

RECENT TRENDS IN HERBAL ECTOPARASITICAL DRUGS

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INTRODUCTION:

Contribution of huge livestock population of India to gross national product is approximately Rs.200,000 million per year. Animals are large food and fertilizer factories, converting huge quantities of crop residues into food and enormous quantities of organic manure. Furthermore, animal draft provides employment to about 20 million people and saves petrol of estimated value of 4500 crores annually, in India. Despite, having such valuable importance, the productivity of our animals remain very poor because of several factors. One of the most important factor is that our livestock suffer from different types ailments. Among these diseases parasitic infections especially arthropods/ectoparasite constitutes a major threat to the health and productivity of animals. It is considered that among all known living animals on the earth, almost 75% belong to arthropods (ICAR, 2002).

Arthropods and arthropod born diseases cause immense loss world wide, although precise data/ figures of most countries are lacking. In control strategies, the major goal is either to curtail ectoparasite as a pest or to reduce/ eliminate arthropods-born diseases. Till date the chemicals like chlorinated hydrocarbons, organophosphates, carbamates, formamidines, pyrethroids and macrocyclic lactones are considered as orthodox arsenals to counteract these ectoparasites and their adverse effects. Continuous and indiscriminate uses of these chemicals have led to chemical toxicity, emergence of resistance problem, residual effect in animal food products and environmental pollution. Thus, in present cyber era of canned food culture where trading of animal derived food are monitored by world trade organization, has led to interest in alternative approach of ectoparasite control. The one such method is the exploitation of eco-friendly, safe, effective and economical indigenous plant extracts.

Plants are the miraculous laboratories of nature as they provide various kinds of molecules. In present era, research and development of plant based ectoparasiticidal are given special emphasis. So, far desired effects have not been achieved in veterinary sciences, some of the experiments, carried out using various phyto agents have shown encouraging results. According to Singhal and Sharma (2000) the use of phyto-pesticides has certain advantages like:

1. The spectrum is narrow i.e. they kill only targeted insect pests.
2. Impact on the pest is gradual, 90-100 percent kill of target only, very safe for beneficial insects.
3. Their use is economical as only 2-3 applications are required.
4. There is no report of development of resistance and are effective even against pesticide-resistant strains.

5. They are biodegradable, no residue and non-polluting.
6. Safe for man, mammals, fishes, bird etc.
7. Products based on use of phyto-pesticides are preferred for exports and obtain premium price.

History of phyto-pesticides:

Plants, as a whole or their parts, have been used as a source of medicine and health tonic both in Veterinary and medical practice since time immemorial. According to a note, around 7000 species of plants from lichens to towering trees have been used at one time or another for medicinal purposes by mankind.

In Ayurveda, about 2000 plant species of medicinal values are used. The classical example is that of *Azadirachta indica* (Neem) which has been used in folk-lore medicine way back, but scientifically the use of *A. indica* as a source of natural insecticide was discovered approximately only 30 years ago (Ascher, 1993). All parts of neem-the leaves, bark and seed oil possess therapeutic value in a variety of skin disorders including scabies. The first record reference of natural substance as was that of Marco Polo in 1300 A.D. mentioning the use of oil for controlling mange in camels. The significance of herbals in ancient Indian Veterinary care is underlined by the edict of King Ashoka, Which stats that "The significance of herbs in ancient Indian veterinary care is underlined by the edict of King Ashoka, which states that *everywhere in the dominion of His Majesty King Priyadarshi, and likewise in the neighbouring realms every where on behalf of His majesty have two kinds of hospital been established; hospitals for men and hospitals for animals. Healing herbs medicinal (or man and medicinal for beasts, wherever they were lacking have been imported and planted. . . .*" (Randhawa 1980).

Current trend:

In new millennium allopathic medicines are main weapon against majority of diseases, but still herbal medicines are used at very large scale through out the world. Today herbal global market is estimated approximately US \$ 60 billion, which is growing @ 7-12% annually and expected to be about US \$ 5 trillion by 2050. But the contribution of Indian herbal products in the world is less than 2 % which doesn't justify the kind of rich biodiversity and traditional knowledge our country possess. According to a report nearly 750 medicinal plants are used by traditional healers for treatment of animal and human diseases (Anjaria *et al* 2000). The efficacy of a single ectoparasiticidal /repellent plant can be enhanced by judicious combination with another plant or active principle which has adjuvant properties. These agents act in one or more of the following ways:

1. Antagonists of growth regulatory hormones.
2. Anti-feedant effects.
3. Inhibition of egg development.
4. Disrupt mating and sexual communication.
5. Inhibit chitin formation
6. Act as repellants (especially for ticks)

Various constituent of plants and their commercial preparation are used to treat against various insects (Flies, Flea, lice, mosquitoes, bugs etc) and acarins (ticks and mites) (Table 1).

Treatment of sarcoptic mange in buffalo calves with oil of tarmamira (*Truca sativa*) in combination with or without sulphur and tar oil have been found effective (Srivastava & Chabra 1971). Oil of karanj (*Pongamia* spp.) was found effective against mange of goats (kale and Panchegaonkar, 1969; Sinha *et al.*, 1969) and buffaloes (Prajapatie and Hirrgoudar, 1976). Tropical application of *Argemone mexicana* paste, 4-5 times weekly on dogs suffering with *Demodex canis* gives 100% clinical and parasitological cure (Thakur *et al.*, 1995). A herbal preparation consisting of garlic, onion lemon extracts, turmeric powder and camphor in karanj oil when applied once daily for 5 consecutive days eliminated *Sarcoptes scabiei* infestation in piglets with in 5 days of application (Dwivedi and Sharma, 1986). Similarly neem oil has been reported as effective against demodectic mange in dogs (Singh, 1980) in combination with others, whereas neem oil as alone was found effective against sarcoptic mange in sheep (Hirudkar *et al.*, 1997) and psoroptic mange in rabbits (Dakshinkar *et al.*, 1992). Pandian *et al.* (1989) reported repellent activity of herbal smoke on the biting activity of mosquitoes. They reported that when 10 g of air-dried powdered leaves of the neem tree (*Azadirachta indica*) when burnt on a charcoal brazier between 18.00 and 19.00 hr and between 0.00 and 01.00 hr in a room results in 42% landing/biting rates of *Culex* mosquitoes over 24hr post burning.

Table 1: Acaricidal activity of plant of India with Veterinary applicability*

Herb / Plant	Scientific name	Activity / Application	Reference, if any
Sweet flag	<i>Acorus calamus</i>	Repellent to ixodid ticks	Deshmukh <i>et al.</i> (1982)
Garlic	<i>Allium sativum</i>	Miticidal	Dwivedi and Sharma (1985)
Custard apple	<i>Annona squamosa</i>	Scabies, ticks	*
Worm wood	<i>Artemisia camifolia</i> (<i>A. vulgaris</i>)	Recommended for purulent (Psoroptic scabies)	Caius (1940)
Margosa (Neem)	<i>Azadirachta indica</i>	Range of application includes ticks & scabies	Singh (1983), Singh (1994)
Indian laurel	<i>Calophyllum inophyllum</i>	Effective against mite	Cius (1941)
Safflower	<i>Carthamus tinctorius</i>	Remedy for itch (psoroptic mange)	Cius (1940)
Himalayan cedar	<i>Dedros deodara</i>	Sarcoptic mange	Gupta <i>et al.</i> (1968), Lal <i>et al.</i> (1976)
Pyrethrum	<i>Chrysanthemum indicum</i>	Scabies	*
Lemon	Citrus spp.	Ticks, scabies	Dastur (1960)
Coconut	<i>Cocus nucifera</i>	Scabies, ticks	*
Turmeric	<i>Curcuma longa</i>	Ticks, mites	Nadkarin (1976)

			Dwived & Sharma (1985)
lemon grass	<i>Cymbopogon citratus</i>	Ticks, mites	*
Derris	<i>Derris elliptica</i>	Mites & ticks	Chopra <i>et al.</i> (1941)
Indian persimon	<i>Diospyros ebenum</i>	Ticks	*
Juniper	<i>Juniperus communis</i>	Psorotic mange	Srivastava & Sisodia (1969), Devi & Sisodia (1969)
Tobacco	<i>Nicotina tabacum</i>	Ticks	Bairacli Levy (1984)
Indian beech (Karanj)	<i>Pongamia glabra</i> (<i>P. pinnatar</i>)	Sarcoptic mange	Kale and Panchegaonkar (1969), Prajapati and Hiregoudar (1976)
Castor bean	<i>Ricinus communis</i> <i>Spilanthes acmella</i>	Mites	* Caius (1940)
Fish poison bean	<i>Tephrosia vogelii</i>	Ticks	Bertram (1988)
Guduchi	<i>Tinospora cordifolia</i>	Scabies	*

*: As cited in: Chhabra and Saxena (1998). J. Vet. Parasitol. 12 (1): 3-8.

Kalakumar *et al.*, (2000) have evaluated acaricidal activity of custard seed oil (*Annona squamosa*), neem oil (*Azadirachta indica*) and pyrethrins against 3 tick species *Boophilus microplus*, *Hyalomma anatolicum* and *Rhipicephalus haemaphysalis* both *In vitro* and *in vivo* and have reported 100% efficacy of custard seed oil and pyrethrins and 60-75% efficacy of neem against buffalo ticks. They further observed inhibition of oviposition in female ticks treated with custard seed oil. However neem oil failed to inhibit oviposition. Choudhary *et al.*, (2004) has also reported good acaricidal effect of *Nicotiana tabacum* against *Rhipicephalus haemaphysalis*. Methanolic extract of *Styloxanthes scabra* neem leaves and bark, nochi (*Vitex negundo*) leaves, uashambu (*Acorus calamus*), rhizome and pungu (*Pongamica pinnata*) leaves have been evaluated for acaricidal activity by different workers (Kuudrathulla and Jagannath 2000 ; Pathah *et al.*, 2004). Out of all mentioned extracts bark extract was observed to be highly effective acaricide followed by uashambu (Pathah *et al.*, 2004).

Presently some commercial preparation do have herbal ingredients in them for e.g. an herbal powder of Indian herbs, when used as drench @ 3 g per animal twice a day for 11 days, resulted in reduction of 82.6% live larvae in lambs experimentally infected with *Oestrus ovis* (Gupta *et al.*, 1983). A herbal lotion commercially available as Himex[®] lotion (containing extracts of *Polyalthia longifolia*, *Cedrus deodara*, *Polyalthia extracts*, waxes, soap and distilled water) was found effective against sarcoptic mange of goats and dogs (Tripathy *et al.*, 1988) and sarcoptic mange of camel (Tripathy and Acharjyo, 1990). However against demodectic mange of dogs, the lotion was used as

an ointment and the formulation showed both parasitocidal and repellent properties (Tripathy *et al.*, 1990). Similarly the Himax[®] was found effective against both sarcoptic and psoroptic mange in buffaloes (Sharma *et al.*, 1982 and Ruprah, 1980). Pestoban[®] herbal preparation has been recorded effective against ectoparasite like ticks (*Boophilus* spp. and *Hyalomma* spp.) lice (*Linognathus* spp and *Haematopinus* spp) of cattle and buffalo. Two application of 1:5 dilution results in complete control of ticks & lice (Nooruddin *et al.*, 1986). Similarly Pestoban have been found 100% effective against lice (*Cuclotogaster heterographa*, *lpeurus caponis*, *Menocanthus apamineus*, *Menopon gallinae* and *Goniocotes gallinae*) in poultry (Ahmad, 1986, Das *et al.*, 1993) and in goats (Wadhvani *et al.*, 1990). Srivastava and Sinha, (1990) reported variable efficacy of the preparation against adult and nymphal stages of ticks (*Boophilus microplus*, *Hyalomma anatolicum*, *Rhipicephalus sanguineus*), lice (*Haematopinus* and *Linognathus* spp.) of cattle and buffaloes and fleas (*Ctenocephalids canis*, *C. felis*, *Trichodectes canis*). The larval and nymphal stages of ticks were more susceptible than the adults. A changed version of preparation i.e. Pestoban aerosol spray[®] containing extracts of *Cedrus deodara*, *Azadirachta indica* and *Embelia ribes* was reported as effective against demodectic mange in dogs (Das, 1993), and sarcoptic mange in goats and calves (Hazarika *et al.*, 1995). The ectoparasitocidal efficacy of Pyron[®] - an Indian herbal preparation containing extracts of pyrethrum (*Chrysanthemum*) and *Acorus calamus* is also on record. Galhotta (1989) reported that 3 to 5 treatments of pyron-Ash and pyron-talcum as 1:1 mixture makes pups free of ectoparasites and remains free for 65-75 days post application. Similarly dogs become free of ectoparasite after 3 or 6 treatments and remained so for 70-75 days. Calves become free of infestation after 3 applications and remained so for 95 days. Heifers had low level of infestation even after several treatments and become reinfested at 60-65 days. Cows become free of ectoparasite, but were reinfested after 70 days. A complete clinical recovery in rabbits infested with *Psoroptes cuniculi* and *Notoedres cati* with charmil[®] (Dabur Ayurved Ltd.) containing oils of the medicinal plants *Cedru deodara* and *Pongamia glabra* has been reported by Sangwan *et al* (1994). Similarly Singh and Gill (1993) reported complete cure of bovines against sarcoptic mange in 7-14 days, with the healing of lesions and the starting of hair growth on back. It was also observed that gel formulation acted quicker than the ointment. A herbal cream – Dermacept[®] containing extracts of *Holarrhena pubescens*, *Curcuma longa*, *Berberis aristata*, *Azadirachta indica*, *Onosma echioides* and *Pongamia glabra* when applied on alternate days to sarcoptic mange affected camel resulted in complete cure after 8 applications (Chabra *et al.*, 1994).

The efficacy of herbal compound AV/EEP/14 containing *Azadirachta indica*, *Acorus calamus*, *Pongamica pinnata* and *Eucalyptus globules* as ectoparasitocidal has been reported against sarcoptic mange infestation of rabbits (Das and Sreekrishnan, 1998) against dog ticks-*Rhipicephalus sanguineus* (Panda *et al.*, 1998), canine demodecosis (Pathala and shukla 1998) and against lice and ticks infestation on cattle and buffaloes (Kumar *et al.*, 2000). In addition to cidal effect on the developing stages and the adults, the fertility and fecundity of female was also severely impaired. Das *et al* (1997) reported that daily application of this drug resulted in complete cure of goats in 5-7 days against sarcoptic mange.

Phytoacaricidals are also widely used against ectoparasites abroad. It is estimated that at present the herbal drugs valued more than Rs. 3000 billion are sold globally. This is partially attributed to the resurrection of interested and importance in green medicine (Swarup and Patra 2005). Mignon and Losson (1996) reported excellent acaricidal effect of phytoaromatic gel (Composed of volatile oils of plants such as Juniper, levedar, Thymus, eucalyptus and Rosmery). Efficacy of utashayli derived from *Nicotiana paniculata* against the false tick-*melophagus ovinus* have been reported by Bazalar and Arevalo, (1989). They found that treated sheep gained more weight than untreated sheep. Lee and Chiang (1994) in China reported insecticidal activity of methanolic extract of *Stemona tuberosa* (Stemonaceae) against larvae of *Aedes aegypti*, *Culex quinquefasciatus* and *Anopheles maculates*.

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