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Herbs, Health, and Husbandry: India's Move Toward Antibiotic-Free Animal Production

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Abstract:

The extensive use of antibiotics in animal production has raised significant public health concerns, including antimicrobial resistance and residue issues, creating an urgent need for safe and effective alternatives. In recent years, plant-derived or herbal feed additives have gained increasing attention as potential substitutes owing to their multiple biological functions, minimal toxicity, eco-friendly nature, and lower likelihood of inducing resistance. India, known for its vast and diverse flora, possesses an abundance of medicinal plants traditionally utilized in animal healthcare for treating conditions such as poisoning, cough, dermatitis, bone fractures, and various infectious and metabolic disorders. Nearly 25% of all prescribed drugs worldwide are derived from plants, and around 75% of medicinal species grow naturally across different Indian states. This article highlights plant-derived or herbal feed additives relevance to ethno-veterinary practices, referencing some of plant species officially listed in the Indian Pharmacopoeia (2014).

Keywords: Veterinary herbals, Natural antibiotics, Phytogetic feed additives

Introduction:

Antibiotics have long been utilized as growth promoters to enhance productivity in animal production systems (Hashemi and Davoodi, 2011). However, prolonged use of antibiotics can lead to the accumulation of residues in meat and animal products, contributing to the global problem of antimicrobial resistance in humans. In response to these concerns, several nations have implemented regulations to restrict or prohibit antibiotic use in livestock. The European Union, under Regulation No. 1831/2003/EC, banned antibiotics as growth promoters in 2006, while China's Ministry of Agriculture and Rural Affairs (Announcement No. 194) mandated the withdrawal of all growth-promoting pharmaceutical feed

additives, except traditional Chinese medicines, from January 1, 2020. These initiatives have driven the demand for antibiotic-free animal products, creating new market opportunities and promoting the development of safer, natural alternatives to antibiotics in animal husbandry (Gadde et al., 2017). Among the promising substitutes, phytogetic or herbal feed additives have gained significant attention. These are plant-derived compounds with diverse biological activities, known to enhance animal growth, health, reproduction, and product quality, while reducing toxicity and environmental emissions (Rossi et al., 2020; Kuralkar and Kuralkar, 2021). Various natural alternatives, including enzymes, probiotics, prebiotics, organic acids, and medicinal plants, have been explored, but phytogetic additives stand out for their multifunctional properties—exhibiting antimicrobial, antioxidant, anti-inflammatory, and immunomodulatory effects (Kumar et al., 2014; Lillehoj et al., 2018).

The global reliance on herbal and traditional medicines further supports this trend. According to the World Health Organization (WHO), traditional medicine encompasses “the sum total of knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, used in the maintenance of health as well as in the prevention, diagnosis, and treatment of physical and mental illness.” In Asia and Africa, nearly 80% of the population depends on traditional medicine for primary healthcare, and around 25% of modern pharmaceuticals are derived from plants initially used in traditional systems. The global herbal market was valued at approximately USD 80 billion in 2011–2012, with India’s herbal sector alone worth about ₹16,000 crores (USD 4 billion). In China, traditional medicine accounts for 30–50% of total medical consumption, with around 800 herbal product manufacturers generating annual outputs worth USD 1.8 billion.

Veterinary herbal medicine—the application of plant-based therapeutics in animal health—has a long history in rural communities, particularly in India, where traditional practices remain vital for smallholders who cannot afford costly synthetic drugs. The widespread use of synthetic medications has raised concerns due to the presence of antibiotic residues in meat, the risk of resistance, and toxic metabolites, prompting renewed interest in safer and more sustainable herbal alternatives (Laudato and Capasso, 2013). The Indian Pharmacopoeia (IP), published by the Indian Pharmacopoeia Commission under the Drugs and Cosmetics Act (1940) and Rules (1945), includes detailed monographs of several herbal drugs, ensuring quality control, safety, and efficacy of herbal formulations.

Medicinal herbs contain a wide spectrum of pharmacologically active compounds, often working synergistically within a single plant to produce multiple therapeutic effects. These natural ingredients are generally less toxic, produce fewer residues, and are cost-effective, making them suitable for both human and veterinary applications. Nonetheless, variability in phytochemical composition across batches, coupled with incomplete understanding of their mechanisms of action, remains a challenge. Modern analytical tools such as metagenomics, transcriptomics, proteomics, and network pharmacology offer new

avenues to elucidate the biological pathways and molecular mechanisms underlying the effects of phyto-genic feed additives.

Herbal Drugs used in Veterinary Practice:

Medicinal plants for various animal diseases in different parts of India are compiled in IP 2014. Also, the official statuses of the herbs in the British Pharmacopoeia (BP) 2014 and the United States Pharmacopoeia (USP) 36 are discussed in Table 1.

Table 1: Some of the crude and processed herbs in IP 2014

Botanical name/ Local Name of The Plant	Family	Habitat	Parts of Plant Used	Reported Indications	Authors
<i>Acacia nilotica</i> (Indian gum)	Leguminosae, Mimosaceae	Throughout the drier parts of India	Seeds and bark	Acidity, foot disease	Takhar, Pande <i>et al.</i>
<i>Allium sativum</i> (Garlic)	Liliaceae	Native to Central Asia cultivated all over India	Leaf, Bulb	Snakebite, cold, cough, fever, swollen throat, hemorrhagic septicaemia, arthritis, foot and mouth disease, skin infection, itching, pruritis,	Phondani <i>et al.</i> , Pande <i>et al.</i> , Pandit, Galav <i>et al.</i> , Sadangi <i>et al.</i> , Mulay <i>et al.</i>
<i>Asparagus racemosus</i> (Shatavari)	Liliaceae	Found wild in tropical and subtropical parts of India,	Root, Leaf	Insect bite, In babesiosis, milching disorder, diarrhoea, dysentery, indigestion, haemachuria	Kumar Sadangi <i>et al.</i> , Pande <i>et al.</i> , Galav <i>et al.</i> , Mulay <i>et al.</i> , Kumar, Pal and Jain, Bharati and Sharma, Ashok and Reddy, Kiruba <i>et al.</i>
<i>Azadirachta indica</i> (Neem)	Meliaceae	Native to Burma; found all over India	Leaf	In swellings and inflammation constipation, dyspepsia, ulcer, prolapsed uterus, as mosquito repellent, Indigestion, liver disorders, tissue healing, small pox	Phondani <i>et al.</i> , Pandit, Varshney, Takhar, Pande <i>et al.</i> , Jaiswal <i>et al.</i> , Galav <i>et al.</i> , Sadangi <i>et al.</i> , Mulay <i>et al.</i> , Chakraborty and Pal, Pal and Jain, Varshney, Borthakur and Shar
<i>Bacopa monnieri</i> (Brahmi)	Scrophulariaceae	Throughout the plains of India in damp marshy areas	Whole plant	In paralytic attack	Galav <i>et al.</i>
<i>Cassia fistula</i> (Amaltas)	Caesalpineaceae	Cultivated as An ornamental throughout India	Leaf	Tongue sore, Purgative, constipation, to reduce swelling due to cold	Phondani <i>et al.</i> , Pandit, Galav <i>et al.</i> , Sadangi <i>et al.</i> , Dey and De
<i>Coriandrum sativum</i> (Coriander)	Apiaceae, Umbelliferae	Cultivated chiefly in Madhya Pradesh, Maharashtra,	Seed oil	Constipation, haematuria, indigestion, poisoning, chicken pox, fever, dehydration	Phondani <i>et al.</i> , Pande <i>et al.</i> , Pandit

		Rajasthan, Andhra Pradesh, Tamil Nadu, Karnataka and Bihar			
<i>Eclipta alba</i> (Bhringraj)	Asteraceae	Throughout India, up to 2,000 m on the hills Leaf	Leaf	Wound, antiseptic, swelling	Pandit, Mulay <i>et al</i> , Dey and De, Singh <i>et al</i>
<i>Mentha arvensis</i> (Mint)	Lamiaceae	Cultivated in Jammu and Kashmir	Leaf	Fever, dysentery	Pandit, Phondani <i>et al</i>
<i>Ocimum sanctum</i> (Tulasi)	Lamiaceae	Throughout India; grown in houses, gardens and temples	Leaf	Cough and cold, rhinitis, body ache, purulent disease	Pandit, Sudarsanam <i>et al</i>
<i>Withania somnifera</i> (Ashwagandha)	Solanaceae	Distributed throughout the drier region of India, especially In Wasteland	Root	Fever, ulcer, expulsion of placenta, convulsive seizures, tissue healing, antibacterial, improve sexual vitality	Jaiswal <i>et al</i> , Pandit, Galav <i>et al</i> , Pal and Jain, Ashok and Reddy, Mulay <i>et al</i> , Mishra <i>et al</i> , Wanzala <i>et al</i>

Phytogenic Feed Additives:

Phytogenic feed additives (also referred to as phytobiotics or phytochemicals) are commonly defined as plant-derived natural compounds, herbal formulas, plant extracts, or bioactive compounds that have the capacity to ameliorate feed properties, promote animal production performance, and improve animal product quality. The use of phytogenic feed additives or herbal plants for livestock nutrition can improve animal health and performance. Phytogenics can promote animal growth, production, and reproduction performance, and improve livestock product quality.

Natural Antibiotics:

Antibiotics have long been used as growth promoters to enhance productivity in animal production (Hashemi and Davoodi, 2011). Because of antimicrobial resistance development, the use of antibiotics as growth promoters has been gradually banned and therefore, alternative growth promoters have received increasing attention. Numerous herbal products having multiple biological functions are used as growth promoters to improve production efficiency in the animal industry (Gong *et al.*, 2014; Rossi *et al.*, 2020). Currently, phytogenic feed additives are widely used in feeding programs for swine, poultry, and ruminants.

While most studies on plant additives in ruminants focused on the regulation of rumen fermentation and the prevention or treatment of mastitis, some studies have demonstrated beneficial effects on production performance.

Table 2: Function of some phytogetic feed additives and potential modes of actions

Common Name/ Species Name	Animal Species Involved	Action And Potential Mechanism	References
Poplar (<i>Populus deltoides</i>) and eucalyptus (<i>Eucalyptus citriodora</i>) leaves	Buffaloes (<i>Bubalus bubalis</i>)	Enhance milk production and immunity of Murrah buffaloes.	Dey <i>et al.</i> (2021)
Ashwagandha (<i>Withania somnifera</i>)	Broiler chicks	Improve feed intake, BW gain, hematological profile and immunological status	Mushtaq <i>et al.</i> (2012)
Mustard and cumin seeds	Goats	Improve nutrient digestibility, ruminal fermentation and milk yield positively affect milk Fatty Acid profile	Morsy <i>et al.</i> (2018)
<i>Moringa oleifera</i> seed	Ram	Improve the outcome of semen cryopreservation used as an antioxidant.	Carrera-Chavez <i>et al.</i> (2020)
Mulberry leaf	Ewes	Improve the digestibility of organic matter and reduce CH ₄ output by inhibiting the populations of microbes involved in methanogenesis.	Wang <i>et al.</i> (2019)
Turmeric (<i>Curcuma longa</i>)	Broiler chicks	Protect bursa of Fabricius against toxicity induced by salinomycin probably through increasing antioxidant potential and immune function.	Sayrafi <i>et al.</i> (2017)
<i>Allium sativum</i>	Broiler chickens	antagonize lead toxicity. Reverse the lead-induced toxic impacts on the productive and reproductive performances probably owing to enhanced antioxidant status and immune function.	Alagawany <i>et al.</i> (2018)

Conclusion:

The growing global concern over antimicrobial resistance and antibiotic residues in animal products has accelerated the shift toward safer, eco-friendly alternatives in livestock production. Herbal and phytogetic feed additives offer a sustainable solution, combining traditional knowledge with modern science to enhance animal health, productivity, and product quality. India's rich biodiversity and long-standing heritage in ethno-veterinary medicine position it uniquely to lead this transition toward antibiotic-free animal husbandry. These plant-based additives exhibit diverse biological effects—antimicrobial, antioxidant, anti-inflammatory, and immunomodulatory—while minimizing toxicity and residue risks. However, to realize their full potential, further research is needed to standardize formulations, understand mechanisms of action, and ensure consistent efficacy. Integrating herbal therapeutics into modern veterinary practice can thus promote both animal welfare and public health,

supporting the global vision for sustainable livestock production.

Competing Interests:

The authors declare that they don't have any competing interests.

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