Bridging India's ethnobotanical traditions and *Ayurveda*: Exploring galactagogue plants in livestock and human care

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Review

Abstract

Background: Livestock are vital to rural and agrarian economies, yet enhancing lactation remains a persistent challenge. Ethnobotanical and ethnoveterinary galactagogue plants, deeply rooted in indigenous knowledge systems, offer a sustainable alternative to synthetic lactation stimulants. Drawing upon ancient literature of *Ayurveda* and traditional ethnoveterinary practices, plant-based remedies have long been used to improve milk production, aligning with modern goals of sustainable livestock management.

Methods: This review systematically examined traditional and contemporary literature on ethnobotanical and ethnoveterinary galactagogues, sourcing data from *Ayurveda* ancient classic texts, ethnoveterinary documentation, and modern scientific studies. Plant species traditionally used to stimulate lactation were identified and categorized based on plant family, utilized parts and known phytochemical constituents.

Results: The analysis identified over 170 plant species, predominantly from the Fabaceae family, with seeds and leaves being the most utilized parts in Indian traditional system of medicine. Key bioactive phytochemicals—including flavonoids, terpenoids, alkaloids, and phenolic compounds—were found to play potential roles in enhancing lactation. Pharmacological evidence suggests that these compounds may influence hormonal pathways associated with milk production. However, there remains a lack of standardized herbal formulations and clinical trials validating their efficacy and safety across diverse livestock species.

Conclusion: Ethnobotanical and ethnoveterinary galactagogue plants represent a promising avenue for sustainable dairy management by bridging traditional wisdom with modern veterinary science. Future research should prioritize the standardization of herbal formulations, conduct rigorous clinical validation, and explore policy integration of plant-based galactagogues in veterinary & human healthcare. Promoting these plant-based solutions can reduce reliance on synthetic drugs while ensuring animal health, welfare, and productivity.

Keywords: *Ayurveda*, Ethnoveterinary Medicine, Galactagogue Plants, Phytochemicals, Sustainable Livestock Management

Background

Livestock plays a vital role in the livelihood of millions globally, particularly in rural and agrarian economies, by providing income, nutrition, and raw materials. However, optimizing milk production in lactating animals remains a significant challenge in animal husbandry (Vilar *et al.* 2020). Galactagogues, substances that enhance lactation, are essential in this context, supporting animal health and productivity. Traditional ethnoveterinary practices, deeply rooted in indigenous knowledge systems, have long relied on natural remedies to address livestock health and production challenges, including lactation enhancement. These practices offer a sustainable and culturally acceptable alternative to synthetic drugs, aligning with the global emphasis on organic and sustainable livestock management (Man *et al.* 2023).

Past survey studies have suggested that many traditional galactagogue plants contain bioactive compounds capable of modulating endocrine and metabolic pathways to enhance lactation (Bazzano *et al.* 2016). Despite this, the scientific evaluation of these plants remains limited, particularly in terms of their safety, efficacy, and integration into modern veterinary practice. This study aims to systematically investigate traditional galactagogue plants used in ethnoveterinary practices, bridging the gap between indigenous knowledge and contemporary veterinary science. By doing so, it seeks to establish a scientific basis for their use and contribute to sustainable livestock management systems. India's policy framework strongly supports the integration of traditional practices into modern livestock management through initiatives like the National Livestock Mission (NLM) (Government of India, 2014), the Rashtriya Gokul Mission and National Programme for Dairy Development (NPDD) (Forum IAS, 2024), Livestock Health and Disease Control (LH&DC) Program and National Animal Disease Control Programme (NADCP) (Press Information Bureau, 2023). These programs provide a supportive environment for incorporating herbal galactagogues into livestock care. Furthermore, the Indian government has demonstrated its commitment to promoting ethnoveterinary practices, recognizing their role in sustainable development (Balaji *et al.* 2010).

Ethnoveterinary medicine, particularly in South Asia, has a rich history rooted in traditional systems like *Ayurveda*. Sacred plants, revered in Asian cultures, are recognized for their medicinal activities, including *Vranaropana Karma* (wound healing activity), *Krimighna Karma* (antimicrobial activity) and *Shothahara Karma* (anti-inflammatory activity) (Gajarmal *et al.* 2016). *Pashu Ayurveda*, the ancient Indian system of animal care, has long utilized these plants to treat livestock diseases. Documenting this ethnobotanical as well as ethnoveterinary indigenous knowledge is crucial for preserving traditional methods and leveraging them in modern livestock healthcare. The widespread availability, affordability and acceptance of herbal remedies, particularly in rural areas with limited access to modern veterinary care, underscore their continued relevance (Jayakumar *et al.* 2018). This article focuses on documenting ethnoveterinary medicinal (EVM) plants traditionally used to enhance lactation in livestock as well as in human, with an emphasis on their phytochemicals associated with galactagogue activity. By providing scientific validation of these practices, the study aims to support their integration into modern veterinary medicine. To the best of our knowledge, this is the first comprehensive review that bridges Indian ethnobotanical practices and classical Ayurveda literature to specifically explore galactagogue plants used in both livestock and human care. This interdisciplinary synthesis provides valuable insights for sustainable dairy management and supports integrative health approaches in veterinary and maternal care.

Material and Methods

The present review aims to provide organized information on the ethno-medicinal applications of various herbs having galactagogue activity, their botanical nomenclature and phytochemicals. For this, several well-known searchable online search engines such as PubMed, Scopus, Web of Science, Google Scholar along with ancient *Ayurveda* literary survey, were used to investigate the knowledge of ethno-veterinary medicinal (EVM) plants, with a special focus on their galactagogue activity in livestock. Keywords such as '*Ayurveda'*, 'Ethno-veterinary', 'Ethno-botanical', 'Galactagogue activity', 'Lactation', 'Milk production', 'Plants', 'Livestock' and 'Phytochemical' were used to search the literature and collect relevant references. The study included plants traditionally used in India, both native Indian species and those introduced but widely accepted and utilized in ethno-veterinary practices. The *Sanskrit*/Folk names of the plants are based on the information available in an illustrated dictionary of Indian medicinal plants (Khare, 2007). The *Latin* names of all plants adhere to the nomenclature specified in the 'World Flora Online' (WFO, 2024).

In the traditional Indian medical system (AYUSH), knowledge about plants used in veterinary practices has been systematically gathered through extensive studies of *Ayurveda*, veterinary and folk medicine literature, as well as numerous scientific research articles (Gajarmal *et al.* 2024). A special published issue focusing on herbs with galactagogue properties in the dairy industry (Pashudhan Praharee, 2021), contributions from livestock-focused publications (Mohanty *et al.* 2014) and data from various ethnoveterinary regional surveys conducted in India, such as those in Meghalaya (Bhat *et al.* 2023), Himachal Pradesh (Kumari Dhiraj, 2023), Uttar Pradesh (Kumar *et al.* 2013), and Karnataka (Kumar *et al.* 2017), have been meticulously reviewed. Similar studies from other South Asian countries have also been examined (Pratama *et al.* 2021, Rehman *et al.* 2022). Based on this comprehensive review, several plants identified for enhancing lactation and milk production in livestock are presented in Table 1.

Results

The analysis of over 139 plants reveals the Fabaceae family as the most dominant in contributing to galactagogue activity, underscoring its significant diversity and relevance in the dataset. A total of 77 plant species belonging to various families were identified. Among these, the Fabaceae family was the most predominant, constituting 22.08% of the total species. This was followed by Apiaceae (15.58%), Poaceae (14.29%), and Asteraceae (9.09%). Other notable families included Moraceae (7.79%), Malvaceae (6.49%), Amaranthaceae (6.49%), Convolvulaceae (5.19%), and Euphorbiaceae (5.19%). Families with lower representation included Apocynaceae (3.90%) and Brassicaceae (3.90%) (Fig. 1). These findings highlight the significant role of Fabaceae and other dominant families in ethnoveterinary galactagogue applications.

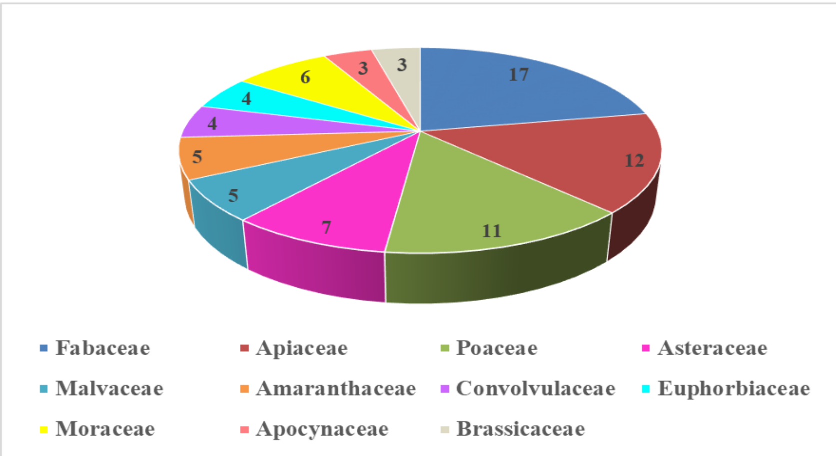

Figure 1. Distribution of plant families used as galactagogues in ethnoveterinary practices

Leaves were the most frequently used plant part, accounting for 25.70% of the total, followed by seeds (20.11%), whole plants (15.64%), and roots (12.85%). Fruits constituted 5.03%, while stems and barks contributed 3.35% each. Other plant parts, including flowers (2.79%), gum resins (2.23%), and oils (1.68%), were also utilized. Less frequently employed plant parts included rhizomes (1.68%), aerial parts (1.68%), twigs (1.12%), and rare components such as tubers, vines, tender coconut water, fruit shells, and pods (each ≤ 0.56%). These findings underscore the preference for vegetative parts, particularly leaves and seeds, in traditional galactagogue formulations.

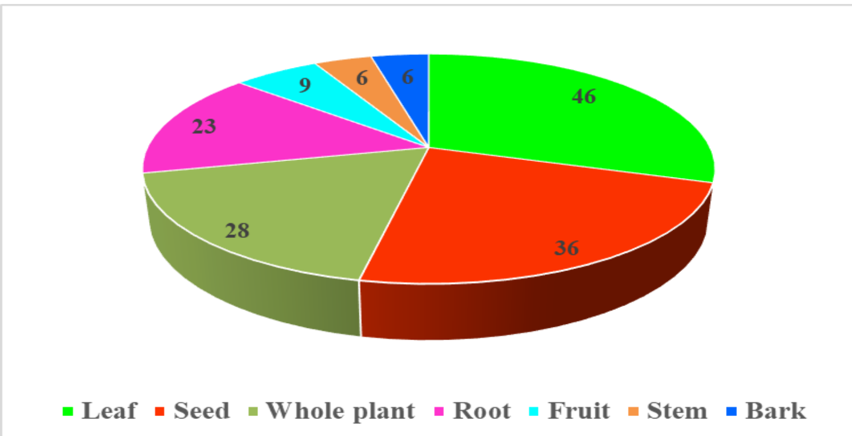

Figure 2. Distribution of plant parts used as galactagogues in ethnoveterinary practices

Table 1. List of ethnoveterinary medicinal plants used as galactagogues in livestock

***Latin* Name**	**Family**	***Sanskrit* / Folk Name**	**English Name**	**Part Used**	**Phytochemicals Associated with Galactagogue Activity**	**Reference**
Alternanthera sessilis (L.) DC.	Amaranthaceae	*Matsyakshi*	Sessile Joyweed	Leaf, Root	Saponins, flavonoids, tannins, reducing sugars, alkaloids, steroids, terpenoids	(Mondal *et al.* 2014)
Amaranthus caudatus L.	Amaranthaceae	*Raam-daanaa*	Love-Lies-Bleeding, Tassel Flower	Seed	Saponins, alkaloids, tannins, phenolic compounds, flavonoids	(Jimoh *et al.* 2019)
Amaranthus viridis L.	Amaranthaceae	*Tanduliya*	Slender Amaranth	Leaf	Polyphenols, flavonoids	(Sarker *et al.* 2019)
Celosia argentea L.	Amaranthaceae	*Shitivaaraka*	Silver Cockscomb	Seed	Saponins, celosins, phenol glycosides, flavonoids	(Miguel, 2018)
Chenopodium album L.	Amaranthaceae	*Vastuka*	Lamb's Quarters	Leaf, Seed	Saponins, alkaloids, phenols, lignins, flavonids, glycosides,	(Zheng, 2017)
Anethum graveolens L.	Apiaceae	*Shatapushpa*	Dill	Seed	Anethole, estragole, fenchone, β-sitosterol, carvone, limonene, eugenol, α-phellandrene, flavonoids, coumarins, tri-terpenes, phenolic acids, umbelliferones	(Shekhawat *et al.* 2010)
Carum carvi L.	Apiaceae	*Krishna Jiraka*	Caraway	Seed	Andlimonene, thujone, pinen, carvone, dihydrocarvone, carveol, dihydrocarveol, flavonoids (quercetin), limonene, germacrene D, transdihydrocarvone	(Johri, 2011)
Centella asiatica (L.) Urb.	Apiaceae	*Mandookparni*	Gotu Kola	Whole plant, Leaf, Aerial parts	Asiaticosides, triterpenoids, flavonoids	(Seong *et al.* 2023)
Coriandrum sativum L.	Apiaceae	*Dhanyaka*	Coriander	Seed	Linalool, coumarins, 1,8-cineole (eucalyptol)	(Brodribb, 2018)
Cuminum cyminum L.	Apiaceae	*Jeeraka*	Cumin	Seed	Essential oil, cuminaldehyde, flavonoids	(Agrawala *et al.* 1968)
Ferula asafoetida H.Karst.	Apiaceae	*Hingu*	Asafoetida	Olea-gum-resin	ferulic acid, esters, coumarins, sesquiterpene coumarins, polysulfides volatile oils (sulphur compounds), flavonoids	(Iranshahy *et al.* 2011)

Foeniculum vulgare Mill.	Apiaceae	Mishreya	Fennel	Seed	Anethole, flavonoids	(Rifqiyati *et al.* 2019)
Pimpinella anisum L.	Apiaceae	Ajamoda	Anise	Seed	Galegine, flavonoids, anethole, estragole, methyl chavicol, anisaldehyde, coumarins, scopoletin, umbelliferone, sterols, terpene hydrocarbons	(Hosseinzadeh *et al.* 2014)
Pimpinella diversifolia DC.	Apiaceae	-	Diverse-Leaf Pimpinella	Whole plant	Phenylpropanoids, terpenoids, flavonoids, coumarins, sterols, organic acids	(Shojaii *et al.* 2012)
Trachyspermum ammi Sprague	Apiaceae	*Yavani*	Ajwain	Seed, Fruit, Root,	Thymol, flavonoids, glycosides, saponins, phenolic compounds, volatile oil, thymol, γ-terpinene, para-cymene, α- and β-pinene	(Bairwa *et al.* 2012)
Calotropis procera (Aiton) Dryand.	Apocynaceae	*Arka*	Apple of Sodom	Flowers	Alkaloids, triterpenoids, flavonoids, cardenolids, tannins, saponosids, reducing sugars	(Maya *et al.* 2023)
Cryptolepis dubia (Burm.f.) M.R.Almeida	Apocynaceae	*Krishna Saarivaa*	Indian Sarsaparilla (black var.)	Root	Alkaloids, flavonoids, fatty acids, phenolics, terpenoids, lignans, tannins	(Mili *et al.* 2024)
Cynanchum annularium (Roxb.) Liede & Khanum	Apocynaceae	*Jivanti*	Indian Swallowwort	Whole plant	Steroidal glycosides, alkaloids, phenolic compounds, saponins, tannins, flavonoids, terpenoids, carbohydrates, amino acids, anthocyanins	(M. *et al.* 2024)
Leptadenia reticulate (Retz.) Wight & Arn.	Apocynaceae	*Jeevanti*	Cork Swallowwort	Whole plant, Leaf	Phytosterols, flavonoids, α-amyrin, β-amyrin, ferulic acid, luteolin, diosmetin, rutin, β-sitosterol, stigmasterol, hentriacontanol	(Patel *et al.* 2016)
Arisaema flavum (Forssk.) Schott	Araceae	*Kandaruha*	Yellow Cobra Lily	Rhizome	Lectins,13-phenyltridecanoic Acid, Asparagine , Cysteine, Glycine, Norvaline, Ornithine, β-setosteryl Galactoside, alfa &beta amyrin	(Ali *et al.* 2021)
Pothos scandens L.	Araceae	*Aanaparuga*	Devil's ivy, Money plant	Whole plant	Alkaloids, flavonoids, tannins, terpenoids, saponin, catechin,	(Kumar *et al.* 2017)

					coumarin, phenol, sugar, glycoside, xanthoprotein steroids	
Cocos nucifera L.	Arecaceae	*Narikela*	Coconut	Tender Coconut Water, Oil, Fruit, Fruit Shell, Inflorescence	Medium-chain fatty acids, polyphenols, tannins, leucoanthocyanidins, flavonoids, triterpenes, steroids, alkaloids	(Lima *et al.* 2015)
Phoenix loureiroi Kunth	Arecaceae	*Pindakhajura*	Mountain Date Palm, Dwarf Date Palm.	Fruits, Root, Stem	Saponins, triterpenoids, steroids, organic acids, polyphenolics, amino acids, ascorbic acid, catechin,	(Rajan *et al.* 2021)
Phoenix sylvestris (L.) Roxb.	Arecaceae	*Kharjura*	Wild Date Palm	Leaf	Flavonoids, polyphenols, sugars	(Foong *et al.* 2020)
Asparagus curillus Buch.-Ham. ex Roxb.	Asparagaceae	*Shatamuli*	Wild Asparagus	Root	Saponins, alkaloids, flavonoids, steroids, catecholic tannin, polyuronoid polyoses, gallic tannin	(Shrestha *et al.* 2018)
Asparagus racemosus Willd.	Asparagaceae	*Shatavari*	Shatavari	Tuber/ Root, Leaf	Steroidal saponins (Shatavarin I–IV), flavonoids	(Alok *et al.* 2013)
Anacyclus pyrethrum (L.) Lag.	Asteraceae	*Aakaarakarabha, Aakallaka*	Spanish, Pellitory, Pyrethrum Root	Roots	Alkaloids, Alkamides, saponins, flavonoids, N-alkylamides, Sesamin, essential oils,	(Harjit, 1998**,** Jawhari *et al.* 2020)
Baccharoides anthelmintica (L.) Moench	Asteraceae	*Shvetakaravi*	Bitter Fleabane	Seed	Triterpenoids, flavonoids, phenolic, terpenes, sesquiterpenes, chalcones, diterpenes	(Singh Rajpoot *et al.* 2024)
Cirsium wallichii DC.	Asteraceae	*Chakkumullu*	Wallich's Thistle	Leaf	Triterpenoids, Flavonoids, Alkaloids, Acetyljacoline, Fumaric acid	(Aggarwal *et al.* 2022)
Cnicus benedictus (L.) L.	Asteraceae	-	Blessed thistle	Flowering tops, Leaf, Seed	Sesquiterpene lactone (cnicin)	(Wu *et al.* 2023)
Eclipta prostrata (L.) L.	Asteraceae	*Bhringaraja*	False Daisy	Whole plant	Coumestan derivatives, triterpene saponins, steroidal saponins, triterpenes, steroids, steroidal alkaloids, flavonoids, phenolic acids, thiophene derivatives	(Timalsina *et al.* 2021)
Silybum marianum (L.) Gaertn.	Asteraceae	--	Milk Thistle	Seed	Sesquiterpenoids, flavonoids, silybin, silydianin, silychristin	(Tedesco *et al.* 2004)

Sonchus oleraceus L.	Asteraceae	*Duudhi, Dodaka, Dudhaali*	Milk Thistle	Leaf	Flavonoids, flavonols, proanthocyanidins, total phenols, saponins, alkaloids, sesquiterpene lactones	(V.Puri *et al.* 2018)
Galinsoga parviflora Cav.	Asteracece	--	Gallant Soldier	Whole Plant	Polyphenols, saponins, flavonoids, terpenoids, tannins	(Ripanda *et al.* 2023)
Borago officinalis L.	Boraginaceae	*Gaozabaan*	Borage	Leaf, flower	Pyrrolizidine alkaloids (amabiline, supinine, lycopsamine, intermedine), choline, minerals (K and Ca), oil, fatty acids	(Farhadi *et al.* 2012)
Brassica rapa L.	Brassicaceae	*Sarshapa*	Field Mustard	Seed cake, Oil	Glucosinolates, flavonoids	(Danna *et al.* 2022)
Eruca vesicaria (L.) Cav.	Brassicaceae	--	Arugula	Seed	Sulforaphane, flavonoids, erucin, β-elemene, hexahydrofarnesylacetone, (E)-β-damascone, erucin, α-longipinene	(Omri Hichri *et al.* 2016)
Nasturtium officinale R.Br.	Brassicaceae	*Jal-indushoor, Sim Saag*	Watercress	Whole Plant	Glucosinolates, flavonoids	(Monteban , 2017)
Commiphora wightii (Arn.) Bhandari	Burseraceae	*Guggulu*	Guggul	Gum resin	Monoterpenoids, sesquiterpenoids, diterpenoids, triterpenoids, steroids, flavonoids, guggultetrols, lignans, sugars, amino acids	(Sarup *et al.* 2015)
Opuntia stricta (Haw.) Haw.	Cactaceae	*Naagaphani, Kanthaari*	Prickly Pear, Slipper Thorn	Whole plant	Polysaccharides, phenolic acids, saponins, polyphenols, flavonoids, quinic acid, hyperoside, tannins	(Affi *et al.* 2024)
Nardostachys jatamansi (D.Don) DC.	Caprifoliaceae	*Jatamansi*	Spikenard	Rhizomes	Polyphenols, flavonoids, sesquiterpenes, coumarins, lignans, neolignans, alkaloids	(Pathak *et al.* 2024)
Cleome viscosa L	Cleomaceae	*Ajagandha*	Wild Mustard	Leaf, Seed	Glucosinolates, flavonoids, triterpenoids, saponins, steroids	(Gupta *et al.* 2012)
Argyreia nervosa (Burm.f.) Bojer	Convolvulaceae	*Vridhadaruka*	Hawaiian Baby Woodrose	Aerial part, Root	Alkaloids, sterols, triterpenoids carbohydrate, proteins, amino acids, flavonoids, tannins, saponin	(Kulkarni *et al.* 2021)
Convolvulus arvensis L.	Convolvulaceae	*Vishnukranta*	Field Bindweed	Whole plant	Alkaloids, phenolic compounds, flavonoids, sterols, resin, tannins,	(Al-Snafi, 2016a)

					unsaturated sterols/triterpenes, lactones	
Ipomoea batatas (L.) Lam.	Convolvulaceae	*Mukhaaluka, Rataalu*	Sweet potato	Leaf	Diosgenin (a steroidal saponin), flavonoids, phenolic acids, anthocyanins, carotenoids, tannins	(Suhendy *et al.* 2023)
Ipomoea digitata L.	Convolvulaceae	*Vidarikanda*	Elephant Creeper	Tuberous root	Pterocarpanone, hydroxyl-tuberosome, oxy-methyl tuberosine, pterocasperohydro tuberosine	(Khan *et al.* 2009)
Hellenia speciosa (J.Koenig) S.R.Dutta	Costaceae	*Kebuka*	Canereed, Wild Ginger	Stem, Leaf	Steroids, terpenes, volatile oils,	(Qin *et al.* 2025)
Equisetum arvense L.	Equisetaceae	*Ashva Pucchha*	Horsetail	Whole Plant	Silicic acid, flavonoids, silicates, saponins, tannin	(Sahdev *et al.* 2018)
Euphorbia heterophylla var. *cyathophora* (Murray) Griseb.	Euphorbiaceae	--	Dwarf Poinsettia	Leaf	Flavonoids, saponins, phytosterol (poliferol, sterols), phenols, terpenes	(Mathuin *et al.* 2020)
Euphorbia hirta L.	Euphorbiaceae	*Dugdhika*	Asthma Plant	Whole plant	Flavonoids, tannins, alkanes, triterpenes, phytosterols, polyphenols	(Koko *et al.* 2019)
Euphorbia lancifolia Schltdl.	Euphorbiaceae	-	Ixbut	Dried aerial part	Sesquiterpenes, eleinol, ingenol, 3-angelate, kaempferol, scopoletin, kaempferol 3-O-glucopyranoside, quercetin, vanillic acid, p-hydroxycinnamic acid, protocatechuic acid, dihydroxycoumarin, β-sitosterol, brevifolin, daucosterol, piceatannol, jolkinolide β, D-glucopyranoside, octacosyl cis-ferulate, ethylbrevifolin, carboxylate, octacosyl trans-ferulate, chrysophanol	(Rosengarten, 1982)
Jatropha curcas L.	Euphorbiaceae	*Kanana Eranda*	Physic Nut	Leaf, Seed, Oil, Twig	Phorbol esters, flavonoids, terpenes, cyclic peptides alkaloids, lignans	(Abdelgadir *et al.* 2013)

Albizia chinensis (Osbeck) Merr.	Fabaceae	*Shirish (Brihata)*	Chinese Albizia	Twigs	Saponins, tannins, sterols, alkaloids, phenolics, polysaccharides	(Chaudharya *et al.* 2011)
Argyrolobium roseum (Cambess.) Jaub. & Spach	Fabaceae	-	Rose-flowered Argyrolobium	Shoots	Phenols, terpenes, saponins, tannins, flavonoids, reducing sugars, alkaloids, glycosides	(Abidullah *et als* 2022)
Cicer arietinum L.	Fabaceae	*Chanaka,*	Bengal Gram, Chick pea	Seed	Isoflavones, phytosterols, saponins, alkaloids, phenolic compounds, tannins, flavonoids, glycosides, amino acids, iron, phosphate, sulphate, chloride	(Al-Snafi, 2016b)
Galega officinalis L.	Fabaceae	--	Goat's Rue	Aerial parts	Silymarin, flavonolignans, flavonol triglycosides, kaempferol, andquercetin	(Penagos Tabares *et al.* 2014)
Glycine max (L.) Merr.	Fabaceae	*Raam Kurthi, Bhat*	Soybean	Seed	Isoflavones, phytosterols, saponins, phenolic, flavonoid, phenolic acids	(Alghamdi *et al.* 2018)
Macrotyloma uniflorum (Lam.) Verdc.	Fabaceae	*Kulitha*	Horse Gram	Seed	Isoflavones, phenolics, mome inositol, ethyl alpha-d-glucopyranoside, n- hexadecanoic acid, linoleic acid, esters, ethyl derivatives, vitamin E, stigmasterol, 3-beta-stigmast-5-en-3-ol.	(Das *et al.* 2014)
Medicago sativa L.	Fabaceae	*Lasunghaas*	Alfalfa	Leaf	Alkaloids (stachydrine, 1-homostachydrine), coumesterol, flavonoids, iso-flavonoids, carotenoids, phenolic acids, minerals (Fe, Ca, K, P and Zn)	(Zuppa *et al.* 2010)
Mimosa pudica L.	Fabaceae	*Lajjalu*	Sensitive Plant	Roots, Leaf, Seed, Stem, Twig, Whole plant	Alkaloids, chalcones, flavonoids, indoles, terpenes, terpenoids, saponins, steroids, amino acids, glycosides, flavanols, phenols, lignoids, polysaccharides, lignins, fatty esters	(Rizwan *et al.* 2022)
Mimosa rubicaulis Lam.	Fabaceae	*Lajjalu*	Indian Mimosa	Shoots, Pods	Alkaloids, tannins, phenol, flavonoids	(Tamboli *et al.* 2019)

Senegalia catechu (L.f.) P.J.H.Hurter & Mabb.	Fabaceae	*Khadira*	Black Catechu	Bark	Catechins, flavonoids, tannins, terpenoids, triterpenoids, alkaloids, ascorbic acid, carbohydrates	(Adhikari *et al.* 2021)
Sesbania grandiflora (L.) Poir.	Fabaceae	*Agastya*	Agati Sesban, Swamp Pea	Leaf	Flavonoids, saponins, tannins, alkaloids, , phenols, quinones, steroids, tannins, proteins, terpenoids	(Abdul Kader Mohiuddin , 2019)
Trifolium alexandrinum L.	Fabaceae	*Tripatra*	Clover, Trefoil berseem	Seed	Alkaloids, coumarins, cardiac glycoside, flavonoids	(Shah *et al.* 2014)
Trifolium pratense L.	Fabaceae	*Ispast,Trepatra*	Red Clover	Flower	Isoflavones (biochanin A, daidzein, formononnetin, genistein, pratensein, trifoside) flavonoids (pectolinarin, trifoliin, isoquercitrin), clovamides; L-Dopa-caffeic acid conjugates, (coumestrol, medicagol, galactomannan, resins, minerals, vitamins, phyto-alexins	(Sabudak *et al.* 2009)
Vachellia nilotica (L.) P.J.H.Hurter & Mabb.	Fabaceae	*Babbula*	Gum Arabic Tree	Pods, Gum	Tannins, polyphenols, amine, alkaloids, cyanogenic glycosides, cyclitols, fatty acids, fluoroacetate, terpenes	(Lompo-Ouedraogo *et al.* 2004)
Vicia sativa L.	Fabaceae	*Kalaya*	Common Vetch	Whole Plant	Saponins, flavonoids, alkaloids, flavanol, flavones, coumarin, oleanane triterpenoids	(Liu *et al.* 2020)
Vigna mungo (L.) Hepper	Fabaceae	*Maasha*	Black Gram, Kidney Bean	Seed, Whole plant	Flavonoids, isoflavonoids, phytoestrogens, phenolic acids, enzymes, fibers, starches, trypsin inhibitors, phytic acid, lectins, saponins, tocopherols, fatty acids	(Dhumal *et al.* 2019)
Vigna radiata (L.) R.Wilczek	Fabaceae	*Mudga*	Green gram, Golden Gram	Seed, Whole plant	fatty acids, phenolic compounds, flavonoids, phenolic acids,	(Wang *et al.* 2021)
Quercus floribunda Lindl. ex A.Camus	Fagaceae	*Thal, Moru, Bele kharmendo*	Mohru Oak, Green oak, Holly oak	Bark, Leaf, Galls	Alkaloids, tri-terpinoids, phenols, glycosides, flavonoids, steroids, tannins	(Ahmad *et al.* 2023)

Quercus glauca Thunb.	Fagaceae	*Banni, Barin*	Ring-cupped Oak, Japanese Blue Oak	Bark, Leaf	Phenol, tannins, saponins, terpenoids, alkaloids, phlobatanins,	(Iqbal *et al.* 2023)
Quercus leucotrichophora A.Camus	Fagaceae	*Baloot, Shila Supari, Kashtavriksha*	Grey Oak	Seed	Fatty acids, triterpenoids, flavonoids, phenolic	(Kumari *et al.* 2023)
Quercus semecarpifolia Sm.	Fagaceae	*Kharshu*	Brown Oak	Leaf, Bark	Tannins, phenols, saponins	(Shalini Sharma *et al.* 2022)
Mentha longifolia (L.) L.	Lamiaceae	*Pudinaa-Barri, Jangali Pudinaa*	English Horsemint	Roots	Flavonoids, phenolic acids, cinnamates, ceramides, sesquiterpenes, terpenes, terpenoids	(Farzaei *et al.* 2017)
Vitex agnus-castus Linn.	Lamiaceae	*Renukaa*	Chaste berry	Fruit, Seed	Iridoid glycosides (agnoside, aucubin) flavonoids (casticin, kampferol, quercetagetin, vitexin), progesterone, hydroxy-progesterone, testosterone, epi-testosterone, androstenedione, alkaloids (viticin), volatile oil (1,8 – cineol, limes, linalool, terpinyl acetate, alpha pinenes, beta pinenes), palmitic acid, oleic acid, linoleic acid, stearic acid	(Abascal *et al.* 2008)
Cinnamomum camphora (L.) J.Presl	Lauraceae	*Karpur*	Camphor Tree	Exudate	Polyphenols, terpenes, essential oils	(Lee *et al.* 2022)
Tulipa clusiana Redouté	Liliaceae	*Kulinachampa*	Lady Tulip	Whole plant	Alkaloids, flavonoids, glycosides	(Wikipedia, 2024)
Linum strictum L.	Linaceae	-	Yellow Flax	Whole plant	Lignan 6-methoxypodophyl-lotoxin, omega-3 fatty acids, phytoestrogenic lignans, phenols, flavonoids, sterols, proteins	(Vasilev *et al.* 2004)
Linum usitatissimum L.	Linaceae	*Atasi*	Linseed, Flax	Seed	Lignans (phytoestrogens), omega-3 fatty acids, fiber, phenolic acids	(Kumar *et al.* 2013**,** Mueed *et al.* 2022)

Dendrophthoe falcata (L.f.) Ettingsh.	Loranthaceae	*Bandaaka, Vrikshadani*	Honey Suckle Mistletoe, Neem mistletoe	Leaf, Flower	Flavonoids, triterpenes, tannins, steroids, open-chain aliphatics, benzyl derivatives	(Kong *et al.* 2023)
Abelmoschus esculentus Moench	Malvaceae	*Latakasturi*	Okra	Whole plant, Seed, Root, Leaf	Flavonoids, polyphenols, mucilage, polysaccharides	(Islam, 2019)
Althaea officinalis L.	Malvaceae	*Khatmi*	Marshmallow	Root, Leaf	D-glucan, diosmetin glucosides, flavanoids (kaempferol, quercitin), polyphenolic acids (syringic, caffeic, salicyclic, vanillic), pectin, asparagine, tannins	(Gudej, 1991)
Gossypium herbaceum Linn.	Malvaceae	*Kaarpaasa*	Levant cotton	Root	Saponins, steroids, glycosides, phenolic compounds, tannins and flavonoids, alkaloids, flavones, β-sitosterol, α-amyrin, terpene naphthalene derivative gossypol	(Khaleequr *et al.* 2012)
Grewia oppositifolia Roxb. ex DC.	Malvaceae	*Beul, Dhaman*	Dhaman	Leaf	Flavonoids, tannins, terpenoids, steroids	(Waliullah *et al.* 2011)
Sida cordifolia L.	Malvaceae	*Bala*	Flannel Weed	Whole plant, Root	Ephedrine, pseudoephedrine, Sterculic, malvalic and coronaric acid, fatty acids, saponine, betaphenethylamine, hypaphorine, ecdysterone, indole alkaloides, palmitic, stearic, β – sitosterol	(Jain *et al.* 2011)
Azadirachta indica A.Juss.	Meliaceae	*Nimba*	Neem	Leaf	Limonoids, azadirachtin, azadirachtanin, azadirone, azadiradione, epoxyazadiradione, isoazadirolide, nimbin, nimbocinolide, isonimbocinolide, nimbolide, nimbocinolide, isonimocinolide, nimocinone, flavonoids	(Zeenat *et al.* 2018)
Melia azedarach L.	Meliaceae	*Mahanimba*	Chinaberry Tree	Leaf, Flower, Gum, Fruit, Seed oil	Limonoids, flavonoids, triterpenoids, steroids, lignans, phenolics	(Hieu *et al.* 2023)

Cissampelos pareira L	Menispermaceae	*Patha*	Velvetleaf	Whole Plant, Root	Alkaloids, sterols	(Semwal *et al.* 2014)
Artocarpus heterophyllus Lam.	Moraceae	*Panasa*	Jackfruit	Seed	Isoflavones, stilbenoids, phenolics, flavonoids	(Pranay Raja *et al.* 2021)
Ficus auriculata Lour	Moraceae	Variety of *Falgu*	Roxburgh Fig	Leaf	Triterpenoids, flavonoids	(Al Fishawy *et al.* 2011)
Ficus palmata Forssk.	Moraceae	*Phalgu*	Indian Fig	Fruit, Leaf	Saponins, tannins, phenols, flavonoid, steroids/terpenes, alkaloids, cardiac glycoside aldehydes, esters of fatty acids, triterpenes, steroids, triterpenoid	(Al-Qahtani *et al.* 2023)
Ficus religiosa L.	Moraceae	*Ashvattha*	Sacred Fig	Leaf	Flavonoids, tannins, phytosterols, amino acids, furanocoumarins, phenolic components, hydrocarbons, aliphatic alcohols	(Singh *et al.* 2011)
Ficus sarmentosa Buch.-Ham. ex Sm.	Moraceae	*Pratanvat*	Creeping Fig, Climbing Fig	Leaf, Fruits, Bark, Root	Steroids, terpenoids, anthraquinones, reducing sugars, flavonoids, tannins, phlobatanins, cardiac glycoside, beta cyanin, amino acid	(Rauf *et al.* 2013)
Morus alba L.	Moraceae	*Shahatuta*	Chinese White-Mulberry	Fruit	Sitosterol, steroids, tannins, phytosterols, glycosides, carbohydrates, proteins, alkaloids, and amino acids, saponins, triterpenes, phenols, flavonoids, benzofuran derivatives, anthocyanins, anthraquinones, glycosides	(Mussarat *et al.* 2014)
Musa paradisiaca L.	Musaceae	*Kadali*	Plantain	Flower, Leaf, Blossom, Stem, Fruit, Root	Alkaloids, saponins, glycosides, tannins, flavanoids steroids	(Mahmood *et al.* 2012)
Jasminum dispermum Wall.	Oleaceae	*Jatipushpam*	Wild Jasmine	Vines	Terpenoids, flavonoids	(Rattan, 2023)
Jasminum multiflorum (Burm. f.) Andrews	Oleaceae	*Kundamallika*	Star Jasmine	Twigs	Triterpenoids, flavonoids, secoiridoids ,	(Singh, 2016)

Oenothera rosea Aiton	Onagraceae	--	Rose Evening Primrose	Whole Plant	Phenolic acids, flavonoids, coumarins, tannins, glycosides, alkaloids	(Vargas-Ruiz *et al.* 2020)
Pandanus amaryllifolius Roxb	Pandanaceae	-	Fragrant Pandan or Screwpine	Rhizome	Flavonoids, polyphenols, tannins, sterols, triterpenes, alkaloids, saponins, glycosides	(Sa'adah *et al.* 2023)
Pandanus tectorius Parkinson ex Du Roi	Pandanaceae	*Ketaka*	Screw Pine	Leaf, fruit	Glycoside, saponins, sterols, terpenoids, flavonoid, steroids	(Andriani *et al.* 2019)
Sesamum indicum L.	Pedaliaceae	*Tila*	Sesame	Seed	Sesamin, sesamol, lavonoids, anthocyanins, saponins, reducing sugars	(Zhu *et al.* 2005)
Breynia androgyna (L.) Chakrab. & N.P.Balakr.	Phyllanthaceae	*Thavasai Murungai*	Star Goose Berry	Leaf	Fatty acids, flavonoids, polyphenols	(Zhang *et al.* 2020)
Breynia retusa (Dennst.) Alston	Phyllanthaceae	*Bahupraja*	Bushweed	Leaf, Bark	Tannins, flavonoids, sterols triterpenoids, steroids	(Bhagyasri *et al.* 2017)
Piper longum L.	Piperaceae	*Pippali*	Long Pepper	Fruits, Root	Piperine, flavonoids	(Goyal, 2017)
Picrorhiza kurroa Royle ex Benth.	Plantaginaceae	*Kutaki*	Kutki	Rhizomes	Picrosides, iridoid glycosides	(Azad *et al.* 2013)
Avena sativa L	Poaceae	*Yavikaa*	Oats	Seed	Beta-glucans, saponins	(Ergol *et al.* 2016)
Cenchrus americanus (L.) Morrone	Poaceae	-	Pearl millet	Seed	Flavonoids, tannins, essential amino acids, minerals	(Elangovan *et al.* 2024)
Echinochloa colonum subsp. edulis(Honda) Banfi & Galasso	Poaceae	*Varaka*	Shama millet	Seed	Alkaloids, steroids, glycosides, tannins, phenols, flavonoids	(Sumitra *et al.* 2018)
Echinochloa crus-galli (L.) P.Beauv.	Poaceae	*Ambah Shyaamaaka*	Barnyard Millet	Whole plant	Alkaloids, glycosides, flavonoids, saponins, tannins, polysaccharides, phenolic, loliolide, tricin	(Castrosanto *et al.* 2021)
Eleusine indica (L.) Gaertn.	Poaceae	*Shyamaka*	Indian Goosegrass	Whole Plant	Polyphenols, flavonoids	(Umair *et al.* 2024)
Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult.	Poaceae	-	Black speargrass	Aerial parts, Roots	Alkaloids, steroids, phenols, flavonoids, glycosides, carbohydrates, resin	(Provenza *et al.* 2003, Yadav *et al.* 2023)

Hordeum vulgare L.	Poaceae	*Yava*	Barley	Seed/Grain	Beta-glucans, alkaloids	(Anshul Sinha *et al.* 2012)
Oryza sativa L.	Poaceae	*Shali*	Rice	Seed	Gamma-oryzanol, sterols	(Government of India, 2006a)
Saccharum officinarum L.	Poaceae	*Ikshu*	Sugarcane	Stem, Leaf	Polyphenols, flavonoids	(Patel *et al.* 2013)
Triticum aestivum L.	Poaceae	*Godhuuma*	Wheat	Seed, Leaf	Alkaloids, flavonoids, tannins, terpenoids, steroids, glycosides	(Suriyavathana *et al.* 2016)
Zea mays L.	Poaceae	*Mahaa-Kaaya*	Corn	Corn silk (stigma)	Phenolic acids, phytosterols, volatile oils, steroids, polyphenols, flavonoids	(Singh *et al.* 2022)
Portulaca oleracea Linn.	Portulacaceae	*Brihat Lonika*	Common Purslane	Leaf	Akaloid, saponin, tannin, flavonoid, cardiac glycoside, terpenoid	(Okafor I. *et al.* 2014)
Embelia ribes Burm.f.	Primulaceae	*Vidanga*	False Black Pepper	Fruits	Embeliaribyl ester, embeliol, embelinol, Embelialkyl resorcinols A-I, virenol A, pentaketide, tannins	(Vineet Sharma *et al.* 2022)
Actaea racemosa L.	Ranunculaceae	*Jiuenti, Cohosh*	Black cohosh	Root (dried)	Triterpene glycosides (actein cimigoside, cimifugine, macrotin, racemoside), isoflavones, (formononetin), isoferulic acid	(Mishra *et al.* 2006)
Clematis barbellata Edgew.	Ranunculaceae	*Nikidakodi, Pedutivva*	Gourian Clematis, Indian Traveler's Joy	Leaf	Flavonoids, alkaloids, steroids, saponins	(Chawla *et al.* 2012)
Nigella sativa L.	Ranunculaceae	*Upakunchika / Kalajaji*	Black Cumin	Seed	Thymoquinone, alkaloids, oil, saponin, alkaloid, proteins	(Zulkefli *et al.* 2020)
Helinus lanceolatus Brand.	Rhamnaceae	*Jhum laguli, Murian*	Helinus	Whole Plant	Flavonoids, polyphenols, aconitic acid, saponins, scyllitol, glycosides, steroids, alkaloids, tannins, terpenoids, benzoic acid	(Maroyi, 2024)
Rosa indica L.	Rosaceae	*Taruni*	Indian Rose	Flowers	Polyphenols, flavonoids, quinic acid, 5-hydroxymethylfurfural, pyrogallol, levoglucosan	(Rasheed *et al.* 2015)

Rubus idaeus L.	Rosaceae	-	Raspberry	Leaf, Fruits	Polypeptides, flavonoids, glycosides of kaempferol and quercitin, tannins, pectin, fructose,volatile oil, citric acid, malic acid, vitamin (A, B complex, C, E), minerals (Fe, Ca, K, P)	(Shinde *et al.* 2012)
Rubia manjith Roxb.	Rubiaceae	*Indian Madder, Bengal Madder*	Manjishthaa	Stem, Roots	Alkaloids, amino acids, saponin, glycosides, phenolic compound, tannins	(Gupta *et al.* 2017)
Salvadora oleoides Decne.	Salvadoraceae	*Pilu, Kalawa*	Large toothbrush tree	Fruit	Sterols like beta-sitosterol, glucosides, flavonoids, dihydroisocoumarin, terpenoids, methoxy-4-vinylphenol, cis-3-hexenyl benzoate	(Garg *et al.* 2014)
Sideroxylon mascatense (A.DC.) T.D.Penn.	Sapotaceae	-	Mascat Milkwood, Mascat Stopper	Leaf	Polyphenols, flavonoids	(Al Hasani *et al.* 2023)
Bergenia ciliata (Haw.) Sternb.	Saxifragaceae	*Pashanabheda*	Hairy Bergenia, Winter Begonia	Rhizome, Leaf	Tannins, flavonoids, glycosides, phenols, alcohols, terpenoids, fatty acid	(Ahmad *et al.* 2018)
Datura metel L.	Solanaceae	*Dhattura*	Devil's Trumpet	Leaf, Fruit, Seed, Root	Alkaloids, scopolamine, flavonoids, tropane, tannins, saponins, withanolides	(Alam *et al.* 2021)
Withania somnifera (L.) Dunal	Solanaceae	*Ashwagandha*	Ashwagandha	Leaf, Root, Whole plant	Withanolides, alkaloids, phytosterol, saponins, phenols, flavanoids	(Saiyed *et al.* 2016)
Debregeasia longifolia (Burm.f.) Wedd.	Urticaceae	*Tusara, Sausaru*	Orange Wild Rhea	Leaf, Root	Triterpenoids, saponins, alkaloids, phenolics, flavonoids,	(Bo *et al.* 2003)
Urtica ardens Link	Urticaceae	*Kukur-chitika*	Himalayan Nettle	Whole plant	Alkaloids, flavonoids, terpenoids, tannins, phenols	(Bharti *et al.* 2023)
Urtica dioica L.	Urticaceae	*Vrishchikali*	Stinging Nettle	Aerial parts	Vitamin (A, B complexes, C, D), minerals (Fe, P, K, S, Mg), fiber, acetylcholine, histamine, serotonin	(Easton *et al.* 2021)
Verbena officinalis Linn.	Verbenaceae	*Faristariun*	Vervain	Aerial parts	Iridoid glycosides (verbenin, verbenalin, bastatoside), tannin, volatile oils (citral, geraniol,	(Budzynska *et al.* 2013)

					limonene, verbenone), saponin, mucilage, alkaloid	
Ampelocissus rugosa (Wall.) Planch.	Vitaceae	-	Wild Grape, Rugose Grape	Root, Leaf	Alkaloid, flavonoids, saponin, terpenoids	(Trias-Blasi *et al.* 2015)
Cissus quadrangularis L.	Vitaceae	*Asthisamhara*	Veldt Grape	Leaf, Stem/ Vine, Whole plant	Flavonoids, stilbenes, triterpenoids, saponin glycosides, steroids, tannins, organic acids	(Rex *et al.* 2020)
Parthenocissus semicordata (Wall.) Planch.	Vitaceae	*Amru bail, Baakhre Laharaa , Charchare, Parenu*	Himalayan Virginia Creeper, Climbing Ivy	Roots, Leaf, Stems	Flavonoids, tannins, saponins, phenolic acids, flavonols, anthocyanins, stilbenoids	(Pozzo *et al.* 2023)
Curcuma longa L.	Zingiberaceae	*Haridra*	Turmeric	Rhizome	Volatile oils, polysaccharides, zingiberene, curcumenol, curcumol, eugenol, tetrahydrocurcumin, triethylcurcumin, turmerin, turmerones, turmeronols	(Adinew, 2012)
Zingiber officinale Roscoe	Zingiberaceae	*Shunthi*	Ginger	Rhizome	Gingerols, shogaols, zingerone, paradol	(Paritakul *et al.* 2016)

A comprehensive analysis of the phytochemical profile of various plant species revealed a diverse array of bioactive compounds. Among these, flavonoids emerged as the most prevalent phytochemical class, occurring in a significant number of plants. This finding underscores the importance of flavonoids in plant-based therapies and their potential for various health benefits. Other frequently occurring phytochemicals included terpenoids, alkaloids, and phenolic compounds, highlighting the complex chemical nature of plant-derived remedies and their potential for multi-target therapeutic interventions.

Under the ancient literature of *Ayurveda*, in *Charaka Samhita* (Indian ancient traditional medicine textbook), there are some great formulations/herbs available those may serve more benefits too. These medicinal herbs are organized into 50 groups known as *Mahakashaya* or *Dashemani*, each formulation comprising 10 herbs (Acharya Charaka, 2004). Notably, among these groups, the herbs of formulations of [A] *Stanyajanana Mahakashaya* (group of herbs stimulating lactation), [B] *Jeevaniya Mahakashaya* (providing nutrition) used in humans. These *Mahakashayas* may also be used experimentally in dairy animals to enhance milk yield. *Acharya Chakrapani's* commentary on *Charaka Samhita* stated that the number of herbs, only ten in each group (*Mahakashaya*) is not limiting but indicative, allowing for the inclusion of other herbs from other groups with similar properties and actions when needed. In ancient tradition, the number ten is referred to as *'Dika'* (direction), signifying guidance. *Acharya Charaka's* aim in developing the concept of *Mahakashaya* was to facilitate the formulation of various treatments using a collection of substances with similar properties. Also, it is indicated that, according to the need, the herbs from these *Mahakashaya*may be used individually or as the bare minimum available species or as a complete combination by taking them in equal proportion (*Samabhaga*) as a compound formulation in pharmaceutical preparation. The term *'Kashaya'* means *'Kwatha'* (Acharya Charaka, 2005) or 'decoction,' as suggested in ancient texts (Darshan Babu N *et al.* 2015). Using the methods of decoction, these *Mahakashaya* are utilized to prepare extracts from combinations of herbs. These extracts can be introduced to dairy animals to enhance milk production. This aspect, however, requires further research. Along with this, a unique formulation of four seeds mentioned in *Ayurveda*, called *Chaturbeeja*, herbs listed in the Ayurvedic Pharmacopoeia of India (API) and a few others have been successfully used in humans to improve lactation which are mentioned in Table 2. All these formulations can be evaluated for their galactagogue activity to increase milk production in dairy animals under research.

Stanyajanana Mahakshaya, *Jeevaniya Mahakashaya*, *Chaturbeeja* and other herbs mentioned in API serves as a potent solution for managing reduced milk production. The synergistic action of the ingredients in these formulations helps address issues such as *Stanyakshaya* (insufficient milk), *Rasakashaya* (depletion of body fluids), *Agnimandya* (impaired digestion), *Strotorodha* (blockage in bodily channels) and *Manasa Vikara* (psychological disturbances). These effects collectively contribute to enhanced maternal health and improved metabolic functions. The galactagogue properties of the herbs may be linked to the presence of bioactive compounds like alkaloids, flavonoids and phenolics in the constituent herbs. These compounds are known to promote milk production, potentially through phytoestrogenic effects or by mimicking 17-β-estradiol (E2) action, particularly in the myoepithelial cells of the mammary glands. Research indicates that alkaloids facilitate milk let-down, while certain isoflavones and polyphenols enhance milk yield and improve its composition, including fat, protein, and lactose content (Srikanth *et al.* 2015). Furthermore, flavonoids have been found to reduce maternal anxiety, further supporting the holistic benefits of this herbs (Nirwane *et al.* 2015, Ali *et al.* 2020). Saponin acts as a ruminotoric, enhancing the overall health status of livestock while boosting their productivity (Sen *et al.* 1998). Stearidonic acid aids in improving rumen bio-hydrogenation and, with adequate ruminal protection, significantly increases omega-3 fatty acids in milk (Bernal-Santos *et al.* 2010). α-Linolenic acid functions as a ruminotoric, modifying milk fat composition and enhancing the oxidative stability of the fat (Liu *et al.* 2010). Tannins exhibit anthelmintic properties and serve as a ruminotoric, improving protein digestion and promoting better health in livestock (Waghorn *et al.* 1990, Athanasiadou *et al.* 2001).

Table 2. List of ancient *Ayurveda* medicinal plants used as galactagogues in humans

***Sanskrit* Name**	**English Name**	***Latin* Name**	**Family**	**Part Used**	**Phytochemicals Associated with Galactagogue Activity**	**Reference**
Formulation 1: *Stanyajanana Mahakashaya* (Group of herbs stimulating lactation) (Raj *et al.* 2021)						
Virana	Vetiver, Khas	*Chrysopogon zizanioides* (L.) Roberty	Poaceae	Roots	Flavonoids, alkaloids, terpenoids, essential oils, phenolics, lignins, tannnins, quinines	(Nirwane *et al.* 2015)
Shaali	Rice	*Oryza sativa* L.	Gramineae	Roots/Seed	Amino acids, polysaccharides, vitamin B complex	(Jamil *et al.* 2016)
Shastika (Variety of *Shaali*)	Rice variety	*Oryza sativa* L.	Gramineae	Described earlier		
Ikshuwalika	Marsh barbel	*Hygrophila auriculata* (Schumach.) Heine	Acanthaceae	Whole Plant	Flavonoids, tannins, glycosides, saponins, phytosterols, fatty acids, minerals polyphenols, proanthocyanins, mucilage, alkaloids	(Chauhan *et al.* 2010)
Darbha	Thatch Grass	*Imperata cylindrica* (L.) Raeusch.	Poaceae	Roots	Flavonoids, alkaloids, saponins, tannins, phenylpropanoids, triterpenes, phenolic compound	(Liu *et al.* 2012)
Kusha	Sacrificial Grass	*Desmostachya bipinnata* (L.) Stapf	Poaceae	Roots	Saponins, flavonoids, phenolic compounds	(Srikanth *et al.* 2015)
Kasha	Sugarcane	*Saccharum officinarum* L.	Poaceae	Described earlier		
Gundra	Lesser Indian Reed-Mace	*Typha domingensis* Pers.	Typhaceae	Roots	Flavonoids, alkaloids, tannins, essential oils, polyphenols, gallic acid, kaempferol	(Dilshad *et al.* 2023)
Itkata	Prickly Sesban	*Sesbania bispinosa* (Jacq.) W.Wight	Fabaceae	Roots	Flavonoids, alkaloids, triterpenoids, saponins, glycosylated sterols, cinnamic acid, sugar, fatty acid derivatives	(Larkem *et al.* 2021)
Katrina	Lemon-grass	*Cymbopogon citratus* (DC.) Stapf	Poaceae	Roots	Flavonoids, essential oils, alkaloids, terpenoids	(Özalkaya *et al.* 2018)

Formulation 2: *Jeevaniya Mahakashaya* (Group of herbs providing nutrition) (Manhas *et al.* 2022)						
*Jivaka***	Pointed Malaxis	*Crepidium acuminatum* (D.Don) Szlach.	Orchidaceae	Whole plant or aerial parts	Alkaloids, flavonoids, glycosides, β-sitosterol, eugenol, stigmatserol	(Arora *et al.* 2022)
Vidarikanda (substitute of *Jivaka*)	Indian Kudze	*Pueraria tuberosa* (Roxb. ex Willd.) DC.	Fabaceae	Tuber	Isoflavonoids, puerarin, saponins, starch	(Chithra *et al.* 2019)
*Rishabhaka***	Fly orchid	*Malaxis muscifera* (Lindl.) Kuntze	Orchideaceae	Pseudobulb	Alkaloids, glycosides, flavonoids, triterpenes, tannins, polyphenols	(Sri Venkata Deekshitha Dokalaa *et al.* 2023)
Vidarikanda (substitute of *Rishabhaka*)	Indian Kudze	*Pueraria tuberosa* (Roxb. ex Willd.) DC.	Fabaceae	Described earlier		
*Meda***	Whorled Solomon's seal	*Polygonatum verticillatum* (L.) All.	Liliaceae	Rhizome	Saponins, flavonoids, steroidal glycosides, α-bulnesene, linalyl acetate, eicosadienoic, pentacosane, piperitone, docasane, diosgenin, santonin, calarene	(Bibi *et al.* 2016)
Shatavari (substitute of *Meda*)	Indian asparagus	*Asparagus racemosus* Willd.	Liliaceae	Described earlier		
*Mahameda***	Twining Solomon's seal	*Polygonatum cirrhifolium* (Wall.) Royle	Liliaceae	Rhizome	Steroidal saponins, alkaloids, flavonoids, glycosides	(Luo *et al.* 2022)
Shatavari (substitute of *Mahameda*)	Indian asparagus	*Asparagus racemosus* Willd.	Liliaceae	Described earlier		
*Kakoli***	Himalayan giant ginger	*Roscoea purpurea* Sm.	Zingiberaceae	Rhizome	Flavonoids, terpenoids, alkaloids, kaempferide, kaempferol 3-O-methyl ether, adenosine	(Miyazaki *et al.* 2014)
Ashwagandha (substitute of *Kakoli*)	Winter Cherry	*Withania somnifera* (L.) Dunal	Solanaceae	Described earlier		
*Kshirkakoli***	Many-leaved Lily	*Lilium polyphyllum* D.Don	Liliaceae	Root	Saponins, flavonoids, alkaloids, linalool, citronellal, kaempferol,	(Bera *et al.* 2022)

					caryophyllene, humulene, neridiol	
Ashwagandha (substitute of *Kshirkakoli*)	Winter Cherry	*Withania somnifera* (L.) Dunal	Solanaceae	Described earlier		
Mudgaparni	Wild Gram	*Pueraria montana* var. lobata (Willd.) Maesen & S.M.Almeida ex Sanjappa & Predeep	Fabaceae	Root tuber	Isoflavonoids, puerarin, saponins, tannins	(Chao *et al.* 2021)
Mashaparni	Horse vine	*Teramnus labialis* (L.f.) Spreng.	Fabaceae	Seed	Flavonoids, saponins, alkaloids	(Sahoo *et al.* 2016)
Jivanti	Corky milkweed	*Leptadenia reticulata* (Retz.) Wight & Arn.	Asclepiadaceae	Described earlier		
Madhuka	Liquorice	*Glycyrrhiza glabra* L.	Fabaceae	Root	Glycyrrhizin, flavonoids, triterpenoids, glycosides	(Hajirahimkhan *et al.* 2015)
Formulation 3: *Chaturbeeja*						
Methika	Fenugreek	*Trigonella foenum-graecum* L.	Fabaceae	Seed	Saponins, flavonoids, alkaloids, phytsoestrogens	(Khan *et al.* 2018, Tewari *et al.* 2020)
Chandrashura	Garden Cress	*Lepidium sativum* L.	Brassicaceae	Seed	Alkaloids, glucosinolates, flavonoids, essential fatty acids, protein, amino acids, saponins	(Shah *et al.* 2021, Hekmatshoar *et al.* 2022)
Kalajaji	Black Cumin	*Nigella sativa* L.	Ranunculaceae	Described earlier		
Yavani	Ajwain/Carom Seeds	*Trachyspermum ammi* Sprague	Apiaceae	Described earlier		
Formulation 4: API						
Nala	Giant Reed	*Arundo donax* L.	Poaceae	Roots	Flavonoids, alkaloids, saponins, tannins, terpenoids	(Sharma, 1988, Al-Snafi, 2015)
Rohisha	Palmarosa	*Cymbopogon martini* (Roxb.) Will.Watson	Poaceae	Whole plant	Flavonoids, terpenoids, citral, geraniol, citronellol, citronellal, linalool, elemol, 1,8-cineole, limonene, geraniol, β-caryophyllene,	(Government of India, 2006b, Promila, 2018)
Guduchi	Giloy/Heart-leaved Moonseed	*Tinospora cordifolia* (Willd.) Hook.f. & Thomson	Menispermaceae	Stem	Alkaloids, triterpenoids, steroids, glycosides	(Government of India, 2006c, Mir *et al.* 2015)
Kakatashringi	Chinese Pistache	*Pistacia chinensis* Bunge	Anacardiaceae	Gall	Triterpenoids, flavonoids, phenolic compounds, tannin,	(Government of India, 2006d, Tang *et al.* 2012)

Tuga	Thorny Bamboo	*Bambusa bambos* (L.) Voss	Poaceae	Leaves, Roots	Phenolic compounds, flavonoids, saponins	(Sushruta, 1979, Hossain *et al.* 2024)
Padmaka	Wild Himalayan Cherry	*Prunus cerasoides* Buch.-Ham. Ex D.Don.	Rosaceae	Heart wood	Anthocyanins, flavonoids, tannins, phenolic acids, terpenoids	(Government of India, 2006e, Bahuguna *et al.* 1987)
Riddhi	Intermediate Habenaria	*Habenaria intermedia* D. Don	Orchidaceae	Tuber	Alkaloids, glycosides, flavonoids, tannins, proteins, saponins, phenols, resins	(Government of India, 2006f, Arora *et al.* 2023)
Draksha	Grape Vine	*Vitis vinifera* L.	Vitaceae	Fruit	Polyphenols, resveratrol, flavonoids, tannins	(Government of India, 2006g, Al-Snafi *et al.* 2015)
Yava	Barley	*Hordeum vulgare* L.	Poaceae	Described earlier		
Lashuna	Garlic	*Allium sativum* L.	Amaryllidaceae	Bulb	Sulfur compounds (Allicin), flavonoids, saponins	(Government of India, 2006h, Ekambaram, 2023)
Kasheruka	Kysoor Bulrush	*Actinoscirpus grossus* var. kysoor (Roxb.) Noltie	Cyperaceae	Rhizome	Triterpenoids, alkaloids, phenolic compounds, coumarins, flavanoids, steroid, tannin	(Government of India, 2006i, Ganapathi *et al.* 2017)
Shringataka	Water Chestnut	*Trapa natans* L.	Lythraceae	Dried Seed	Saponins, flavonoids, tannins, phenolic, saponin, starch, phenols	(Government of India, 2006j , Bharthi *et al.* 2015)
Kamala	Sacred Lotus	*Nelumbo nucifera* Gaertn.	Nelumbonaceae	Rhizome	Flavonoids, alkaloids, phenolic compounds, glycosides	(Government of India, 2006k, Paudel *et al.* 2015)
Tanduliya	Amaranth/Spinach	*Amaranthus spinosus* L.	Amaranthaceae	Leaves	Alkaloids, flavonoids, glycosides, phenolic acids, steroids, amino acids, terpenoids, lipids, saponins, betalaine, b-sitosterol, stigmasterol, linoleic acid, routine, catechuic tannins, carotenoids, steroids, polyphenols	(Sarker *et al.* 2020)
Takkolam	Star anise	*Illicium verum* Hook f.	Schisandraceae	Dried fruit	Sesquiterpenes, phenylpropanoids, lignans, flavonoids, palmitic acid, essential oil, trans-anethol, shikimic acid	(Thakur *et al.* 2023**,** Wei *et al.* 2014)

Discussion

The present review reveals a remarkable alignment between ethnoveterinary practices and *Ayurveda* traditions in India. The predominance of the Fabaceae family in galactagogue usage is consistent with prior ethnobotanical surveys, suggesting its strong therapeutic relevance. The frequent use of seeds and leaves indicates an emphasis on vegetative plant parts, which are not only pharmacologically potent but also accessible to traditional healers and farmers. The presence of flavonoids, alkaloids, and terpenoids across multiple formulations underscores their likely contribution to lactogenic effects. Several flavonoids, such as quercetin and kaempferol, have been demonstrated to enhance milk production by mimicking estrogenic activity or modulating prolactin release. Similarly, saponins function as ruminotorics, improving digestion and nutrient absorption, thereby indirectly supporting lactation in dairy animals.

From the *Ayurveda* perspective, formulations like *Stanyajanana Mahakashaya* and *Jeevaniya Mahakashaya* were historically tailored for human lactation. Their inclusion in this review offers a novel cross-application in livestock care. While their human efficacy is well-documented in classical texts and modern studies, the proposed veterinary application represents an untapped research frontier. Interestingly, some components like *Chaturbeeja* and herbs from API texts have dual use in both humans and animals. This dual application underscores the potential for integrative approaches in galactagogue therapy. Despite the robust dataset, there remains a significant gap in experimental validation for many of the plants, especially in livestock models. Furthermore, standardization, dosing protocols, and toxicological evaluations are needed to ensure safety and efficacy before mainstream adoption in dairy practices. This study opens avenues for ethnoveterinary pharmacological research, phytochemical standardization, and policy-level support for integrating traditional galactagogues into modern animal husbandry frameworks.

Conclusion

This comprehensive review highlights over 170 plant species with documented or traditional galactagogue properties, showcasing a deep interconnection between India's ethnobotanical heritage and classical *Ayurveda* wisdom. The predominance of the Fabaceae family, along with the frequent use of seeds and leaves, points toward culturally preferred and pharmacologically active plant parts in traditional formulations. The identification of key phytochemicals such as flavonoids, alkaloids, terpenoids, and saponins further supports the potential biological basis for the observed galactagogue effects. *Ayurveda* herbs in the formulations like *Stanyajanana Mahakashaya*, *Jeevaniya Mahakashaya*, *Chaturbeeja*, and in others from the *Ayurvedic Pharmacopoeia of India* offer unique insights for developing plant-based lactation enhancers not only for humans but also for livestock. The study underscores the need for further research into the pharmacodynamics, dosage standardization, and clinical validation of these botanicals in veterinary contexts. Bridging classical knowledge with modern scientific methods can support the development of sustainable, cost-effective, and culturally rooted solutions in dairy management.

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