

Veterinary Phytomedicine in India : A Review

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ABSTRACT

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Nature is a unique source of structures of high phytochemical diversity, many of them possessing interesting biological activities and medicinal properties. Phytochemicals ensure safe, eco-friendly and most effective drug for animal use. Veterinarians use these phytochemicals with the knowledge from traditional system and modern pharmacology. High cost of allopathic medicine is one of the major contributing factors in loss of productive livestock and animal productivity. Many plants have been identified which show promising abilities in disease prevention and cure. Phytochemicals can be used either by feeding whole plant parts or by the process of extraction of these chemicals and delivering in concentrated forms. The pharmacological activities of plants are attributed to certain active principles, namely alkaloids, glycosides, fats, oils, tannins, saponins etc. The use of cheap and easily available phytochemicals can thus be made by taking a leaf out of the ethno-veterinary practices. Although the effects of natural remedies may seem slower, the results are sometimes better on the long run especially with respect to chronic diseases. The horizon of phytochemicals has to be explored and exploited to create a “green treatment” protocol to develop an ecofriendly and toxin free production system that is beneficial for existence of both human and animal population in the near future.

Keywords: Phytochemicals, active principles, ethno-veterinary practices, diseases

I. INTRODUCTION

India, being one of the six richest mega biodiversity countries of the world is native to over 8000 species

of medicinal and aromatic plants. Even though human activities on the earth during last three centuries have wiped out hundreds of plant species, the ethno-veterinary practitioners have not given up

to anti biodiversity activities especially against the wealth of medicinal plants on earth. At this gesture the herbalists are helplessly looking upon the United Nations to enforce laws and checks so as to ensure conservation of medicinal plants for the holistic human and livestock health management practices.

Phytochemicals are chemicals that are naturally found in plants. They add color, odor and flavor to the plants. The word 'phyto' is derived from a Greek work meaning 'plant'. There are lots of phytochemicals in different parts of plants like fruits, leaves, bark, roots etc [1]. They protect from disease and damage, apart from contributing to the plant's color, aroma and flavor. Phyto-veterinary medicine for disease treatment and prevention in livestock is often the only available choice among rural and peri-urban populations, especially in developing countries like India. Moreover, livestock is an important contributor to the economic development of the country, Globally, about 90% population still relies on phyto-veterinary remedies for livestock. One important reason for this is the fact that the cost of allopathic medication is skyrocketing. In general, the plant chemicals that protect plant cells from environmental hazards like pollution, stress, drought, UV exposure and pathogenic attack (like bacteria, fungi etc.) are called phytochemicals. These are not essential nutrients and are not required by the animal body for sustaining life, but at the same time they are having curative and prophylactic properties against a wide range of animal diseases. Knowledge of plant phytochemistry provides a basic framework for using plant materials as potential therapeutic agents in the field of medicine. Phytochemicals have always been in existence and medicinal plants have been traditionally used all over the world. Hence, many drugs available from plants are even used today by many of the veterinarians in their daily practice [2]. Also, effective and affordable veterinary aid is necessary for enhancing livestock productivity which can only be achieved through wide scale application

of traditional knowledge of ethno-veterinary practice. Revival of this ancient heritage by focused approach on conservation and utilization of the medicinal plant biodiversity will alleviate livestock suffering and enhance availability of nutritional animal products to weaker section also.

Phytochemicals ensure safe, eco-friendly and most effective drug for animal use. Veterinarians use these phytochemicals with the knowledge from traditional system and modern pharmacology. High cost of allopathic medicine is one of the major contributing factors in loss of productive livestock and animal productivity. It is true that antibiotics, hormones, insecticides and pesticides have proven to be very effective ever since their introduction [3]. However, their indiscriminate use has played vital role in higher drug and pesticide resistance cases. The presence of their residues in human food chain needs to be reduced to a safe limit. As a result, there has been a great interest in the search for alternative, plant-based medicines with antimicrobial activity. In addition, the prohibitive cost of conventional medicines and their limited availability especially to the rural communities and other developing regions have driven the necessity of relying upon the traditional practices. Phytomedicine almost went into extinction in India during the first half of the 21st century with the arrival of the more powerful and potent synthetic drugs. But due to numerous side effects of these drugs, the value of medicinal plants is being rediscovered [4]. Moreover, some of them have proved to be as effective as synthetic medicines with fewer or no side effects and contraindications. Although the effects of natural remedies may seem slower, the results are sometimes better on the long run especially with respect to chronic diseases. Switching to Indian system of medicine in veterinary practice for curing ailments other than emergencies and serious infections may therefore be examined at apex level.

II. HISTORY OF PHYTOCHEMICALS

India has great traditional background in the field of Ethno-Veterinary Medicine (EVM) and practices. Animals and plants have always been an integral part of our culture, religion, magico-religion and traditional pharmacopoeia. Traditional practices are still prevalent in many villages which is a clear indication of their faith in the folk medicine. Use of specific phytochemicals as remedies for various maladies developed by trial and error over many centuries. The Chinese have the oldest medicine system and it has evolved greatly over the years. More than 5000 years ago, the Chinese based their medicine on the yin and yang principle and on the basis of the five elements. In Greece, Dioscorides came up with De Materia Medica in the first century AD. Vedic literatures of ancient India have already described the treatment of animal diseases by using medicinal herbs. For instance, "Rigveda" and "Yajurveda" cited the importance of the medicinal plants and "Atharvaveda" mentioned the value of indigenous medicines in curing diseases. The books written by Salihotra and Charaka (2350 BC) and Palikapya (1000 BC) have documented treatment of animal diseases using medicinal plants. Exclusive information on Veterinary Practices dates back to Mahabharat and two Pandavas "Nakul" and "Sahadev" who practiced Veterinary medicine with reference to horses and cattle. In the 19th and 20th century, scientists discovered many active ingredients, which had medicinal or pesticidal properties, e.g. salicylic acid, morphine and pyrethroids (pesticides). In the 1980s, many laboratories started to identify phytochemicals in plants for their use in medicines. Epidemiological studies in relation to these phytochemicals were also done [5].

III. SIGNIFICANCE OF PHYTOCHEMICALS

With the development of chemical science and pharmacognosy, physicians started to extract

chemical products from the medicinal plants. A few examples are - quinine was isolated from Cinchona and aspirin was obtained from the bark of the willow. With the active principles in medicinal plants identified and isolated, plant-based prescriptions began to be substituted more and more with pure substances, which were more powerful and easier to prescribe and administer. More than 4,000 phytochemicals have been cataloged till date and are classified by protective function, physical characteristics and chemical characteristics. Of these, nearly 150 phytochemicals have been studied in detail till date [6]. The phytochemicals present in plants that are responsible for preventing disease and promoting health have been studied extensively in the recent past to establish their efficacy and to understand the underlying mechanism of their action. Such studies have included identification and isolation of the chemical components, establishment of their biological potency both by *in vitro* and *in vivo* studies in experimental animals and through epidemiological and clinical-case control studies in animals. These compounds are known as secondary plant metabolites and have biological properties such as antioxidant activity, antimicrobial effect, modulation of detoxification enzymes, stimulation of the immune system, decrease of platelet aggregation, modulation of hormone metabolism and anticancer property. In addition, phytochemicals can reduce the risk of coronary heart disease by preventing the oxidation of low-density lipoprotein (LDL) cholesterol, reduce the synthesis or absorption of cholesterol, normalize blood pressure and clotting, and improve arterial elasticity [7]. These also aid in management or prevention of arteriosclerosis which is a condition precipitated by cholesterol. Phytochemicals may detoxify those substances that cause cancer. They appear to neutralize free radicals, inhibit enzymes that activate carcinogens, and activate enzymes that detoxify carcinogens. For example, genistein prevents the formation of new capillaries that are needed for tumor growth and metastasis. Phytochemicals have

also been promoted in these days for the prevention and treatment of diabetes, high blood pressure, and macular degeneration.

Findings from laboratory studies have shown that phytochemicals may stimulate the immune system, absorb free radicals, block carcinogens, reduce inflammation, prevent DNA damage and promote DNA repair, slow growth rate of cancer cells, cause damaged cells to undergo apoptosis before they can reproduce, counteract infection, alleviate pain and regulate hormones [1]. Thousands of phytochemicals have been identified so far, and scientists have only begun to truly understand the importance of these chemicals. Even as we claim to be technologically advanced, we mostly do not create any new compounds but only make chemical replicates of the phytochemicals already present in plants. Lately, due to changing global needs, there is a renewed interest in the discovery of more phytochemicals. Plant phytochemical remedies are used in many species including ovine, bovine, swine, poultry, equines, rabbits and canines. Prime disorders addressed by these preparations comprise gastrointestinal illness, postnatal maladies, wounds and dermatological complications.

IV. TYPES OF PHYTOCHEMICALS

Plants synthesize a wide variety of chemical compounds. These are sorted by their chemical class, bio-synthetic origin and functional groups into primary and secondary metabolites. The quantity and quality of phytochemicals present in plant parts may differ from one part to another. Phytochemicals can also be classified into hydrophilic and hydrophobic compounds, of which a great majority of terpenoid and polyphenolic compounds, as well as alkaloids, carbohydrates and non-protein amino acids are well known. Phytochemical analysis results state that terpenoid, steroids, tannins, flavonoids, saponins, and carbohydrates are commonly present in plants and it is these secondary metabolites that have therapeutic

activities and may act as synergistic or antagonistic agents in disease therapeutics [8]. Bioactive and disease preventing phytochemicals present in plants are mainly NSA (Non-starch polysaccharides), which include cellulose, hemicellulose, gums, mucilages, pectins, and lignins. Their biological functions include water holding capacity, delay in nutrient absorption and binding toxins and bile acids. Antibacterial & antifungal agents include terpenoids, alkaloids and phenolics, which are inhibitors of micro-organisms and also reduce the risk of fungal infection. Antioxidants include polyphenolic compounds, flavonoids, carotenoids, tocopherols and ascorbic acid [9]. Their functions include oxygen free radical quenching and inhibition of lipid peroxidation. Anticancer agents are carotenoids, polyphenols, curcumin and flavonoids. Flavonoids have gained recent attention because of their broad biological and pharmacological activities. They exert multiple biological property including antimicrobial, cytotoxicity, anti-inflammatory as well as antitumor activities apart from being a very powerful antioxidant. They act as inhibitors of tumor, inhibit development of lung cancer and have anti-metastatic activity. Detoxifying agents include reductive acids, tocopherols, phenols, indoles, aromatic isothiocyanates, coumarins, flavones, carotenoids, retinoids, cyanates and phytosterols. These serve as inhibitors of procarcinogen activation, inducers of drug binding of carcinogens and inhibitors of tumorigenesis. Alkaloids, terpenoids, volatile flavor compounds and biogenic amines functions as neuropharmacological agents, anti-oxidants and cancer chemoprevention [10-11].

The pharmacological activities of plants are attributed to certain active principles in plants. They are alkaloids, glycosides, fats, oils, tannins, saponins etc. It is known that tannins are able to precipitate proteins of the wound, forming a protective layer on the wound, thus assisting in the arrest of bleeding and therefore promoting wound. Tannins have also been used in treatment of diarrhea as an effective

astringent medicine that does not only stop the flow of the disturbing substance in the stomach; rather controls the irritation in the small intestine. Several health benefits have been recognized for the intake of tannins and some epidemiological associations with the decreased frequency of chronic diseases have been established [12]. Saponins have been linked with decreased cholesterolemia. They are also thought to aid in the absorption of calcium. Analgesic properties have been reported to be present in the alkaloids like morphine and codeine. However, some of the alkaloids like the morphine have addictive tendencies. It may therefore be a necessity to investigate any of the extracts for discovery of alkaloids with analgesic properties and less or non-addictive tendencies. Anthraquinones have been associated with anticancer, laxative and anti-arthritis properties [11, 13].

V. PLANTS USED IN VETERINARY PRACTICE

In day-to-day veterinary practices, parts of plants containing high concentration of specific phytochemicals are used. The main parts of plants used in healing are the storage organs, namely bark, bulbs, tubers and rhizomes, which are characterized by abundant quantities of storage lectins and proteins. The aerial regions of the plants are used more frequently (26%), leaves (14%), flowers (14%), fruits, and seeds (16%, including olive oil) and roots (5%). Legumes such as *Entada phaseoloides* seeds contain high levels of trypsin inhibitor and saponins, *Sesbania aculeate* seeds are rich in non-starch polysaccharides and *Mucuna pruriens var. utilis* seeds rich in 1-3,4-dihydroxyphenylalanine and have potential use in fish feed. *Cassia fistula* seeds are a source of antioxidants. *Canavalia ensiformis*, *C. gladiata* and *C. virosa* seeds contain high levels of trypsin inhibitors, lectins and canavanines. *Rosa* sp. (Gulab) petals are given to cure cold in cattle, *Helianthus annuus* L. (Gul-e-aftab) seeds is used as a tonic for cattle, Turmeric has its use in mastitis, applied on udder FMD ulcers Wound and having healing and antiseptic effect,

Rheum emodi powder is sprinkled on ulcers, wounds for quick healing & is also used as laxative, tonic & for GIT bleeding, *Allium cepa* L. crushed bulbs are used to stimulate the oestrus cycle in cows, *Datura stramonium* L. crushed seeds when given along with egg yolk are said to cure urinary bladder infections, *Rumex acetosa* crushed roots are made into balls and given along with salt to cattle to cure cough, gaseous bloat and sprained body parts, *Conyza canadensis*, crushed aerial portion is made into small soft balls and fed to cattle against indigestion and dysentery. *Annona squamosa* L. leaves are left in hens' nest or rubbed on floor to keep away vermin, *Allium sativum* *Liliaceae* (Garlic) bulb, *Kalanchoe pinnata* *Crassulaceae* (Wonder of the world) leaves, *Momordica charantia* vine, *Neurolaena lobata* leaves are all used for reduced appetite, *Chrysobalanus icaco* containing Chrysobalanaceae is used for the treatment of Pox, Citrus species, Rutaceae juice and peel is given for respiratory conditions and heat stress. *Coffea arabica / robusta* grounds may also be used for respiratory conditions. *Aconitum heterophyllum* is a bitter tonic especially given for fever, potato protein in diet increases average daily gain (ADG) parameters and gain and also reduces microbial populations in the caecum, colon and rectum, as well as in faeces in pigs. *Cannabis sativa* (Charas) leaves are crushed and given to animals for two days for indigestion. *Bergenia ligulata* (Pulfort) dried roots are ground to make powder is given to cattle with warm water during diarrhea, weakness and to enhance milk production, also *Sonchus arvensis* are fed to goat and cattle for the same reason. Plants used traditionally for the treatment of wounds and placenta retention in livestock have high levels of dichloromethane (DCM) and 90% methanolic extracts, when screened for antibacterial, anti-inflammatory and mutagenic activity were found effective in combating infection and for pain reduction. *Brassica rapa* L. leaves is given to cows for the removal of placenta. *Hypoxis hemerocallidea* and *Equilobium parviflorum* inhibit *Escherichia coli*. *Scilla natalensis* and *Ledebouria*

ovatifolia contain phytochemicals having anti-bacterial, anti-inflammatory, anathematic, anti-schistosomic and anticancer. Antibacterial activity is also exhibited by DCM extracts of *Dicerocaryum eriocarpum*, *Pterocarpus angolensis*, *Ricinus communis* and *Schkuhria pinnata* also have high antibacterial activity. *Nicotiana tabacum* leaves, have anti helminthic properties against *Haemonchus contortus* worms. *Artemisia absinthium* L. extract of the whole herb is used to cure the liver infection in cattle and is also a wormicide, *Cedrus deodara* oil is used for foul ulcers and wounds also applied on skin for treating ticks, fleas and lice. *Ananas comosus* (pine apple), *Momordica charantia* (bitter gourd) and *Azadirachta indica* (neem) contain anthelmintic compounds which are used for controlling internal parasites. Aqueous bulb extracts from *Allium sativa*, *Warburgia salutaris* and *Tulbaghia violacea* possess antifungal efficacy and both proved to be effective against fungus. *Lippia javanica* for the treatment of cough, cold and other problems of the bronchus and to disinfect meat contaminated with anthrax. Leaf decoction of *Caladium bicolor* is used to get rid of external festers in cows [14-16].

Use of medicinal plants ranges from treatment of ectoparasites to even surgical cases. *Aloe vera*, neem plant and sandal wood are those plants used with respect to their antipyretic and anti-infective properties. Plants like *Acacia catechu*, *Azadirachta indica*, *Nerium oleander* and *Ricinus communis* are used widely for their action against external parasite infestation. Spices have good carminative action which can relieve pain, flatulence and bloat apart from promoting gastro-intestinal peristaltic function. Barley and coriander are used as diuretics which increase urine production by direct effect on kidney and urinary bladder. Laxatives and purgatives are of good significance in the field as they relieve constipation and promote bowel movement. Anorexia is a common condition encountered where an animal refuses to eat totally, thereby leading to drastic

weight loss. *Aristolchia indica* leaves can be crushed and given as a paste which increases food intake. No days may pass in the life of a veterinarian without a case of indigestion. A mixture of *Allium sativum*, *Ferula assa-foetida*, *Piper nigrum* and *Zingiber officinale* is considered to be an excellent remedy for indigestion. Infertility often stands to be a great challenge for veterinarians. *Citrullus colocynthis*, *Cocos nucifera*, *Solanum melongena*, *Areca catechu*, *Oryza sativa* etc. are all effective in treating infertility [5, 17]. These are only a very few examples of the many cases wherein veterinarians apply people's tradition of animal health care system for curing animal diseases.

VI. CONCLUSION

Nature is a unique source of structures of high phytochemical diversity, many of them possessing interesting biological activities and medicinal properties. In the context of the worldwide spread of different diseases, chronic diseases and a variety of cancers, an intensive search for new lead compounds for the development of novel pharmacological therapeutics is extremely important. Given the number of phytochemicals isolated so far, nature must still have many more in store. With the advances in synthetic methodology and the development of more sophisticated isolation and analytical techniques, many more phytochemicals need to be identified. Still there exists a further need to deepen the horizon of research on the phytochemical composition of the plants, their mode of action, and furthermore to assess the lethal dose as well as explain how further studies might be conducted to bridge the gap between common uses and lack of studies on the safety and effectiveness of these herbs in lactation. Hence, an optimal standardization and dosing recommendations of these phytochemicals need to be developed by an explicit clarification in pre-clinical and clinical studies through in-vitro and in-vivo experimentations is needed. Advanced research on plants of excessive

medicinal values may lead to new source of drugs which are really beneficial for health care of mankind and other important domestic animals. There is an urgent need for biochemical analysis and pharmaceutical investigations of more and more plant species to formulate and standardize the medicine for sustainable uses, progress and development of new avenues. With the advances in synthetic methodology and the development of more sophisticated isolation and analytical techniques, many more of these phytochemicals should be identified. The horizon of phytochemicals has to be explored and exploited to create a “green treatment” protocol to develop an ecofriendly and toxin free production system that is beneficial for existence of both human and animal population in the near future.

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