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RESEARCH ARTICLE

An Inventory of the Plants Used for Parasitic Ailments of Animals

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ABSTRACT

This study was conducted to document the botanicals used for major parasitic ailments of animals in Bhakkar District of Pakistan. Rapid Rural Appraisal was carried out to identify the key respondents (n=115) including local healers, quacks, herders and farmers for the present study. Information was collected using a pre-designed questionnaire and verified through focused group discussions through participatory rural appraisal technique. Gastrointestinal parasites were the most frequently (n=105/115; 91%) reported problem of livestock followed by tick infestation (n=91/115; 79%) and myiasis (n=84/115; 73%). A total of 69 prescriptions based on 30 plants including 32 for GI parasites, 16 for tick infestation and 21 for myiasis were documented. There were some plants which were reported to be used with a different dose, method of preparation and/or vehicle within the same or a different parasitic condition. Leaves, seeds and/or seed oil and fruit were the most commonly used parts of the plants. The plant materials were given orally in crude form as powder, oil and decoction, and topical application as powder, sprinkling, bath, washing and paste. Plants documented in the present study were new to the area but have already been reported elsewhere for different ailments of animals. Majority of the plants, however, need to be evaluated using standard parasitological procedures to validate their use as anti-parasitics.

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INTRODUCTION

Agriculture continues to play a central role in the national economy of Pakistan. Nearly, 62% of the country's population resides in the rural areas and is directly or indirectly linked with agriculture for their livelihood. Livestock contributed 53% of the agriculture value added and 11.4% to the national GDP during 2009-2010. Majority of the livestock is distributed into small units throughout the Pakistan. Smallholders keep a major share of livestock, i.e., ≤ 60% farmers have 5-6 animals per family (Anonymous, 2009-2010; Bano *et al*., 2011). Optimum production of their animals is, therefore, extremely crucial for maintenance of their day to day living. In animals, the major challenge faced by the rural farming communities all over the world is the parasitism leading to low productivity (Ahmed *et al*., 2007) and frequent treatment failures due to development of drug resistance (Saeed *et al.,* 2010). Documentation and validation of plants used as anti-parasitics has been considered among the novel approaches for the control of parasites as an alternate to the synthetic chemicals. Pakistan has centuries-old history of keeping livestock and their treatment using plants. Recently, some workers have documented (Sindhu *et al.,* 2010) and validated some plants (Al-Shaibani *et al.,* 2009; Bachaya *et al.,* 2009) for their use in ethnoveterinary medicine (EVM) in Pakistan. This paper reports plants used as anti-parasitics in animals in district Bhakkar of Pakistan.

MATERIALS AND METHODS

Study area: Bhakkar is located in the south of Punjab Province (Pakistan) including three subdivisions (Bhakkar, Kallurkot and Mankera). It is located between 31° 09' to 32° 12' north latitude and 70° 19' to 71° 58' east latitudes with a total area of 3,134 square miles. The district has extreme climate with sizzling hot summer. The maximum temperature goes up to 42°C with a minimum to 28°C. The hottest months are June, July and August. Winter is equally cold and frosty with maximum at 10°C and minimum below freezing point. A total of 20 localities making 10% of the study area were selected for this study.

EVM Survey: An exploratory survey was conducted initially to identify the respondents following Rapid Rural Appraisal techniques. The population of concern was people familiar with EVM including local healers, quacks, herders and farmers. A total of 115 key respondents were selected in the survey from amongst the 180 people interviewed for the purpose. All the respondents were males, more than 40 years in age, and having good repute among the farming communities. Survey team comprised of a veterinarian, a community representative well versed with the local language and a note taker. Information was collected from the key respondents using a well-structured questionnaire on the use of plants as anti-parasitics following standard Participatory Rural Appraisal technique (Khan, 2010). Focused group discussions and field visits were conducted with the key respondents for documentation of the information. Information was cross-checked in different meetings organized with the key respondents.

RESULTS AND DISCUSSION

Gastrointestinal (GI) parasites were the most frequently (n=105/115; 91%) reported problem of livestock followed by tick infestation (n=91/115; 79%) and myiasis (n=84/115; 73%). Respondents were well aware of the tick infestation and myiasis but they used to diagnose GI parasites based on the symptoms like poor growth, loss of weight, diarrhea and dysentery in animals. Animal husbandry practices in the area are generally poor and majority of the farmers has to depend on the communal grazing. Therefore, often the animals are under fed and suffer malnutrition. These factors coupled with abundance of intermediate hosts/flies, humid climate and mixed animal species grazing contribute to high prevalence of parasitic diseases. This was confirmed by the qualified veterinarians and observed by the survey team working in the area.

This is the first documentation of the anti-parasitic plants from District Bhakkar, Pakistan. A total of 30 plants were documented for their use against GI parasites, tick infestation and myiasis (Table 1). A total of 69 prescriptions including 32 for GI parasites (Table 2), 16 for tick infestation (Table 3) and 21 for myiasis (Table 4) were documented. There were some plants which were reported to be used with a different dose, method of preparation and/or vehicle within the same or a different parasitic condition. For GI parasites, the plants which were part of multiple prescriptions included *Trachyspermum ammi* (n=4), *Acacia nilotica* (n=3), *Brassica campestris* (n=3), *Moringa oleifera* (n=2), *Ziziphus jujuba* (n=2), *Coriandrum sativum* (n=2) and *Terminalia chebula* (n=2). Likewise, *Piper nigrum* (n=3), *Melia azedarach* (n=2), *Aloe vera* (n=2), *Azadirachta indica* (n=2) and *B. campestris* (n=2) were the part of multiple prescriptions for tick infestation. Similarly, for myiasis, *A. indica* (n=5), *Calotropis procera* (n=3), *Capsicum annuum* (n=2) and *Nicotiana tabacum* (n=2) were part of multiple prescriptions.

A. indica was the most frequently (n=103/115; 89.6%) reported plant used for one or more than one parasitic conditions followed by *T. ammi* (n=94/115; 81.7%), *B. campestris* (n=51/115; 58.6%), *P. nigrum* (n=56/115; 48.7%), *N. tabacum* (n=39/115; 44.9%), *Citrullus colocynthis* (n= 36/115; 31.3%), *A. vera* (n=28/115; 24.4%), *C. annum* (n=25/115; 21.7%), *C. procera* (n=23/115; 20%), *Mallotus phillippinensis* (n=21/115; 24.2%), *Allium sativum* (n=19/115; 16.5%) and *Vernonia anthelmintica* (n=16/115; 13.9%). Leaves, seeds and/or seed oil (n=23), and fruit (n=18) were the most commonly used parts of the plants. Resin, gel, bulb, nut, pulp and rhizomes were the less frequently used parts

Table 1: Plants with their local names used against different parasitic conditions in animals

Family	Plant species (voucher specimen number)[a]	Local name	Indications
Aloaceae	*Aloe vera* (L.) Burm. f. (Bk35/07)	Kawar gandal	GI parasites and tick infestation
Apiaceae	*Coriandrum sativum* L. (Bk16/07)	Dhania	GI parasites
Apiaceae	*Ferula asafoetida* L. (Bk24/07)	Heeng	GI parasites
Apiaceae	*Foeniculum vulgare* P. Mill. (Bk63/07)	Sounf	GI parasites
Apiaceae	*Trachyspermum ammi* (L.) Sprague ex Turrill. (Bk05/07)	Ajwain	GI parasites
Arecaceae	*Areca catechu* L. (Bk34/07)	Kattha	GI parasites
Arecaceae	*Phoenix dactylifera* L. (Bk38/07)	Khajoor	Myiasis
Asclepiadaceae	*Calotropis procera* (Ait.) W.T.Ait. (Bk01/07)	Aak	Myiasis
Asteraceae	*Vernonia anthelmintica* (L.) Willd. (Bk32/07)	Kali zeeri	GI parasites and tick infestation
Brassicaseae	*Brassica campestris* L. ssp. *napus* Duthie & Fuller (Bk59/07)	Sarson	GI parasites, tick infestation and myiasis
Combretaceae	*Terminalia chebula* Retz. (Bk23/07)	Harar	GI parasites
Cruciferae	*Eruca sativa* Mill. (Bk69/07)	Ussoo	GI parasites, tick infestation and myiasis
Cucurbitaceae	*Citrullus colocynthis* (L.) Schrad. (Bk40/07)	Kor tuma	GI parasites and tick infestation
Euphorbiaceae	*Mallotus philippinensis* (Lamk.) Meull. Arg. (Bk33/07)	Kamela	GI parasites
Fabaceae	*Acacia nilotica* (L.) Willd. ex Delile (Bk37/07)	Keekar	GI parasites
Lamiaceae	*Mentha arvensis* L. (Bk53/07)	Podina	Myiasis
Liliaceae	*Allium cepa* L. *var. aggregatum G. Don* (Bk53/07)	Piaz	GI parasites
Liliaceae	*Allium sativum* L. (Bk41/07)	Lehsan	GI parasites
Linaceae	*Linum usitatissimum* L. (Bk06/07)	Alsi	Myiasis
Meliaceae	*Azadirachta indica* A. Juss. (Bk48/07)	Neem	GI parasites and myiasis
Meliaceae	*Melia azedarach* L. (Bk17/07)	Dharek	Tick infestation
Moringaceae	*Moringa oleifera* Lam. (Bk61/07)	Sohanjna	GI parasites
Piperaceae	*Piper nigrum* L. (Bk31/07)	Kali mirch	GI parasites, tick infestation and myiasis
Poaceae	*Triticum aestivum L. (*Bk19/07)	Gandum	Tick infestation
Rhamnaceae	*Ziziphus jujuba* L. Lam., non P. Mill. (Bk11/07)	Beri	GI parasites
Rutaceae	*Citrus medica* L. (Bk50/07)	Nimbu	Myiasis
Solanaceae	*Capsicum annuum* L. (Bk64/07)	Surkh mirch	GI parasites, tick infestation and myiasis
Solanaceae	*Nicotiana tabacum* L. (Bk65/07)	Tambaku	GI parasites, tick infestation and myiasis
Solanaceae	*Withania coagulans* Dunal (Bk51/07)	Paneer	GI parasites and tick infestation
Zingiberaceae	*Curcuma longa* L. (Bk22/07)	Haldi	Myiasis

Table 2: Dose, preparation, administration and frequency of usage of different plants against gastrointestinal parasites of animals

Parts used/Plant species	Dose, preparation and administration	Frequency (n=115), n (%)
Seeds		
Trachyspermum ammi	125 g seeds given orally	69 (60)
Trachyspermum ammi	Decoction of 100 g seeds mixed with 250 ml water given orally	10 (8.7)
Trachyspermum ammi	100 g seeds mixed with 25 g each of sodium chloride and *Piper nigrum fruit* given orally	9 (7.8)
Trachyspermum ammi	125 g seeds mixed in jaggery given orally	6 (5.2)
Vernonia anthelmintica	100 g seeds each of *Vernonia anthelmintica, Piper nigrum* and *Foeniculum vulgare* with 50 g each of sodium chloride and black salt given orally	6 (5.2)
Foeniculum vulgare	100 g each of *Foeniculum vulgare* seeds, *Piper nigrum* fruit, *Vernonia anthelmintica* seeds and added 50 g each of sodium chloride and black salt; given orally	6 (5.2)
Coriandrum sativum	Give 50 g seeds *given orally*	1 (0.87)
Coriandrum sativum	50 g seeds mixed with 25 g sodium chloride given orally	1 (0.87)
Moringa oleifera	100 g seeds mixed in 250 ml *Brassica campestris* seed oil and given orally	1 (0.87)
Fruit		
Mallotus philippinensis	250 g fruit (cut in small pieces) mixed in animal feed given orally	21 (18.3)
Citrullus colocynthis	250 g finely chopped fruit mixed with 50 g each of sodium chloride and black salt given orally	15 (13)
Piper nigrum	*25 g each of Piper nigrum* fruit, sodium chloride mixed with 50 g *Trachyspermum ammi* seeds given orally	9 (7.8)
Piper nigrum	100 g each of *Piper nigrum* fruit, *Vernonia anthelmintica* seeds, *Foeniculum vulgare* seeds and added 50 g each of sodium chloride and black salt; given orally	6 (5.2)
Piper nigrum	125 g *Piper nigrum* fruit and 250 g jaggery added in 1 kg desi ghee (vanaspati) given orally	5 (4.4)
Capsicum annuum	100 g finely chopped red chillies given orally with jiggery	4 (3.5)
Piper nigrum	25 g each of sodium chloride and *Piper nigrum* fruit added in lassi (milk whey); given orally	2 (1.7)
Terminalia chebula	50 g chopped fruit cooked in 250 g desi ghee (vanaspati) given orally	1 (0.87)
Terminalia chebula	50 g chopped fruit given orally	1 (0.87)
Leaves		
Azadirachta indica	250 g leaves soaked in 1L water given orally	22 (19.1)
Nicotiana tabacum	500 g leaves soaked in 1 L water and added 50 g sodium chloride to the filtrate; given orally	10 (8.7)
Ziziphus jujuba	2-3 kg leaves given orally	7 (6.1)
Withania coagulans	2 kg chopped leaves mixed with 125 g each of sodium chloride and black salt, mixed well and added *Eruca sativa* oil to make bolus; given orally	2 (1.7)
Acacia nilotica	1-2 kg leaves given orally	2 (1.7)
Ziziphus jujuba	1 kg leaves soaked in 2 L water overnight and the filtrate is given orally	1 (0.87)
Moringa oleifera	500 g leaves given orally	1 (0.87)
Acacia nilotica	1 kg leaves soaked in 2 L water overnight and given orally	1 (0.87)
Seed oil		
Brassica campestris	500 ml hot seed oil mixed with 100 g *Allium sativum* bulbs and given orally	19 (16.5)
Brassica campestris	500 ml seed oil given orally	9 (7.8)
Eruca sativa	*Eruca sativa* seed oil mixed with 2 kg chopped leaves of *Withania coagulans* and added 125 g each of sodium chloride and black salt. Mixed well to make bolus and given orally	2 (1.7)
Brassica campestris	250 ml seed oil mixed with 100 g seeds of *Moringa oleifera* and given orally	1 (0.87)
Bulb: *Allium sativum*	50 g bulbs cooked in 500 ml *Brassica campestris* seed oil and given orally	19 (16.5)
Pulp: *Aloe vera*	250 g pulp given orally	3 (2.6)
Nut : *Areca catechu*	100 g nut powder added in 1 L lassi (milk whey) and given orally	1 (0.87)
Bark: *Acacia nilotica*	1 kg dried bark soaked in 2 L water and given orally	1 (0.87)
Resin: *Ferula asafetida*	50 g resin mixed with 250 g jaggery given orally	1 (0.87)

Figures in parenthesis indicate percentage.

Table 3: Dose, preparation, administration and frequency of usage of different plants against tick infestation in animals

Conditions/Plant species	Dose, preparation and administration	Frequency (n=115), n (%)
Seeds		
Azadirachta indica	Neem seed oil mixed with *Brassica campestris* seed oil in the ratio of 1:3; applied topically	31 (27)
Vernonia anthelmintica	50 g powdered seeds mixed in animal feed and given daily for 3 days	10 (8.7)
Brassica campestris	1 L seed oil mixed with 500 g *Aloe vera* gel; applied topically	6 (5.2)
Brassica campestris	1 L seed oil mixed with 50 g powdered seeds of *Capsicum annuum;* applied topically	4 (3.5)
Eruca sativa	Sufficient quantity of seed oil applied on the affected skin	4 (3.5)
Triticum aestivum	250 g seed flour and added 5-10 g each of *Piper nigrum* fruit and *Vernonia anthelmintica* seeds to prepare a bread and given orally	2 (1.7)
Fruit		
Piper nigrum	50 g *Piper nigrum* fruit mixed in animal feed and give daily for 3 days	22 (19.1)
Citrullus colocynthis	2-3 doses of 100 g *Citrullus colocynthis* fruit mixed in animal feed given orally	11 (9.6)
Capsicum annuum	50 g powdered fruits mixed with 500 ml *Brassica campestris* seed oil; applied topically	4 (3.5)
Piper nigrum	50 g *Piper nigrum* fruits mixed with 500 g desi ghee (vanaspati) and given orally daily for 3 days	4 (3.5)
Piper nigrum	5-10 g each of *Piper nigrum* fruit and *Vernonia anthelmintica* seeds mixed with 250 g *Triticum aestivum* seed flour to prepare a bread and given orally	2 (1.7)
Leaves		
Azadirachta indica	500 g leaves boiled in 2 L water; applied topically	25 (21.7)
Nicotiana tabacum	500 g leaves boiled in 2 L water; applied topically	18 (15.7)
Melia azedarach	Paste of ground fresh leaves applied over the skin	10 (8.7)
Melia azedarach	1 kg leaves boiled in 2-3 L water and given a bath to the animal	9 (7.8)
Withania coagulans	500 g leaves soaked in 2 L water; applied topically	3 (2.6)
Gel		
Aloe vera	Gel applied on the affected areas	19 (16.5)
Aloe vera	500 g gel and ground leaves mixed with 1 L *Brassica campestris* seed oil and applied topically	6 (5.2)

Figures in parenthesis indicate percentage.

Table 4: Dose, preparation, administration and frequency of usage of different plants against tick infestation in animals

Conditions/Plant species	Dose, preparation and administration	Frequency (n=115), n (%)
Leaves		
Calotropis procera	100 g ground leaves of *Calotropis procera* mixed with 50 ml *Brassica campestris* seed oil to make a paste and applied topically on the wound	9 (7.8)
Nicotiana tabacum	Ground fresh leaves applied on the wound	9 (7.8)
Calotropis procera	100 g ground leaves mixed with 50 g *Capsicum annuum* fruit applied as needed to cover the wound	7 (6)
Azadirachta indica	1 kg fresh leaves soaked in 2 L water for 24 hours and filtrate drenched orally	7 (6)
Azadirachta indica	Seed oil applied on the wound	7 (6)
Azadirachta indica	100 g fresh leaves grinded and mixed with *Brassica campestris* seed oil to make a paste and applied topically	5 (4.4)
Phoenix dactylifera	1 kg dried leaves soaked in 2 L water overnight; wound washed with the filtrate	3 (2.6)
Azadirachta indica	Sufficient fresh leaves ground to cover the wound; application changed daily for 3-4 days	3 (2.6)
Nicotiana tabacum	250 g leaves boiled in 1 L water; given orally	2 (1.7)
Mentha arvensis	125 g leaves ground to make a paste with water and wound is covered with the paste	1 (0.87)
Fruit		
Capsicum annuum	25 g each of *Capsicum annuum* fruit and *Curcuma longa* rhizomes fried in 125 g desi ghee (vanaspati); applied on the wound	10 (8.7)
Capsicum annuum	10 g *Capsicum annuum* fruit mixed with 100 g ground leaves of *Calotropis procera;* applied as needed to cover the wound	7 (6)
Piper nigrum	Ground *Piper nigrum* fruit sprinkled on the wound	6 (5.2)
Citrus medica	Fresh juice applied on the wound	4 (3.5)
Seeds		
Eruca sativa	Oil of seeds applied on the wound	10 (8.7)
Brassica campestris	50 ml seed oil mixed with 100 g ground leaves of *Calotropis procera* to make a paste; applied topically	9 (7.8)
Linum usitatissimum	100 g seeds soaked in water overnight, ground to make a paste and applied topically	3 (2.6)
Azadirachta indica	100 ml seed oil mixed with 50 g naphthalene and applied on the wound	3 (2.6)
Rhizome: *Curcuma longa*	25 g each of *Curcuma longa* rhizome mixed with *Capsicum annuum* fruit fried in 125 g desi ghee (vanaspati); applied topically on the wound	10 (8.7)
Resin: *Calotropis procera*	Sufficient quantity of resin applied topically to cover the wound	7 (6)
Bulb: *Allium cepa*	500 g bulbs cut in small pieces and soaked in 1 L water for 24 hours and wound washed with the filtrate	1 (0.87)

Figures in parenthesis indicate percentage.

of plants. The plant materials were given orally in crude form as powder, oil and decoction, and topical application as powder, sprinkling, bath, washing and paste. The vehicles used for delivery of crude plant materials were animal feed, common salt, black salt, *B. campestris* and *E. sativa* seed oil, wheat flour and bread, desi ghee (vanaspati), jaggery, milk whey and water.

It is evident from the above description that the key respondents were rich in the indigenous knowledge. The information provided by them was cross checked and was confirmed by the farming communities as to the use of plants for different parasitic conditions. The key respondents were good in symptomatic diagnosis of different ailments of animals. All the plants reported for their usage in parasitic conditions were available in the farmer's fields, roadsides and/or grocery shops of the villages. Same plants were used for treatment of different diseases in human beings as well at a lower dose.

Numerous plants documented in this study have been validated for their use as anti-parasitics or other conditions in animals. Plants validated for their anthelmintic activity include *A. indica* (Iqbal *et al.,* 2010), *T. ammi* (Lateef *et al.,* 2006), *N. tabacum* (Iqbal *et al.,* 2006a), *C. procera* (Iqbal *et al.,* 2005), *A. sativum* (Iqbal *et al.,* 2001), *V. anthelmintica* (Iqbal *et al.,* 2006b), *A. nilotica* and *Z. nummularia* (Bachaya *et al.,* 2009). Likewise, *A. indica* (Landau *et al*., 2009), *C. procera* (Pari *et al*., 1998), *N. tabacum* (Rosell *et al*., 2008) and *Piper nigrum* (Fan *et al.,* 2011) have been reported for their insecticidal, acaricidal and repellant effects. *M. azedarach* extracts inhibit the egg production of ticks (Borges *et al*., 2003), and its topical application decreases the number of ticks on goats and cattle (Webb and David, 2002; Schwalbach *et al*., 2003). Some plant acaricides produce sticky secretions that instantly immobilize and kill larvae of ticks (Sutherst *et al*., 1982). *C. procera* is known to contain cardiac glycosides which are lethal to ticks (Al-Rajhy *et al*., 2003). Azadirachtin, an important chemical component of *A. indica* is lethal by impairing development in a variety of arthropods (Schmutterer, 1990).

Diversity in the usage of different plants and variation in the claims of their efficacy is typical of the traditional veterinary medicine practices. The farmers of the study area are well satisfied and trust the documented prescriptions based on the empirical evidence of their efficacy. In addition to aiming at the treatment of animals with specific plants, farmers regularly (often weekly) administer mixed plant prescriptions based on *Allium cepa, A. sativum, C. annuum, C. colocynthis, C. sativum, F. vulgare, P. nigrum, T. ammi* and *V. anthelmintica* as stomachics and galactogogues to their animals. Likewise, *B. campestris* seed oil, *T. aestivum* flour, jaggery and desi ghee (vansapati) are used as energizers for animals.

Scientific studies suggest diverse phytochemicals (e.g., phenolics and polyphenols, terpenoids and essential oils, alkaloids, lectins and polypeptides, mixtures, other compounds, etc.) to exert antiparastic effects on the parasites in different ways (Cowan, 1999) like disrupting in the energy metabolism (Stern *et al*., 1996), microbial membranes (Zhang and Lewis, 1997), etc. In fact, most of these are the known target sites for commonly used anti-parasitics (Kohler, 2001; Mottier *et al*., 2006).

In conclusion, plants documented in the present study are though new in the area but have already been reported elsewhere for different ailments of animals. There are many plants in the current inventory that need to be validated using standard parasitological procedures. The validated plants may be recommended to farmers for use after standardization of doses.

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