

Sheep parasitism and its control by medicinal plants: A review

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Review Article

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ABSTRACT

Sheep production is a major source of income for resource poor farmers of the world. The main purpose of sheep raising is to fulfill the needs for mutton, milk, and wool production. Parasitic diseases, one of the principal hindrances in the development of commercial livestock business, are facilitated through favorable climatic conditions and lack of awareness. A variable prevalence ranging from 18.63 to 100% of different gastrointestinal parasite (GI) species in sheep were reported from different parts of the world. Incidence, prevalence, and intensity of parasitic infections is a multifactorial phenomenon and depends on environment, geographic location, pasture condition, host characteristics, grazing habits, and nutritional status. Prevalence of parasitic infections not only adversely affects animal health but also causes huge economic losses up to billions of rupees by decrease in milk, meat and wool production, retarded growth, parasite control measures and death of animals. For the control of GI parasites in small ruminants especially kept by resource-poor farmers, it is better to identify the burden and types of helminths along with specific risk factors associated with helminthosis of a specific area. Factors responsible for development of resistance are lavish use of anti-parasitic drugs, poor efficacy of anti-parasitic agents, inadequate dose level, low protein diet and environmental toxicity. Due to limitations of chemotherapy during the past decade, use of plants with anthelmintic properties (ethnoveterinary medicine) are under consideration around the world. A number of plant species have been identified with anti-parasitic properties that may disturb the regular physiological functions of parasites. Use of plants with anthelmintic properties is considered the best choice for control of parasites in the present scenario. In this review, sheep production, GI parasitic infection of sheep, medicinal plants, and their uses for control have been described.

Keywords: gastrointestinal parasites, phytotherapy, prevalence, sheep, treatment.

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INTRODUCTION

The economy of a country depends upon definite factors, and livestock is one of them. Livestock are the main source of wool, milk, meat, manure, and hides^[1]. In the world, about 770.8 million tons of milk and 65,838 thousand tons of meat are produced from large ruminants; 4.5 million tons of milk and 15048 tons of meat from small ruminants^[2,3]. The livestock sector plays a vital role in agriculture economy of Pakistan and shares more than 50% in gross domestic product (GDP). Main products obtained from sheep industry are milk, mutton and wool. In the sheep production system, wool is a good source of earning. However, milk obtained from sheep industry cannot meet the milk requirements, although it is especially good in

quality and suitable for human consumption^[4]. On the otherhand, parasitic infection is one of the most prevailing reasons that prevents achievement of all these benefits from sheep production system. Due to poor housing system, malnutrition, poor production system, management practices and burden of parasitic diseases small ruminant industry is not getting full benefits^[5,6].

For the control of GI parasites in small ruminants especially reared by resource-poor farmers, it is better to identify the burden and types of helminths along with specific risk factors associated with helminthosis of specific area^[7]. Breakdown of life cycle of GI parasites is the main goal in attempting the

control of parasitic infection. Use of anthelmintics and proper management (of both animals and pastures) help to disturb the life cycle of GI parasites. Specific combination of these factors usually gives the best results for control of GI parasites^[8]. In developing countries, anti-parasitic drugs are used lavishly for the control of parasitic infections especially by smallholder farmers, leading to the development of resistance. Other factors responsible for development of resistance are: poor efficacy of anti-parasitic agents, inadequate dose level, low protein diet and environmental toxicity^[9]. Development of resistance against anthelmintics and their residual effects stimulate scientists to investigate alternative sources to control parasitic infection and to improve public health^[10]. Keeping in view the limitations of chemotherapy, alternative solutions like biological control of parasites, use of vaccines and development of resistant host genotypes are being considered.

During the past decade, use of plants with anthelmintic properties (ethnoveterinary medicine) is also under consideration around the world^[11-15]. A number of plant species with anti-parasitic properties were identified. Fundamental mechanisms involved in inducing these effects were not completely investigated but they may consist of direct, indirect, or combined effects^[16]. In direct effects, components of plants disturb the regular physiological functions as reproduction, food absorption and mobility of GI parasites by directly interacting with their surface proteins^[17]. In indirect effects, condensed tannins (CT) released by plants build complexes with proteins and are passed to the abomasum without ruminal degradation. In the abomasum dissociation of these complexes releases proteins that are ready for absorption^[18].

In this review, the importance of sheep production in the economy of world, prevalence and species of GI parasites, strategies to control GI parasites, medicinal plants, and their uses for the control of GI parasites are described.

Sheep production

Nowadays, the livestock sector is one of the most secure and reliable sources of income for smallholder farmers around the world^[19]. Small ruminant farming in comparison with large animals is less expensive due to low maintenance cost, expenditures, startup investment and feedstuffs requirements^[20]. Different Asian countries are providing hygienic food and contribute to their economy by sustaining the small ruminant production system^[21]. In Pakistan, livestock share in agriculture has increased from 55.5- 59.5%, and the role in GDP has also increased from 11.5-11.9%. Similarly, a 2.7 billion increase in increment is reported in gross value due to livestock involvement^[22]. In Pakistan, the four practiced production systems include household, nomadic, sedentary, and transhumant.

In nomadic and transhumant systems, 90% feed is provided by rangelands^[23].

Among sheep producing countries, Pakistan is the 11th in number. A total of 26488 sheep are present in Pakistan and among these, 6362 (24%) are raised in Punjab. Baluchistan shares with 42% in total sheep population while 16% are from Sindh and 18% from Khyber Pakhtown Khawah^[24]. In Pakistan, about 28 recorded sheep breeds are divided into thin tail and thick tail categories. Environmental conditions of Pakistan are favorable for parasites propagation and survival in pastures round the year^[6]. Those areas where parasite prevalence is not high as in Sweden, Denmark, Netherlands and United Kingdom, production losses are relatively low^[25].

Gastrointestinal parasites

Livestock play a vital role in agriculture economy, but due to poor management practices chances for parasitic infections increase^[26]. Grazing is the most common feeding method used for sheep; so, there are chances of higher worm load. Pastures are considered the most suitable locale for transmission of parasites, as most parasites hibernate in pastures and complete their lifecycle by gaining entry in the animal body. Parasites can inversely affect livestock and cause damage by reducing wool and hair growth, as well as cause blood loss and reduced body growth. Among parasitic infections that cause huge economic losses to the livestock industry, are those due to endoparasites (roundworms, tapeworms, flukes and coccidia), which are the most severe^[27]. Among endoparasites, *Haemoncus (H.) contortus* is the biggest threat to the livestock and sucks blood (approximately 0.05 ml blood per worm per day) from abomasum directly^[28]. Others that are gaining more importance e.g., *Trichostrongylus Cooperia*, *Nematodirus* and *Ostertagia* species should be considered while treating parasitic infections. Different studies have shown that losses caused by these parasites are more severe as compared to other infections^[29].

Prevalence of parasites depends on a variety of factors as environment, volume and height of pasture, geographical location, grazing habits, nutritional status of host and immunological factors. Along with breed, age, and epidemiological data (of both husbandry practices and physiological factors), involvement of parasitic species are important factors affecting the prevalence of parasites^[30]. In small ruminants, parasitic infections cause decrease in resistance against diseases, improper feed utilization and decrease in weight gain^[31].

For better control of parasitic infections, environmental factors and proliferating velocity of parasites should be taken into consideration. Although drugs used against parasites are of great value, but the increasing resistance to these drugs (because of their broad spectrum and excessive use), cost of drugs

and their remnants in blood and meat are the leading causes to find an alternative source to overcome these problems^[32,33].

Gastrointestinal parasites directly affect the host by disturbing metabolism, feeding on blood and causing damage to the intestinal wall^[34]. These parasites are also responsible for low food conversion ratio, low food absorption by intestinal wall and decreased appetite^[35]. Parasitic infection may lead to production losses as decrease in growth rate and reproduction^[36] as well as resulting in compromising the immune status of host and in turn increasing animal susceptibility for harmful pathogens^[37].

Prevalence of gastrointestinal parasites

Frequency of parasitic infections in sheep depends upon factors that include host breed, parasite species, epidemiological data, host age, humidity, parasite developmental stages, rainfall, temperature management practices and geography^[38]. Previous data indicates that GI helminths in sheep ranged from 25.1-92% in Pakistan^[15,37,39-43].

A wide range of parasites is prevalent in the sheep population of Pakistan such as *Avitellina* (*Av.*) *centripunctata*, *Paramphistomum* (*P.*) *explanatum*, *P. cervi*, *Cotylophoron* (*Co.*) *cotylophorum*, *Ostertagia* (*Os.*) *Circumcincta*, *Os. ostertagi*, *Moniezia* (*Mo.*) *expansa*, *Mo. betzedetzi*, *Bunostomum* (*B.*) *trigonocephalum*, *Chabertia* (*Ch.*) *ovina*, *Trichuris* (*Tr.*) *ovis*, and *Haemonchus* (*H.*) *contortus*^[44]; as well as *Trichostrongylus* sp., *Tr. globulosa*, *Os. circumcincta*, *Strongyloides* (*S.*) *papillosus*, *Mo. Expansa*, *Fasciola* (*F.*) *hepatica*, *Co. cotylophorum*^[45]. Studies from other countries revealed other species like *Dicrocoelium* (*D.*) *dendriticum*, *Strongyle* sp., *F. hepatica*, *Nematodirus* sp., and *Trichuris* sp., (Greece)^[46]; *Strongyloides* sp., *Schistosoma* (*Sc.*) *indicum*, *Trichuris* sp., *Bunostomum* sp., *F. gigantica* and *Strongyles* sp., (Bangladesh)^[47]; and *Bunostomum* sp., *Haemonchus* sp., *Trichostrongylus* sp., *Strongyloides* sp., and *Oesophagostomum* sp., (Ethiopia)^[48]. According to Domke *et al.*^[49], important helminths species infecting sheep in Norway are *Nematodirus* (*N.*) *filicollis*, *N. battus*, *N. spathiger*, *Cooperia* (*C.*) *oncophora*, *H. contortus*, *Os. trifurcata*, *Os. circumcincta*, *Ch. ovina*, *Trichostrongylus* (*T.*) *vitrius*, *T. colubriformis*, *T. capricola*, *B. trigonocephalum*, *Tr. ovis*, *Oesophagostomum* (*O.*) *venulosum*. In another study, the parasitic species found in sheep from Ghana were *Gaigeria pachyscelis*, *Cooperia* sp., *Trichostrongylus* sp., *Strongyloides* (*S.*) *papillosus*, *H. contortus*, and *O. columbianum*^[50]. Variable prevalences and species of GI parasites reported from different localities of Pakistan and other parts of the world are outlined in tables 1 and 2, respectively.

Strategies to control gastrointestinal parasites

For the control of GI parasites in small ruminants, especially those kept by smallholder farmers, it is better

to identify burden and types of helminths along with specific risk factors associated with helminthiasis in the specific area^[6,7]. The breakdown of GI parasites' life cycles through anthelmintics and proper management practices are the best methods to control parasitic infections^[51]. However the development of drug resistance to almost all parasitic helminths classes due to regular use of anthelmintics over past decades became a problem all around the globe.

Most of the anthelmintic compounds are used without registration and proper tests which directly affects their efficacy^[8]. Inadequate use of anthelmintic compounds, and poor efficacy of anti-parasitic agents, low protein diet and environmental toxicity are the factors that result in resistance development^[9]. Anthelmintic treatment of small ruminants in most countries is not being practiced regularly in a systemic way, which may have a considerable effect on the prevalence and abundance of parasitic species. Furthermore, sample size and nature of sample sources (faecal or autopsies) are also considerable factors in this regard^[52-54]. Keeping in mind the importance of parasitic infection and development of drug resistance, control trials for checking the efficacy of anthelmintic compounds should be carried out.

The development of resistance to anthelmintics and presence of drug residues in the food chain stimulate the investigation of alternative sources to control parasitic infection and improve public health. Anti-parasitic agents extracted from plants have also been used in human and animal populations but as compared to commercial anthelmintics, their scientific evaluation is limited^[55].

Alternate approaches to control parasites

Anthelmintic resistance is widespread in parasitic helminths, especially in nematode population around the world^[56]. To overcome this problem, an alternate strategy to control resistance is the manipulation of genetic variation. There are three ways to introduce the genetic variation *i.e.*, by selection of particular breeds, cross-breeding and selection among breeds^[57]. In Pakistan, some sheep breeds are resistant to *H. contortus* *e.g.*, the native Lohi breed^[58]. These methods are sustainable, efficient, safe, and economical; but the only hindrance is the need of expertise in genetic field^[59]. Another option is the grazing management and its strategies *e.g.*, rotational grazing, and movement to clean pastures^[59]. Grazing management scheme is related to ecology of helminth larvae, plant species in grazing pasture, epidemiology of GI parasites, climatological status, schedule of using anthelmintics and prevailing local conditions^[60,61]. Another method of control is by biological monitoring of a nematophagous fungus (*Duddingtonia flagrans*) which directly decreases the number of infective L3 larvae in pastures^[62]. Fungal spore addition in diet is also a method for control of worms^[63].

Table 1. Prevalence of gastrointestinal parasites from different districts of Pakistan.

	Muzaffar-Garh	Rawalpindi	Hyderabad	Toba Tek Singh	Cholistan	Lahore	Quetta	Peshawar	Kohat	Sialkot
Overall	62	72.00	41.91	44.17	43.60	72.08	49.47	35.40	40.50	32.60
<i>Haemonchus</i> sp.	28	58.10	24.60	22.98	18.80	29.58	71.36	11.80	13.60	23.40
<i>Fasciola</i> sp.	2	2.32	-	35.00	2.80	15.00	-	1.70	-	8.30
<i>Trichostrongylus</i> sp.	-	23.20	10.80	5.83	4.80	3.75	28.84	5.30	18.20	-
<i>Nematodirus</i> sp.	-	20.90	-	-	4.00	-	9.47	-	-	-
<i>Paramphistomum</i> sp.	7	-	-	-	-	-	-	-	-	-
<i>Teladorsagia</i> sp.	3	-	-	-	-	-	-	-	-	-
<i>Ostertagia</i> sp.	-	-	15.70	-	4.40	-	17.26	3.40	-	-
<i>Trichostrongylus</i> sp.	-	-	18.00	-	14.40	5.42	58.94	10.30	-	12.20
<i>Strongyloides</i> sp.	-	-	12.70	-	2.00	-	-	4.00	17.30	-
<i>Oesphagostomum</i> sp.	-	-	8.30	15.00	-	-	-	1.70	-	-
<i>Chabertia</i> sp.	-	-	4.30	-	-	-	-	-	-	-
<i>Monezia</i> sp.	-	-	-	8.93	1.20	5.42	-	1.70	14.80	-
<i>Strongyles</i> sp.	-	-	-	-	-	7.50	-	-	-	-
<i>Thysaniezia girdi</i>	-	-	-	-	-	-	-	-	16.00	-
Study population (n)	100	86	1200	840	250	240	960	186	200	384
References	[40]	[88]	[89]	[90]	[42]	[91]	[92]	[93]	[36]	[94]

Table 2. Prevalence of sheep gastrointestinal parasites from different countries of the world.

	Turkey	Kenya	KSA	Egypt	Ethiopia	Germany	Bangladesh	Cameroon	Sri Lanka	New Guinea	India	Iraq	Nigeria
Overall	100	50.4	18.63	51.9	46.07	62.8	81.1	73.1	94.4	72	62.02	86.71	43.1
<i>Haemonchus</i> sp.	-	35.8	14.6	7.9	-	32.9	-	23.1	-	-	-	-	4.5
<i>Fasciola</i> sp.	-	-	4.19	0.53	8.52	-	8.4	-	-	5.5	-	-	18.1
<i>Trichostrongylus</i> sp.	74	-	-	4.8	4.8	3.4	2.1	7.7	2.8	1.8	-	-	4.5
<i>Nematodirus</i> sp.	44	-	-	-	-	13	-	-	-	1.8	9	-	-
<i>Paramphistomum</i> sp.	-	-	-	2.12	0.87	-	44.2	-	2.8	-	-	-	4.5
<i>Teladorsagia</i> sp.	-	-	-	-	-	14	-	-	-	-	-	-	-
<i>Schistosoma</i> sp.	-	-	-	-	-	-	3.7	-	-	-	-	-	-
<i>Trichostrongylus</i> sp.	42	42	-	-	-	52	-	28.8	-	-	-	-	9.1
<i>Strongyloides</i> sp.	-	12	-	-	34.06	0.7	9.5	25	75	8.2	15.33	68.75	-
<i>Oesphagostomum</i> sp.	-	4.7	-	-	-	-	-	2.9	-	-	-	-	-
<i>Bunostomum</i> sp.	-	-	-	-	-	-	19	-	-	-	-	-	-
<i>Monezia</i> sp.	-	-	10.48	19.04	3.93	-	-	-	16.7	-	3.3	65.62	-
<i>Dicrocoelium</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Cooperia</i> sp.	-	5.5	-	-	-	0.3	-	-	-	-	-	-	-
<i>Strongyles</i> sp.	-	-	-	-	-	-	62.6	-	-	67.3	24.66	71.87	-
<i>Ostertagia</i> sp.	80	-	-	-	-	-	-	-	-	-	-	-	-
Study population (n)	50	307	1144	189	458	3924	190	104	100	110	750	143	44
Reference	[95]	[96]	[97]	[98]	[99]	[100]	[48]	[101]	[102]	[103]	[104]	[105]	[106]

The use of a botanical dewormer is a good approach and a possible solution to combat anthelmintic resistance^[64]. Plants have been used from ancient times for treatment purposes of domesticated animals and humans, constituting a large source of antibacterials, antiparasitics and insecticides agents^[65]. Plants are being studied in different parts of the world for their ovicidal, adulticidal and larvicidal activity^[11,12,14,52,55,66-68].

Phytotherapy

A traditional medicinal application that uses extracts from botanical origin to treat the animal and human illness is referred to as phytotherapy^[60,70]. Phytomedicine, botanical medicine and herbal medicine are the other names for phytotherapy^[71]. Herbal medicine has been considered a part of ethnoveterinary knowledge (EVK) or ethnoveterinary medicine (EVM). Definition of EVM is the interdisciplinary acquisition of local knowledge and its related expertise concerning the care of livestock products; with the primary objective of flourishing animal resources leading indirectly to improved human revenue^[13]. There are three main purposes of systematic research in EVM: firstly it can give necessary knowledge for maintaining therapeutic practices in livestock that can be satisfied according to local environmental conditions; secondly it can contribute to new curative drugs in the pharmacopoeia; and lastly it has a role in conservation of biodiversity^[72].

About 122 chemical components derived from the medicinal plants, were identified by researchers in the field of herbal medicine in 2001^[73]. Plants have the capability to develop certain chemicals which can provide protection against predators including herbivorous mammals, insects, and fungi^[69]. These chemical components are dangerous to their predators, but they have been found beneficial in treating animals' and humans' ailments. About 12000 secondary metabolites of botanical origin have been isolated and these numbers are 10% less than the entire chemical compounds. Chemical components of plants have an effect on animal and human bodies due to presence of available receptor molecules^[74]. However, inappropriate formulations and drug interactions of plants like *Dryopteris* (Male Fern), *Viscum* (Mistletoe) and *Corynanthe* (Yohimbe) can result in life threatening reactions^[75-77].

Control of parasites through plant sources

The alternative sources for anthelmintic drugs are of great interest to the animal rearer because of their herbal nature and easy availability^[78]. For consumers of both agriculture and livestock it is important that meat and other livestock products should be clean and green. In the clean sense it should be free from drugs residues treatments of animals such as antibiotics and anthelmintics, which may have serious impact on human health. Green sense, applies to the production of livestock using green feeding system in which animals are reared in controlled houses rather than the *In vitro* feeding system^[79]. In Europe, most countries are working to

establish organic farming by grazing animals outside on pastures, and without the use of any chemical substances such as antibiotics or anthelmintics. Parasitic infection that may be acquired by grazing, should be treated using specific herbal therapy rather than chemical treatment. At first, alternative herbal anthelmintics (areca nut, castor oil, clove, and extracts of garlic) were applied to control parasites, but after the discovery of synthetic drugs, their use was reduced^[80].

In Asia and other regions, many medicinal plants are being used as anthelmintics but due to lack of knowledge about these plants, their effectiveness is not satisfactory. Furthermore, they are used excessively due to their easy availability^[81,82]. The worm infestation in sheep was reported to decrease up to 50% after the use of medicinal plants like *Lotus pedunculatus* and *Hedysarum corinarum*. Certain scientific work on tannin effectiveness against worms has shown that it is beneficial in either passive or active ways^[83]. In the latter tannin binds with the external and internal proteins of parasites and changes their parasitic activity. Contrarily, in the passive manner condensed tannin binds with the ruminal proteins and reaches the intestine for maximum absorption and increases the immunity. Both possible actions of CT have no effect on the different ages of lambs, and after oral administration, they showed good anthelmintic results and reduced the faecal egg count (FEC)^[84]. Similarly, CT extracted from seven herbage were given to lambs and there was a relation between the amount of tannin and 3rd larval stage of *Trichostrongylus colubriformis* indicating that increased tannins decrease the amount of larvae in the animal body^[83]. Similarly, pineapple fruits (*Ananas comosus*) have many medicinal properties in wound healing, in cancer treatment, and increases drug metabolism so that it becomes more beneficial^[85]. Bromelain is a compound obtained from pineapple trees, particularly the stem. It acts on the cuticle of parasites and being proteinase in nature, it removes the cuticles and finally kills them by damaging their outer covering^[86]. Similarly, there are also other plants that have characteristic anthelmintic activities such as *Azadirachta indica* of the family Miliaceae, which can be used against *Haemonchus* infection of ruminants^[87]. A list of medicinal plants used to control GI parasites is given in table (3).

Conclusion: Sheep rearing at small and large levels play an important role in the economy of farmers and overall, in the economy of country. Parasitic infection is one of the major hindrances not only to the development of economy but also in increasing the cost of production. Cost of chemicals to control GI parasites, development of resistance against these chemicals and presence of residues of these chemicals in livestock are major problems facing the sheep industry. To overcome these problems, identification of active ingredients in local medicinal plants according to geographic locations, and determination of their mode of action is crucial.

Table 3. List of medicinal plants used to control GI parasites of sheep.

Scientific name	Local name	Plant source	Preparation method	Reference
<i>Agapanthus praecox</i>	African Lily	Leaves	Infusion	[107]
<i>Centella coriacea</i>	Swamp Pennywort	Bark	Decoction	[107]
<i>Cussonia spicata</i>	Natal cabbage Tree	Bark	Infusion	[107]
<i>Gasteria bicolor</i>	Elephant's Foot	Leaves	Infusion	[107]
<i>Bulbine latifolia</i>	Broad leaved bulbine	Leaves	Decoction	[107]
<i>Bulbine frutescens</i>	Cat's tail	Whole plant	Infusion	[107]
<i>Bulbine abyssinica</i>	Snake flower	Leaves	Decoction	[107]
<i>Capparis sepiaria</i>	Caperbush	Roots	Infusion	[107]
<i>Gunnera perpensa</i>	River pumpkin	Tuber	Decoction	[107]
<i>Hypoxis argentea</i>	Yellow stars	Tuber	Decoction	[107]
<i>Ocotea bullata</i>	Black stinkwood	Bark	Decoction	[107]
<i>Pittosporum viridiflorum</i>	Cheese wood	Bark	Infusion	[107]
<i>Rumex lanceolatus</i>	Common dock	Roots	Decoction	[107]
<i>Ptaeroxylon obliquum</i>	Sneezewood	Leaves	Decoction	[107]
<i>Ziziphus mucronata</i>	Buffalo Thorn	Leaves	Infusion	[107]
<i>Hermannia incana</i>	Sweet yellow bells	Whole plant	Decoction	[107]
<i>Grewia occidentalis</i>	Crossberry	Bark	Decoction	[107]
<i>Leonotis leonurus</i>	Wild dagga	Leaves	Decoction	[108]
<i>Aloe ferox</i>	Bitter aloe	Leaves	Decoction	[109]
<i>Harpephyllum caffrum</i>	Wild plum	Bark	Decoction	[110]
<i>Acokanthera oppositifolia</i>	Bushman's poison	Leaves	Decoction	[110]
<i>Aloe arborescens</i>	Bitter aloe	Leaves	Decoction	[110]
<i>Elephantorrhiza elephantina</i>	Elephant's root	Roots	Decoction	[110]
<i>Schotia latifolia</i>	Bush Boerbean	Bark	Decoction	[110]
<i>Pelargonium reniforme</i>	Pelargonium	Tuber	Decoction	[110]
<i>Zanthoxylum capense</i>	Small knobwood	Roots	Decoction	[110]
<i>Teucrium trifidum</i>	Dutchmen's fever plant	Leaves	Infusion	[111]
<i>Strychnos henningsii</i>	Red bitter berry	Bark	Decoction	[112]
<i>Albuca setosa</i>	Ingwebeba	Tuber	Decoction	[113]
<i>Mallotus philippensis</i>	Kamala	Fruits	Decoction	[69]
<i>Azadirachta indica</i>	Neem	Leaves	Decoction	[60]
<i>Calotropis procera</i>	Aak	Flowers	Decoction	[69]
<i>Cucurbita maxima</i>	Kadu	Seeds	Decoction	[69]
<i>Papaver somniferum</i>	Post	Seeds	Decoction	[69]
<i>Withania coagulans</i>	Paneer	Aerial parts	Decoction	[69]
<i>Ferula assa-foetida</i>	Heang	Latex	Decoction	[69]
<i>Nicotiana tabacum</i>	Tambaco	Leaves	Decoction	[69]
<i>Punica granatum</i>	Anar Fruit	Fruit Peel	Decoction	[69]
<i>Trachyspermum ammi</i>	Ajjwain porji	Seeds	Decoction	[69]

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