

A Review on Phytochemical and Pharmacological Profile of Endangered Medicinal Plant *Leptadenia Reticulata* (Retz) Wight & Arn



Biotechnology

KEYWORDS : *Leptadenia reticulata* (Retz) wight & Arn, galactogogue, Asclepiadaceae

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ABSTRACT

Leptadenia reticulata (Retz) wight & Arn popularly known as *methidodi* or *jivanti* is a twining shrub of Asclepiadaceae family. *Jivanti* is used as an ingredient in formulations like *Jivantadya Gharita*, *Jivatayadi rasa*, *Jivantayadi taila*, *Ashwagandhadi Gharita*, *Anuthaila*, *Chandanadi thaila* and so is considered as one of the important *Rasayana* drugs in *Ayurveda*. It is used in treatment of tuberculosis, emaciation, fever, hemorrhage and cardiac ailments due to its stimulant, galactogogue, and restorative properties. Its inevitable constituent like *Leptadenol*, β -sitosterol, β -amyryn and alkaloid like *Jibentin α* and β -*jivantic acids* nourishes and rejuvenates the body and increases memory, longevity, immune modulation and adoption. Its medicinal properties have threatened the survival of this plant species and thus the plant is now listed as endangered. Many of the beneficial aspects of this plant have been explored but still there exist a vast ocean for research and findings. Additionally, Limited research has been done to improve the role of medicinal plant and herbs in daily life of the population. This review is to compile its valuable phytochemical and pharmacological activities under same platform thus viewing its ayurvedic importance along with biotechnology approaches used in its propagation.



INTRODUCTION

Plants have always been a major component of traditional system of healing in developing countries, which have also been an integral part of their history and culture. Medicinal plants offer alternative remedies with tremendous opportunities. Many traditional healing herbs and plant parts have been shown to have medicinal value especially in the rural areas and that these can be used to prevent and cure several human diseases. *Rasayana* is one of the classes of *ayurveda* that improves the general health of the body. Herbs are a natural path to maintain and preserve good health such as *Jivanti* (*svarnajivantz*) (Gupta, 1997). Herbs are more compatible with body because of their

effects; therefore they are more suitable, especially in case of long consumption (Borimnejad, 2008). *Jivanti* is sweet in taste and useful in alleviating all the three doshas, namely, *vata*, *pitta* and *kapha*. Mainly, the roots and the whole plant are used for medicinal purposes so it also included vitalizing group (Gupta, 1997). *Leptadenia Reticulata* is such an economically important medicinal plant species of Indian Thar desert (Bhandari, 1990; Shetty and Singh, 1991).

Leptadenia reticulata (Retz) wight & Arn belongs to family Asclepiadaceae is an important medicinal plant. This plant is commonly known as *Jivanti*, *Dori* or *Swarn*. Indian synonyms: Bengali: *Bhadjivai*, English: *Leptadenia*, Gujarati: *Methidodi* or *Dodi*, Hindi:

Dori, Kannada: *Hiriyahalle*, Marathi: *Haranel*, Sanskrit: *Jivanti* and Telugu: *Kalasa* This plant, belonging to the Asclepiadaceae family, is considered to be a *Rasayana* (tonic) drug and is thus used to vitalize, nourish and rejuvenate the body (Daniel, 2006). It grows in the sub-Himalayan tracts of Punjab, U.P. and throughout the Deccan Peninsula up to an altitude of 900 m. (Gupta, 2005). Charaka had treated it as an important *rasayana* drug, capable of maintaining youthful vigour and strength. *Vagbhata* included it among the ten drugs that constitute the *Jivaniya gana* or the vitalizing group (Sivarajan, 1994). The bark is yellowish brown, corky, deeply cracked. Leaves are ovate-cordate, coriaceous glabrous above, more or less finely pubescent beneath (Sonara *et al.*, 2013); the flowers are in many flowered cymes, greenish yellow and are axillary or terminal (Kalidaas *et al.*, 2011); the follicles are sub-woody and turgid (Sathiyannarayan *et al.*, 2007). Huge demand and multipurpose uses of these plants in pharmaceutical industries, population bloom, urbanization, over-exploitation and recurring drought and famine in this region make these plants species endangered (Bhandari, 1990; Shetty and Singh, 1991).

Taxonomic hierarchy

Kingdom: Plantae
Class: Angiosprmae
Cladus: Eudicots
Order: Gentianales
Family: Asclepiadaceae
Sub Family: Asclepidoideae
Tribe: Ceropogeeae
Genus: *Leptadenia*
Species: *reticulata*

Systematic position

Family: Asclepiadaceae
Botanical Name: *Leptadenia reticulata* (Retz.)Wight. & Arn.
Vernacular Name: *Palaikkodi*, *Palakudai*
Common name: *Jivanti*
Sanskrit: *Arkapushpi*, *Svarnajvanti*

Ayurvedic Features

Rasa: Madhur (sweet)
Guna: Laghu (light), snigdha (unctuous)
Veerya: Shita (cold)
Vipaka: Madhur (sweet)
Dosha: Balances tridosha

Importance in Sanskrit literature

आश्च्योतन हेतुः (Use in Aaschyotana)

द्राक्षाम्बु कमञ्जिष्ठाजीवनीयेः ।

प्रातराश्च्योतनं पथ्यशोथशूल्लाक्षिरोगिणाम् ॥ (सकृदत-नेत्ररोगिणि 28)

Jivanti comes under jivaniya gana which is used as aschyotan dravyas for eye ailments along with other drugs. (**chakradutta**)

जीवनीयगण : (Jivaniya Gana)

नेत्ररोगो मे द्रक्षादि सिद्ध दूध का आश्च्योत्तन
जीवन्ती मधुराशीतासुस्निग्धा ग्र गहिणी लघु।
चक्षुष्या सर्व दोषघ्नी बल्यस्या रसायनी।। (कैयदेवनिघण्टु)

Jivanti is madhura, sheeta, snigdha, grahi. Laghu, chakshushya, balya, yushya, Doshahara and Rasayana. (**Kaiydev Nighantu**)

स्वर्ण जीवन्तिका कृया चक्षुष्या मधु रा तथा ।
शिशिरा वातपित्तास्र र्दाहजित् बलवर्धि नी (खजनिघण्टु)

Swarna Jivanti is Vrishya, chakshushya, madhura, sheeta, balya, Vata-Pitta haraand Rasayana. (**Raj Nighantu**)

नक्तान्ध निवारणार्थ :

चू कसिद्धानि जीवन्त्याःपल्लवानि च भक्षयेत् ।
तथातिवु कर्कण्डशैफाल्यमिरुजानि च ।
भू पृष्टं तं कु म्नायोनिः पत्रैः पानेच पूजितम् ।। (अ० ह० उ० 13/88,89)

Role in Night Blindness

Shaka (leafy vegetables) are beneficial in curing night blindness. Jivanti shaka along with other shaka prepared in ghrita is used for curing naktandhya. (Night blindness), (**A.H.U.-13/88**)

सर्व शाकमयम चक्षुष्यं चक्षुष्यं शाकपत्रं चकम् ।
जीवन्ती वास्तु मत्स्याक्षी श्वेनादः पु नर्न वा । (क० र० 1)

All Shaka are chakshushya especially Shaka Pancham: Jivanti, Vastuka, Matsyaakshi, Meghnaad And Punarnava (**YogaRatnakara-1**)

चक्षुष्या सर्व दोषघ्नी जीवन्ती मधु रा हिना (ध० निघण्टु)

Jivanti is chakshushya, sarvadoshghara, Madhura and Sheeta. (**Dhanwantari Nighantu**)

चक्षुष्या सर्व दोषघ्नी जीवन्ती समुह ता ।। (सू०)

Jivanti is exemplified as chakshushya and sarvadoshghani. (Sushruta)

रसायनी बलकारी चक्षुष्या ग्र गहिणी लघु । (भा० नि०)

Jivanti is Rasayani, Balakari, chakshushya, Grahi, and Laghu. (**Madhava Nidana**)

आयु वृद्धिकसेत्र्यं गु रू दोषत्रयापहम् । (स०म०)

Jivanti is Ayuvridhdhikara, Netrya, Guru and doshahara. (**S.M.**)

जीवन्ती शाकं सु निष्णकं च सतण्डु लीयं वरवास्तु कं ।
घिल्ली तथा मूलकपोतिकं च वृष्टिर्हि ब्राकुनं जांगलं च ।। (सू०)

Jivanti is along with other ingredients is beneficial to cure Timira Roga. (**Sushruta**).

जीवन्ती शीतला स्वादुः स्निग्धा दोषत्रयापहा ।
रसायनी बलकारी चक्षुष्या ग्र गहिणी लघु । (क० प्र०)

Jivanti is sheetala, Madhura, Snigdha, Tridoshahara, Rasayani, Balakari, chakshushya, Grahi and Laghu. (**Bhava Prakasha**)

जीवन्ती शाकं शाकानम् । (च० सू० 25)

Jivanti is best among all Shaka (Leafy Vegetables) (**Charaka Sutra sthana-25**)

Principal Constituents

The plant contains acetyl alcohol, β -sitosterol (Sonara *et al.*, 2012), β -amyirin, lupanol 3-O diglucoside, leptidine, Saponin (Figure.6), Flavonoid, Luteolin (Figure.4), Diosmtin and Tannin (Sonara *et al.*, 2012). Leaves contain two resins and also contain bitter neutral principal, albuminous and colouring matter, Ca-oxalate glucose, carbohydrate and tartaric acid (Srivastav & Khare, 1994). Previously reported chemical constituents of *Leptadenia reticulata* (retz) wight & Arn also includes α -amyirin (Figure.1), hentriacontanol (Figure.2) (Krishna *et al.*, 1976), ferulic acid (Figure.5), rutin, stigmasterol (Figure.7), a triterpene alcohol simiarenenol (Subramaniam *et al.*, 1977) and apigenin (Figure.3) (Sastry *et al.*, 1985). Pregnane glycosides reticulatin,

deniculatin and leptaculatin have also been isolated from the aerial parts (Srivastav *et al.*, 1995).

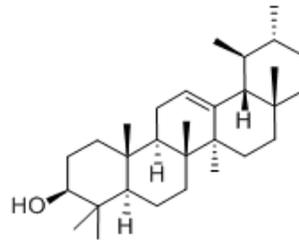


Figure 1: Alpha-Amyrin

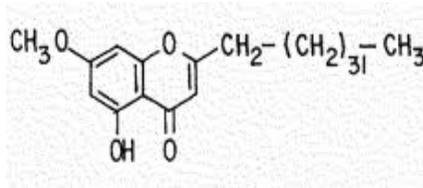


Figure 2: Hentriacontanol

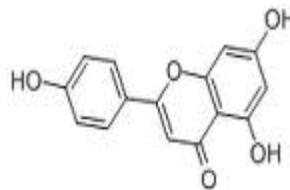


Figure 3: Apigenin

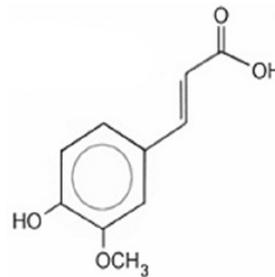


Figure 4: Luteolin

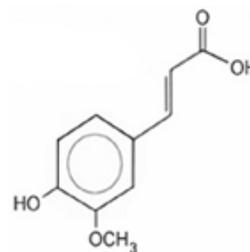


Figure 5: Ferulic Acid

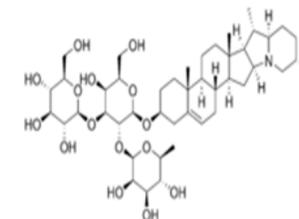


Figure 6: Saponin

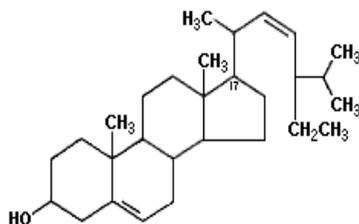


Figure 7: Stigma Sterol

Figure: Chemical constituent of *Leptadenia reticulata* (Retz & wrn.)

Table 1: Account of pharmacological activities of various parts of the plant

S. no	Pharmacological Activity	Part of plant	Effects	Reference
1.	ANTIBACTERIAL EFFECT	Roots	Aqueous and ethanolic extract showed effect against various pathogens including <i>Streptococcus pyogenes</i> var. a- and f3-haemolyticus, <i>Salmonella typhi</i> , <i>S. paratyphi</i> , <i>S. schottmulleri</i> and <i>Escherichia coli</i>	Vaghasiyaz,2007 ; Patel et al., 1958 ; Sivarajan, 1994
2.	ANTIFUNGAL EFFECT	Leaf And Roots	Aqueous and 50% ethanolic extracts of the leaf and root of <i>Leptadenia reticulata</i> (Retz) wight & Arn against <i>Trichophyton rubrum</i> . The alcoholic extract was the more active.	Patel et al., 1958
3.	ANTICANCER EFFECT	Leaves	Ethanolic extract of leaves (200 mg/kg, i.p.) result in significant increase in the lifespan and decrease the cancer cell number and tumor weight.It normalized Hematological parameters	Sathiyarayanan, 2007
4	ANTI DEPRESSANT EFFECT	Whole Plant	Use of <i>Leptadenia reticulata</i> (Retz) wight & Arn in the anti depressant drug named as <i>Celastrus paniculata</i> , <i>Acorus calamus</i> , <i>Nardostachys jatamansi</i> was reported. It showed marked improvement in hysteria or epilepsy	Hakim, 1964
5	HYPOTENSIVE EFFECT	Whole Plant	Aqueous extract of <i>Leptadenia</i> showed potent and prolonged hypotensive action in anaesthetised dogs, the initial hypotension followed by a complete recovery and a secondary progressive hypotension.	Agarwal et al., 1960
6	GALACTOGOGUE EFFECT	Root and Leaves	significantly increase milk flow so plant possesses the potent lactogenic, anabolic and galactogogue effect	Ravishankar, 2007
7	VASODILATOR EFFECT	Stem	Aqueous extract showed vasodilator effect along with transient negative inotropic, and chronotropic effect.	Agarwal et al., 1960
8	ANTI ANAPHYLACTIC EFFECT	Stem	DLH-3041 formulated by Himalaya drug company, Bangalore is a herbal formulation of Stem of <i>Leptadenia reticulata</i> (Retz) wight & Arn. DLH-3041 showed beneficial effect on mast cell degranulation induced by 0.5 ml Horse serum and DPT vaccine in rat. It showed significantly increase in the number of intact mast cell on intestinal mesenteric tissue.	Anjaria, 1975
9	ANTIABORTIFICIENT EFFECT	Whole Plant	use of leptaden is clinically tried in the threatened and recurrent abortion. Safe and simple dosage of Leptaden is an additional advantage for its use through pregnancy	Patel, 1958
10	OLIGOSPERMIC EFFECT	Whole Plant	Spemen an Ayurvedic herbal preparation containing <i>Leptadenia reticulata</i> (Retz) wight & Arn (without root whole plant 16 mg/kg quantity per tablet) is used for treatment of prostatic hyperplasia	Madaan, 1985 ; Marya, 1995
11	CARDIOVASCULAR EFFECT	Whole Plant	used in ayurveda for the management of cardiac vascular diseases as per the specific etiology of the patients according to Ayurvedic principles	Mehrotra et al., 2007
12	ANTI-IMPLANTATION EFFECT	Whole Plant	Ethanolic extract of plant (300 mg/kg) exhibited the strong anti-implantation (Inhibit100%) and uterotrophic activity but no anti estrogenic activity was detected.	Reni, 2009

Table-2: Medicinal uses of different parts of *Leptadenia reticulata* (Retz) wight & Arn

S. no	Plant part	Disease cured	References
1.	Flowers	Lack of craving, eyesight disorder.	Sonara et al.,2013 ; Bawra et al.,2010 ; Kalidaas et al.2011
2.	Leaves	Arthritis, gout, odema, cough and other respiratory conditions, burning sensation, eye disease in swine, Tuberculosis.	Patel et al., 1958 ; Sonara et al., 2013; Bawra et al. 2010; Sathiyarayanan et al., 2008

3.	Roots	Toothache, diarrhea, skin infection, ringworm, wound, nose and ear disorder, asthma, abortion in women, tuberculosis.	Patel et al., 1958 ; Sonara et al., 2013 ; Bawra et al. 2010; Kalidaas et al.,2011; Sathiyarayan et al., 2008
4.	Bark	Improve decreased milk production.	Kirtikar et al.,1998; Bawra et al., 2010
5.	Stem	Helpful in curing piles	Sonara et al., 2013

MARKETED FORMULATION OF JIVANTI

Leptadenia reticulata (Retz) wight & Arn is used for the preparation of at least 43 marketed poly herbal formulations which are being used in wide range of health and physiological disorders. The herbal formulations listed are Speman, Jivantadya Gharita, Jivatayadi rasa, Jivantayadi Taila, Ashwagandhadi Gharita, Anuthaila, Chandanadi thaila, Leptaden, Ashoka Gharita, Balaristha, Brahma rasayana, Chyvanprash avleha, Madhuyastyadi Taila, vidaryadi Gharita (Bawra et al., 2012). *Leptadenia reticulata* (Retz) wight & Arn is one of the ingredients of the patented siladan which is used for curing used different kinds of mental disorders like sex neurosis. *Leptadenia reticulata* (Retz) wight & Arn is an ingredient of *Dabur chyawanprash*, a traditional poly herbal formulation (Chauhan and Saraf, 2010)

TISSUE CULTURE

The biotechnological approaches for conservation of germplasm, problems of propagation and sustainable utilization of some important Asclepiadaceae plants of Indian Thar Desert had been studied. Plant tissue and cell culture has an important role to play in solving the problems related to plant improvement. Cell and tissue culture technology if suitably developed may help improve system productivity (Rathore and Shekhawat, 2006; Arya et al., 2003). Micropropagation method for *Leptadenia reticulata* (Retz) wight & Arn has been established. The nodal shoot segments were surface-sterilized and cultured on Murashige and Skoog (MS) medium along with additives. Plant regeneration through indirect somatic embryogenesis on leaf, internode, node and shoot-tip derived callus of *Leptadenia reticulata* (Retz) wight & Arn was also established. Somatic embryos at the highest frequency was induced on Murashige and Skoog

(MS) medium (Sathiyarayan et al., 2007). This technology has been increasingly exploited and successes in a number of areas have been achieved. (Hall, 2000).

To date, there are only few reports on the micro propagation of *Leptadenia reticulata* [Hariharan et al., 2002; Arya et al., 2003; Sudipta et al., 2011].

CONCLUSION

The natural strand of this species is first disappearing due to its restricted distribution and indiscriminate exploitation for medicinal use by pharmaceutical industry. As a result, it is now listed as an endangered species by the international union for conservation of nature and natural resources. Commercial exploitation for production and conventional propagation is hampered due to its poor seed viability, low rate of germination and seasonal availability. Huge demand and multipurpose uses of these plants in pharmaceutical industries, population bloom, urbanization, over-exploitation and recurring drought and famine make these plants species endangered. The increasing demand for this plant material and loss of habitat will put this medicinal species under more pressure which may endanger human health. This in turn may lead to loss of consumer confidence in herbal medicines.

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