; Moya and Escudero, 2015; Espinosa-Moreno et al., 2016; Martínez and Jiménez, 2017; Rivero-Pérez et al., 2022) |
| Anti-inflamatory | *Aloe vera, Salpichroa origanifolia, Croton menthodorum*, *Curcuma longa, Echeveria elegans, Ficus racemosa*, *Manguifera indica*, *Opuntia fícus indica*, *Piper lenticellosum* | (Mandal et al., 2000; Boerisa and Toso, 2009; Souza et al., 2017; Soleimani et al., 2018) |
| Antihyperlipidemic | *Artemisia absinthium,Curcuma longa* | (Moya and Escudero, 2015; Soleimani et al., 2018) |
| Antimicrobial | *Anethum graveolens*, *Curcuma longa*, *Hibiscus sabdariffa*, *Kalanchoe daigremontiana*, *Lippia graveolens*, *Silybum marianum*, *Thymus vulgaris* | (Olaleye, 2007; García, 2008; Barahona, 2016; Soleimani et al., 2018; Ponsati and de Freitas, 2020; Rivero-Pérez et al., 2022) |
| Antioxidant | *Artemisia absinthium, Curcuma longa, Echeveria elegans* | (Castro et al., 2023) |
| Antipyretic | *Croton macrostachyus*, *Lawsonia inermis* | (Eguale and Giday, 2009; Mumed et al., 2022) |
| Antiseptic | *Eucaliptus cinerea*, *Pimpinella anisum, Rosmarinus officinalis*, *Thymus vulgaris* | (García, 2008) |
| Antiviral | *Artemisia absinthium* | (Moya and Escudero, 2015) |
| Healing | *Aloe vera, Daptura ferox*, *Mycenastrum corium* | (Martínez and Jiménez, 2017; Carrasco and Mariño, 2022) |
| Gastrointestinal disorders | *Achillea millefolium, Aloysia polystachya*, *anadenanthera colubrina*, *Artemisia absinthium*, *Cocos nucifera*, *Chamaemelum nobile*, *Lavandula angustifolia*, *Linum usitatissimum* (semillas), *Mentha spicata*, *Opuntia ficus-indica*, *Origanum vulgare*, *Sambucus nigra*, *Schinus fasciculatus*, *Sphaeralcea bonariensis* | (García, 2008; Mayer et al., 2014; Martínez and Jiménez, 2017) |
| Hepatoprotective | *Angelica sinensis, Artemisia absinthium*, *Astragalus membranaceus*, *Bidens odorata*, *Capparis spinosa*, *Cichorium intybus*, *Cuscuta chinensis*, *Cynara scolymus*, *Equisetum hyemale*, *Ginkgo biloba*, *Glycyrrhiza glabra*, *Linum usitatissimum Litsea coreana, Lycium barbarum*, *Peumus boldus*, *Phyllanthus amarus*, *Rosmarinus officinalis*, *Salvia miltiorrhiza*, *Sapindus mukorossi*, *Schisandra chinensis*, *Silybum marianum*, *Solanum nigrum*, *Tecoma stans*, *Vitex trifolia*, *Woodfordia fruticosa* | (García, 2008; Rosales et al., 2017; Alí et al., 2018; Ponsati and de Freitas, 2020) |
| Hypoglycemic | *Artemisia absinthium*, *Cicer arietinum*, *Citrullus colocynthis,* *Echeveria elegans* | (Afsheen et al., 2013; Moya and Escudero, 2015) |
| Hypotensive | *Echeveria elegans* | |
| Inmunoestimulant | *Aloe vera, Lupinus albus* | (Mayer et al., 2014; Souza et al., 2017) |
| Painkiller | *Aloe vera*, *Salpichroa origanifolia* | (Boerisa and Toso, 2009; Souza et al., 2017) |
| Nutraceutical | *Artemisia absinthium* | (Moya and Escudero, 2015) |

**Source**: Own elaboration with case in the cited references.

**Phytotherapy: Different Options for the Same Objective**

Research carried out with plants to test their therapeutic effects tends to focus on diseases that cause significant effects on the health and well-being of animals. The approximations that are generated account not only for the effectiveness of the treatments, but also for the range of options used in each region, based on the native plants available. Taking as a reference to show these differences, Hemonchosis caused by *Haemonchus contortus*, the most important parasitosis in sheep worldwide, due to its wide distribution, prevalence and incidence. Considered the most pathogenic gastrointestinal nematode, since it usually affects all stages of the life of sheep, although the most susceptible are lambs and pregnant females. Its hematophagous habits and its location in the abomasum significantly affect the digestive processes and nutrient absorption. Consequently, animals develop anemia, weight loss, diarrhea, and in the most serious cases of infestation, it causes emaciation and sudden death, with consequent economic losses for producers (Hamad et al., 2013; Ojeda et al., 2022).

The impact of this parasitosis is associated with the great capacity for adaptation of *H. contortus* to different climates and multiple resistance to commercial anthelmintics such as Levamisole, Ivermectin, Closantel and Fenbendazole (Muchiut et al., 2013). In addition to this, the serious damage caused to the environment by waste disposal, the costs of treatments, their low availability and access in some regions, have encouraged the search for alternative treatments for this parasitosis (Mumed et al., 2022).

As part of the search for new alternatives, various investigations analyze the anthelmintic effectiveness of different plants against this nematode. In a study carried out in Addis Ababa, capital of Ethiopia, we sought to test *in vitro* the effectiveness of aqueous and hydroalcoholic extracts of henna leaves (*Lawsonia inermis*) and epazote (*Chenopodium ambrosioides*), as well as tempate pine nut seeds (*Jatropha curcas*), collected in their natural environment, against *H. contortus*. Seven concentrations of the extracts were used (0.03, 0.06, 0.125, 0.25, 0.5, 1 and 2 mg/mL). The greatest efficiency in inhibiting egg hatching was for *C. ambriosioides*, followed by *J. curcas*, for both types of extracts, although it was higher in the first, with 100% in concentrations 0.5-2 mg/ mL and *J. curcas* only for 2 mg/mL. For *L. inermis*, little significant efficacy is reported, the highest percentages of inhibition 25-30% were achieved at the highest doses. As for adults, only the aqueous extracts of *C. ambriosioides* reduced motility and increased mortality of larva 3 (L3) (Eguale and Giday, 2009).

In another study also with plants from Ethiopia, but in Haramaya, eastern area of Haraghe, Mumed et al. (2022), carried out an *in vitro* evaluation of the anthelmintic efficacy of crude methanolic extracts of leaves of two plants (*Croton macrostachyus* and *Nicotiana tabacum*) and the rhizome of *Zingiber officinale* against adults of *H. contortus*. For each extract, they used concentrations of 62.5, 125, 250 and 500 mg/mL, distilled water as a negative control and Albendazole as a positive control at a concentration of 1.25 mg/mL. At 2 hours post-treatment, in all cases, the highest mortality was associated with the highest concentration (500 mg/mL). With greater effectiveness for *N. tabacum* (9,33±0,667/10) and Albendazole with the same effectiveness as *Z. officiniale* (4,67/10). At 6 hours all concentrations with 100% mortality, except for *N. tabacum* with 8,33 (62.5 mg/mL) and *Z. officiniale* with 6.33% (dose 62.5 mg/mL), 9,00% (125 mg/mL); 8,33% (250 mg/mL) and 9,33% (500 mg/mL). Albendazole achieved a mortality of 6.00 (4 hrs), 8.00 (6 hrs) and 10.00 (8 hrs). A high nematicidal efficacy of the extracts was determined, except for *Z. officiniale*, comparable to the commercial anthelmintic, but without the risks entailed by its use.

On the other hand, in a study carried out in Mexico with plants of traditional use collected in Macuspana, Tabasco, Espinosa-Moreno et al. (2016), evaluated *in vitro* the anthelmintic activity against L3 larvae of *H. contortus*. They used aqueous extracts of *Cydista aequinoctialis* and *Heliotropium indicum* leaves and from leaves and fruit of *Momordica charantia* at a concentration of 20 mg/mL. As a negative control, distilled water and positive Fenbendazole (1 mg/mL). They recorded the mortality of L3 from the beginning of the confrontation (0), and at 24, 48 and 72 hours. At 24 hours, they obtained the highest percentage of mortality with the extracts of the fruit of *M. charantia*, (23%) and the lowest with the leaves of *C. aequinoctialis* (9.67%), with Fenbendazole with 99,1%. At 48 hours, the highest percentage was recorded in the *M. charantia* leaf extract (46,87%), followed by the fruit extract of this plant (43,37%), Fenbendazole with 100%. In the last measurement (72h) the highest percentage of mortality corresponded to the test with fruit extract (68,13%) followed by the leaf extracts of *M. charantia* (53.83%), *C. aequinoctialis* (39,57%) and *H. indicum* (19.75%).

Finally, Islam et al. (2015) carried out an *in vitro* evaluation of the anthelmintic effect of three plants from Bangladesh against adults of the trematode *Paramphistomum cervi* and the nematode *H. contortus*. They used aqueous extracts of *Ananas sativus* leaves, *Erythrina variegata* bark, and *Alocasia indica* rhizomes at concentrations of 25, 50 and 100 mg/mL, distilled water as a negative control and Albendazole as a positive control (15 mg/mL). They quantified the anthelmintic effect based on the times of paralysis and death of the adult parasites. In the different concentrations of the extracts used, the quantified times were shorter for *P. cervi* than for *H. contortus*, likewise, lower at the concentration of 100 mg/mL. For *P. cervi*, Albendazole had a paralysis time (minutes) of 14.62 and death time of 22.10, while for *H. contortus* of 26,56 and 37,24 min, respectively. From the results, it was determined that the *E. variegata* bark and *A. sativus* rhizome extracts had a significantly lower anthelmintic effect than the *A. sativus* leaves, which showed greater efficacy, especially with the hydroalcoholic extracts. Likewise, the effects are greater in *P. cervi* than in *H. contortus*.

The set of these studies and their results serve to highlight several aspects that are important in phytotherapy. In principle, the way to approach the generation of knowledge about the therapeutic applications of plants presents various approach options. Thus, although we seek to address the same objective, as in this case, the anthelmintic efficacy of different plant structures against *H*. *contortus*, the methodological approach is different. In the aforementioned studies, they used different local plants, as well as components (leaves, bark, rhizome or fruit). There are variations in the types of extraction, the concentrations used, the exposure times, as well as the phase of the life cycle affected (egg, larva or adult). These differences highlight other relevant aspects in phytotherapy, among others:

1. Distribution and availability: Plant diversity is variable in each region of the world. The ecological, geographical and climatic characteristics are determining factors in its distribution. Although many may be native, endemic, and therefore available only in some places, others can expand their distribution by being artificially introduced as exotic species, which also increases their availability (Galán et al., 2019).

2. Characteristics of plants: The bioclimatic distribution, time of year, as well as the environmental and soil characteristics in which plants grow, are determinants of the types and quantity of secondary metabolites that may be present in them. Variations in soil nutrients have a direct effect on the secondary metabolism of plants and, therefore, on the phytochemicals they produce (Ávalos and Pérez-Urria, 2009; Solomon et al., 2013).

3. Plant components: Plant components can serve different purposes, which depends on the secondary metabolites that are present in each portion. For example, in a phytochemical screening carried out on *Dennettia tripleta*, it was determined that flavonoids and saponins were present in the stem bark extracts, but were absent in the roots of this plant (Solomon et al., 2013).

4. Characteristics of the extractions and identification of active compounds: The protocols followed in the extractions determine the characteristics of the phytotherapeutics. The plant/solvent proportions, the types of solvents and the procedures to determine the presence of active compounds (secondary metabolites) are decisive for the confrontation of their effects. Between solvents, there are differences in extraction efficiency. Dimethylformamide and acetone are highly effective in the extraction of antioxidants. Ethanol extracts greater amounts of phenolic compounds than water, acetone and methanol. However, given the high polarity of methanol, it has greater precision in the extraction of different bioactive compounds. In general, the higher the polarity of the solvent, the better the precision of the extraction (Altemimi et al., 2017; Mumed et al., 2022).

5. Differentiated extraction: Depending on the solvents used for the extraction of bioactive compounds, the results are different. In the phytochemical analysis of *Dennettia tripleta*, using as solvents: water, 70% ethanol, acetone, methanol and hexane. Hexane extracted the sterols from the plant, while the Terpenoids, from the extracts with water and methanol. In the analysis of *Echeveria elegans* leaves, using benzene, acetone, hexane, chloroform and ethanol as solvents, it was only possible to extract anthraquinones with benzene, steroids with all solvents except benzene, while triterpenoids, only with hexane and chloroform. From this, success in determining the active components will depend on the type of solvents used and their presence in the selected part of the plant (Solomon et al., 2013; Kumar et al., 2016).

6. Concentration of doses and exposure time: All studies carried out *in vitro* show that the concentrations used of the extracts, as well as the exposure times, vary in their results. Furthermore, there are variations between the parasite species in question (Mumed et al., 2022).

**Use of Phytotherapy in the Health and Well-being of Animals**

Veterinary phytotherapy is an alternative for animal care, whether for prophylactic purposes, to treat diseases in their early stages, recurrent infections or chronic diseases. Likewise, it is used in feeding supplementation, to promote the growth and development of animals, as well as to increase the production and quality of milk, improve the quality of colostrum and the composition of milk, which means benefits for offspring and for human consumption (Davidović et al., 2012; Al-Khafaf et al., 2023).

In pets (dogs and cats) it is usually used with high frequency to control stress, improve blood circulation, treat dermatitis and wounds, promote good gastrointestinal, liver and kidney functioning, diabetes, hepatitis and mainly for the control of parasites such as ticks, fleas and *Toxocara* spp., among other conditions (Villalobos, 2006; Ponsati and de Freitas, 2020; de Almeida et al., 2023).

However, its use is usually broader in domestic species, particularly livestock. The great diversity of plants used for veterinary therapeutic purposes in the world is incalculable, since until now there is a lack of inventories in this regard. Some countries already have the identification of medicinal plants useful for Ecological and Organic livestock: 92 plant species in Spain, 31 in Panama (García, 2008) and 590 in Europe (Mayer et al., 2014).

Veterinary phytotherapy uses plants with therapeutic properties to treat different conditions of animals, with the purpose of restoring their health and contributing to their well-being. In general, they include care for respiratory and digestive conditions, hepatic colic, cystitis, skin infections, wounds; as well as its use as antibacterial, antidysenteric, antiamebiotic, fungicidal, spasmolytic, appetite stimulant, antifungal, diuretic, purgative, antihemorrhagic, healing, antidiarrheal, tranquilizer, among many others. Those most frequently used are dewormers, mainly for endoparasites of cattle and sheep (García, 2008).

In the latter, there is evidence that shows that depending on the plant and the type of preparation carried out, the results obtained are different. For example, in a study in goats in which the effectiveness of epazote (*Chenopodiumambrosioides)* on *H*. *contortus* was tested, they observed that the essential oil is highly effective in inhibiting the larval activity of these nematodes. In the form of extracts, aqueous extracts inhibit egg hatching and larval activity, while hydroalcoholic extracts act on the activity of adults (Ketzis et al., 2002).

Likewise, the dose administered may vary depending on the type of extraction used to prepare the preparation, the parasite in question and the severity of the parasitosis. In the case of *Allium sativum* (garlic), to inhibit the activity of gastrointestinal nematodes, doses of 100 mg/mL are required in aqueous extracts and in ethanolic extracts, the dose varies between 25-50 mg/mL. In the case of fennel (*Foeniculum vulgare*), different concentrations (25, 50, 100, 200 mg/mL) of aqueous and ethanolic extracts of fruits with high anthelmintic efficacy are used. However, for the total inhibition of infecting larvae (L3) of *H. contortus*, the concentrations have the same numerical scale (25, 50, 100, 200) but in microliters (µL) (Moya and Escudero, 2015). Table 3 integrates some diseases and the components of the plants used for their treatment, in different domestic species.

**Table 3:** Phytotherapy in domestic species

| Species | Disease | Plant | Portion | Reference(S) |
|---|---|---|---|---|
| Dogs | Ectoparasites (fleas and ticks) | *Gloricidia sepium, Azadirahta indica* | Leaves | (Villalobos, 2006) |
| | Diabetes and hepatitis | *Silybum marianum* | Seeds | (Ponsati and de Freitas, 2020) |
| Rabbits | Hyperglycemia | *Cicer arietinum*, *Citrullus colocynthis* | Fruit | (Afsheen et al., 2013) |
| Poultry | Ectoparasites and scabies | *Anadenanthera colubrine*, *Larrea divaricata*, *Tecoma stans* | Leaves Cortex | (Villalobos, 2006; Martínez and Jiménez, 2017) |
| | Infectious coryza (distemper) | *Bixa orellana*, *Clematis montevidensis* | Leaves | (Villalobos, 2006) |
| | Newcastle | *Pedilanthus tithmaloides* | Stem | (Villalobos, 2006) |
| | Colibacillosis | *Lippia graveolens/Psidium guajaba* | Leaves / Fruit | (Barahona, 2016) |
| Pigs | Inflammation due to fracture, blows | *Manguifera indica* | Leaves | (Villalobos, 2006) |
| | Orchiectomy wound healing | *Daptura ferox*, *Mycenastrum corium* | Spores | (Martínez and Jiménez, 2017) |
| Sheep | Low milk production | *Curcuma longa* | Rhizome | (Jaguezeski et al., 2018) |
| | Hemonchosis | *Guazuma ulmifolia/Nicotiana tabacum* | Cortex/ Leaves | (Hamad et al., 2013) |
| | Wounds and injuries | *Anadenanthera colubrina* | Cortex | (Martínez and Jiménez, 2017) |
| Cows | Tick infestation | *Cymbopogon citratus* | Fruit | (Heimerdinger et al., 2006) |
| | Inflammation of the udder, bruises | *Manguifera indica* | Leaves | (Villalobos, 2006) |
| | Malnutrition | *Curcuma longa* | Rhizome | (Mesa et al., 2000) |
| | Retained placenta | *Cucurbita moschata/ Hylocerus undatus/ Jodina rhombifolia* | Seeds / Stem / Leaves | (Martínez and Jiménez, 2017) |
| | Tympany | *Guazuma ulmifolia* | Cortex | (Mesa et al., 2000) |
| | Spider bite | *Bursera simaruba* | Cortex | (Villalobos, 2006) |
| | Wounds and injuries | *Allium sativum*, *Agave americana*, *Anadenanthera colubrina* | Bulb | (Martínez and Jiménez, 2017) |
| Horses | Heat stress | *Ambrosia cumanensis* | Leaves | (Villalobos, 2006) |
| | Spider bite | *Crescentia alata*, *Enterolobium cyclocarpum* | Fruit | |
| | Muscle regeneration | *Aloe vera* | Pulp | (Rojas et al., 2017) |

**Source**: Own elaboration based on the references that are registered

**Conclusion**

Within alternative medicine, veterinary phytotherapy offers the possibility of using local and accessible resources available based on the diversity of both endemic and exotic plants to apply treatments that have shown their effectiveness. More than a displacement of the use of drugs, the use of secondary metabolites obtained from plant extracts is presented as a more accessible and effective alternative to address animal diseases from their initial manifestations, as well as to propose new strategies for their prevention and complementary treatment. Advances in the identification of active compounds such as tannins, polyphenols, flavoniods and phytosterols, among others, as well as their therapeutic characteristics expand the possibilities of their application. This, in addition to contributing to animal health and well-being, has a positive impact on the development of sustainable and safe production, by not generating waste in livestock products, essential to meet the growing demand for protein of animal origin.

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