Shatavari (*Asparagus racemosus*), Jivanti (*Leptadenia reticulata*) and Methi (*Trigonella foenum-graecum*): the herbal galactogogues for ruminants

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Abstract

Use of herbal galactogogue for safe and sound milk production is prerequisite now a days because of increasing the demand for organic food and the ban on the use of certain antibiotics, harmful residual effects and cost effectiveness in the livestock feed. Herbals inclusion in the diet should be encouraged to enhance animal's performance, improve feed efficiency, maintain health and alleviate adverse effect of environmental stress. Galactogogues stimulate the activity of alveolar tissue and increase the secretory activity and thereby restore and regulate milk yield. This review introduces three effective herbal galactagogues named Shatavari *(Asparagus racemosus)*, Jivanti *(Leptadenia reticulata)* and Methi *(Trigonella foenum-graecum)* as feed additive and its effect on livestock performance.

Keywords: galactogogue, *A. racemosus*, *L. reticulata*, *T. foenum-graecum*

Introduction

Livestock sector plays a vital role in the rural economy as providing family income and generating gainful employment in the rural sector. Livestock contributes 3.9 % in total GDP during the year of 2013-14. India is leading country in total milk production. Milk production in India is 137.7 million tonnes in 2013-14 and per capita availability is 307 g/day in 2014-15 (DADF, 2015). During the last two decades, India has emerged as world's top most nations in the dairy sector and has witnessed rapid development in the milk production. On other hands, the productivity of dairy animals in India is very low because of various factors like underfeeding, malnutrition, various diseases, stress, etc which hamper the economy of the dairy industry. With the demand for organic food and ban on the use of certain antibiotics, harmful residual effects and cost effectiveness in the livestock feed, the search for alternative feed additives has become the necessity of the day. Herbal feed additives could either effect feeding pattern, or effect the growth of favourable microorganisms in the rumen, or stimulate the secretion of different digestive enzymes, which in turn may improve the efficiency of nutrients utilization or stimulate the milk secreting tissue in the mammary glands, resulting in improved productive and reproductive performance of dairy animals (Bakshi and Wadhwa, 2000). A medicinal herb has properties to improve digestibility, antibacterial, immunostimulation, coccidiostatic, anthelmintic, antiviral or antioxidative (Uegaki *et al.*, 2001).

Herbals are concentrated foods those provide vitamins, minerals and other nutrients that sustain and strengthen the human and animal body. Indian history is very rich in herbal medicine and one of the oldest surviving systems of healthcare in the world known as ayurveda. Ayurveda is a natural therapy and totally based on herbs. These herbs were being used since pre-vedic time because they were safe to use, cheap and easily available, has no side effect and no residual effect in milk (Krishna *et al*., 2005). So, their inclusion in the diet should be encouraged to enhance animal's performance, improve feed efficiency, maintain health and alleviate adverse effect of environmental stress. Traditional herbal medicines in veterinary practice have a large potential as an alternate therapy. A galactogogue is a substance that promotes lactation in dairy animals. It may be synthetic, plant-derived, or endogenous. They act through exerting an influence on an adreno-hypothalamo-hypophyseal-gonadal axis by inhibiting hypothalamic dopaminergic receptors or by inhibiting dopamine producing neurons. These medications increase prolactin secretion by antagonizing dopamine receptors (Gabay, 2002). Galactogogues stimulate the activity of alveolar tissue and raise the secretory activity and thereby restore and regulate milk yield (Ravikumar and Bhagwat, 2008). The animal production can be enhanced by using different herbals as a component of animal feed. According to Bakshi *et al.* (2004), now a day's herbal plants are broadly used as animal feed additives, having galactogogue properties like Shatavari *(Asparagus racemosus)*, Jivanti *(Leptadenia reticulata)* and Methi *(Trigonella foenum)*.

Shatavari (*Asparagus racemosus*)

Asparagus racemosus is most frequently used in indigenous medicine. The name *Shatavari* means curer of a hundred diseases (shat means hundred and vari means curer) and it is also known as *Satavar* and *Shatmuli.* The leaves are alike pine needles, small and uniform and the flowers are white and have small spikes. It is a common species of asparagus under Liliaceae family distributed throughout India with 1 to 2 m in height. The genuses Asparagus contains about 300 species around the world and out of these 22 species are found in the India. *Asparagus racemosus* is the one most commonly used herb in traditional medicine due to the presence of steroidal saponins and sapogenins in various parts of a plant (Krishana *et al.*, 2005). Traditionally it is used as a health tonic and common Indian home remedy used as a rejuvenator, promoter of strength, breast milk and semen. It is also used for cough, dyspepsia, edema, rheumatism, chronic fevers, aphrodisiac, cooling tonic antispasmodic, diarrhea and dysentery. It is also used for enhancing milk production in freshly parturient and lactating woman (Chopra and Simon, 2000). The general pharmacology of shatavari are galactogogue and mammogenic, it enhances the blood prolactin level and stimulazes the cellular division of mammary gland (Kumar *et al*., 2008).

Choudhary and Kar (1992) recorded that shatavari root is rich source of minerals and it contains macro minerals such as Ca, Mg, K and Fe having concentration of 0.22, 0.40, 2.50 and 0.01 g/100g, respectively and micro minerals such as Cu, Zn, Mn, Co and Cr having concentration of 5.29, 53.15, 19.98, 22.0 and 1.81 µ/gm, respectively. Berhane and Singh (2000) reported the DM, CP, EE, CF, Ash and NFE of Shatavari root powder to be 91.0, 3.85, 0.66, 8.32, 13.15 and 74.02 percent, respectively. Shatavari root contains 4.60 to 6.10 per cent protein, 36.80 to 47.50 per cent carbohydrates, 3.10 to 5.20 mg/g phenols, 4.80 to 5.10 mg/g tannins, 4.10 per cent saponin and 6.50 to 7.40 per cent ash (Mishra *et al*., 2005). Visavadiya and Narasimhacharya (2005) estimated the presence of phyto-components in Shatavari root such as phytosterols (0.79%), saponin (8.83%), polyphenols (1.69%), flavonoids (0.48%) and total ascorbic acid (0.76%). Supplementation of Galactin (50 g/d/animal), a Shatavari based polyherbal galactogogue in lactating crossbred cows had improved milk production (Ramesh, 2000). Feeding herbal formulation containing 25 per cent Shatavari enhanced milk production (25.10%) and an also significant improvement in daily milk yield in buffaloes and crossbred cows. A

response of supplementation of Shatavari in buffaloes is higher than cows (Somkuwar *et al*., 2005). Supplementation of Shatavari @ 50 g per day in 10 lactating cattle and buffaloes with concentrate for the period of 60 days results in the increased milk production in buffaloes and cows by 9.90 per cent (0.8 ± 0.34 kg/day) and 12.72 per cent (1.32 ± 0.15 kg/day), respectively (Tanwar *et al*., 2008). Polyherbal supplementation containing Shatavari @ 150 to 200 mg/kg body weight in Karanfries cows significantly improve fat, protein, lactose and SNF yield during supplementation, residual and post- residual period in fed groups than control (Sharma, 2010). Feeding of Shatavari in Murrah buffaloes during their transition and post-partum period increased 10.68 per cent milk production (Singh *et al*., 2012). Supplementation of Milkplus, a Shatavari based herbal preparation enhanced the milk yield from 8.26 to 10.11 liters/day in crossbred cattle (Sukanya *et al*., 2014).

Fig. 1: Shatavari plant (*A. racemosus*)

Fig. 2: Shatavari root (*A. racemosus*)

(Source: http://www.homeremediess.com/medicinal-plants-shatavari-benefits)

Fig. 3: Jivanti plant (*L. reticulata*)

Fig. 4: Jivanti root (*L. reticulata*)

(Source: http://www.alwaysayurveda.com/leptadenia-reticulata)

Jivanti (*Leptadenia reticulata*)

Leptadenia reticulata is also known as *Jivanti* (or *Jiwanti*) because of its nourishing property for every part of the body. Jivanti specially corrects the metabolism, digestive system and enhance the health status of the body. Indian synonyms of Jivanti are *Bhadjivai* (in Bengali), *Methiododi* or *Dodi* (Gujarati), *Dori* (Hindi), *Hiriyahalle* (Kannada), *Haranvel* (Marathi), *Jivanti* (Sanskrit) and *Kalasa* (Telugu). *Leptadenia reticulate* is belongs to family Asclepiadaceae commonly known as *Jivanti*. It is distributed in subtropical and tropical parts of Asia and Africa, Burma, Sri Lanka, Malayan peninsula, Philippines, Mauritius and Madagascar. In India, Jivanti is found in Gujarat, Punjab, Himalayan ranges, South India, Sikkim, Deccan and Karnataka. The shape of leaves varies from ovate to cordate, 4 to 8 cm long, 2 to 5.5 cm broad, glabrous above and pubescent below. The roots are very rough, white with longitudinal ridges and furrows and in transverse section the wide cork, lignified stone cell layers and medullary rays can be seen and its size varies from 3 to 10 cm in length and 1.5 to 5 cm in diameter. *Leptadenia reticulata* is considered to be a tonic (Rasayana) drug and is used to strengthen, nourish and rejuvenate the body (Kirtikar and Basu, 1993). It can be used in treating various body aliments like bleeding disorders, burning sensitivity of the body, pyrexia, cough, dehydration, weak vision and colitis. It

possesses the aphrodisiac, astringent, galactogogue, diuretic and used as a tonic in debility (Sonara *et al.*, 2013). Its lactogenic effect has been reported in various domestic animals (Dadarkar *et al*., 2005). Extracts of roots and leaves of the plant act as antibacterial, antifungal agent and anti abortificient activity (Patel and Dantwala, 1958). Plant possesses the vigorous lactogenic, anabolic and galactogogue effect (Ravishankar and Shukla, 2007).

Leptadenia reticulata contain α-amyrin, β-amyrin, ferulic acid, luteolin, diosmetin, rutin, β-sitosterol, stigmasterol and hentriacontanol (Krishna *et al*., 1975). Srivastav *et al.* (1994) reported that leaf of Jivanti contains resins, albuminous, Ca oxalate glucose, carbohydrate and tartaric acid. Hewageegana *et al.* (2014) reported that the *Leptadenia reticulata* consist of total ash (16.61%), acid insoluble ash (2.80%), water soluble ash (5.90%), protein (35.80%), crude fat (2.80%), carbohydrates (23.40%), dietary fibre (14.23%), magnesium (1.50%), iron (0.03%) and calcium (0.97%). Supplementation of leptaden tablet consists of Jivanti in buffaloes significantly increased milk yield in field condition (Moulvi, 1963). Feeding of Galactin-Vet bolus in lactating cows improve milk yield of 6.06 per cent during the treatment and 5.48 per cent following the treatment (Sridhar and Bhagawat, 2007). Supplementation of Jivanti in kankrej cows there was non-significantly higher fat yield than control during and post supplementation period (Jain, 2016).

Table 1: Biochemical constituents in root of Shatavari (*A. racemosus*), leaf/root of Jivanti (*L. reticulata*) and seed of Methi (*T. foenum-graecum*).

Biochemical constituents	Shatavari	Jivanti	Methi	References
Protein (%)	4.60 - 6.10	35.80	20.0 - 30.0	Mishra *et al*. (2005) Hewageegana *et al.* (2014) Mehrafarin *et al*. (2010)
Carbohydrates (%)	36.80 - 47.50	23.40	45.0 - 60.0	
Crude Fat (%)	-	2.80	6.53	Hewageegana *et al.* (2014) Sinha *et al.* (2015)
Phenol (%)	3.10 - 5.20	-	-	Mishra *et al*. (2005)
Tannin (%)	4.80 - 5.10	-	-	
Saponin (%)	4.10	-	0.60 - 1.70	Mishra *et al*. (2005) Mehrafarin *et al*. (2010)
Total Ash (%)	13.15	16.61	-	Berhane and Singh (2000) Hewageegana *et al.* (2014)
Calcium (g/100g)	0.22	0.97	-	
Magnesium (g/100g)	0.40	1.50	-	
Potassium (g/100g)	2.50	-	-	Choudhary and Kar (1992)
Iron (g/100g)	0.01	0.03	-	Choudhary and Kar (1992) Hewageegana *et al.* (2014)
Copper (µ/gm)	5.29	-	-	Choudhary and Kar (1992)
Zinc (µ/gm)	53.15	-	-	
Manganese (µ/gm)	19.98	-	-	
Cobalt (µ/gm)	22.00	-	-	
Chromium (µ/gm)	1.81	-	-	

Methi (*Trigonella foenum-graecum*)

Fenugreek is a leguminous herb belonging to a fabaceae family that is cultivated in numerous parts of the world predominantly in India, Middle East, North Africa and South Europe. It is cultivated worldwide as a semi-arid crop. It is commonly known as *Methi*. The seeds are used as a spice and the leaves are consumed as a green vegetable, which are bitter in taste and have been in use for over 2500 years. These seeds are small in size, golden yellow colour and have four faced stone like structure. Raw fenugreek seeds are bitter in taste due to the existence of bitter saponins, which limit their acceptability in foods. India is a major producer and also a chief consumer of fenugreek for cooking uses and medicinal applications (Agrawal *et al.*, 2015). In different languages, it has different names like *Fenugrec* (French), *Methi* (Hindi), *Pazhitnik* (Russian), *Fienogreco* (Italian), *Alholva* (Spanish), *Koroha* (Japanese), *Hulba* (Arabian), *Bockshorklee* (German), *Halba* (Malaya) and *K'u-Tou* (China).

Fenugreek has an extended history in ayurvedic and Chinese medicine for medicinal purpose and used for several indications such as labour induction, assisting digestion and as a general stimulant to improve health and metabolism. It is one of the most ancient medicinal herbs. It has been used as such for centuries as a purpose of galactogogue. In women, fenugreek is mostly used to increase milk supply (Swafford and Berens, 2000). It provides natural food fibre and other nutrients required in the human and animal body. Fenugreek supports the production of milk because it is a rich source of essential fatty acids (Mowrey, 1986). Most applicable part of

Fig. 5: Fenugreek plant (*T. foenum-graecum*)
(Source: http://www.britannica.com/plant/fenugreek)

Fig. 6: Fenugreek seed (*T. foenum-graecum*)

Fenugreek (as spice and medicinal purpose) is the seed (Sharma, 1986). Its leaves and seeds have been used widely to prepare extracts and powders for medicinal uses (Basch *et al*., 2003). The leaves and seeds have anti-diabetic, anti-cancer, anti-microbial, anti-parasitic and procholesterolaemic effects (Al-Habori and Raman, 2002). It is also a tremendous source of selenium, an anti-radiant which helps the body for utilization of oxygen. They are rich in vitamins such as thiamine, folic acid, riboflavin, niacin, vitamins A, B_6, K and C, and are a rich source of many minerals such as copper, potassium, calcium, iron, selenium, zinc, manganese, and magnesium. Fenugreek has been used traditionally by mothers to increase the production of breast milk and quicken milk flow while nursing and breastfeeding (Toshiyuki *et al*., 2000). Also, this herb has been shown to significant effect on the lactation performance in ruminants (Alamer and Basiouni 2005). The biological and pharmacological actions of fenugreek are associated with the variety of its constituents namely steroids, N-compounds, polyphenolic substances volatile constituents, amino acids, etc (Mehrafarin *et al*., 2010). Supplementation of dairy ration, with fenugreek seeds improves the composition of cow milk (Shah and Mir, 2004). Sayed *et al*. (2005) mentioned that the fenugreek seed contains phytoestrogens, which are plant chemicals similar to the female sex hormone estrogen, a key compound, diosgenin, has been shown experimentally to upsurge milk flow.

Fenugreek seed contains 45 to 60 per cent carbohydrates mainly mucilaginous fibre (galactomannans), 20-30 per cent proteins high in lysine and tryptophan, 5 to 10 per cent fixed oils (lipids), calcium, iron, saponins (0.6-1.7%), cholesterol, sitosterol, vitamins A, B_1, C and nicotinic acid (Mehrafarin *et al*., 2010). Sinha *et al.* (2015) reported that the *T. foenum-graecum* seed is excellent source of protein (20-30%) high in tryptophan and lysine; free amino acids *i.e.* 4-hydroxyisoleucine, arginine, lysine and histidine (25.80%), fat (6.53%), ash content (3.26%), crude fibre (6.28%), energy (394.46 Kcal/100g seed) and moisture (11.76 %). Supplementation of fenugreek seeds powder @ 60 g per day in goats for seven weeks significantly increased milk production by 13 per cent (Alamer and Basiouni, 2005). Adding of fenugreek seed at different dose rate 2.5 and 5 g/kg body weight for 7 weeks in ewes significantly increase milk yield and body weight gain (Hassan *et al.*, 2012). Feeding of fenugreek seeds at different levels 5, 10 and 15 per cent of basal diets significantly increased feed intake and milk yield. When fenugreek seed supplement was increased, it is concomitant decrease in milk fat percentage and inconsistent pattern in protein, lactose and SNF (Elmnan *et al*., 2013). Supplementation of polyherbal combination which contains fenugreek in lactating dairy goats after 2 weeks of kidding for a period of 12 weeks significantly improve milk yield (Galbat *et al.*, 2014). Feeding of fenugreek seed to basal ration at level 0.6 and 1.2 g/kg body weight in lactating ewe's significantly increased daily feed intake, daily milk yield, milk protein and solid non-fat percentage while the percentage of fat and lactose were significantly decreased (Al-Sherwany, 2015).

It is concluded that Shatavari *(Asparagus racemosus)*, Jivanti *(Leptadenia reticulata)* and Methi *(Trigonella foenum-graecum)* are effective herbal galactogogue and its uses as feed additive in dairy animals improve livestock performance in general and milk production in particular. Now a day's increasing the demand of organic food and cost effectiveness in the livestock feed, the use of herbal feed additives has become the requirement of recent modalities. Utilization of herbal remedies will not only improve the productive efficiency but improve reproductive efficiency, general health and milk production.

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