

Ethnomedicinal claims and Biological activities of *Dendrophthoe falcata* (L. f.) Ettingsh.

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Abstract

Dendrophthoe falcata (L. f.) Ettingsh belongs to the family Loranthaceae, is an evergreen hemiparasitic plant, popularly known as 'Vanda' in the Indian Ayurvedic system of medicine. It is indigenously said to have potential medicinal properties. It is reported to possess potential to cure various ailments like gynecological uses, gastrointestinal disease, urolithiasis, wound healing, cholesterol reduction, analgesic etc. The present study is an attempt to assess the credibility of various folk claims on medicinal uses of *Dendrophthoe falcata* in view of scientific studies done so far.

Keywords: *Dendrophthoe falcata*, Loranthaceae, Ethnomedicine, Credibility

Introduction

Ethnobotany is broadly defined as the study of the interactions between plants and people in their local environment (Arora, 1997). Since ancient times, plants have been an exemplary source of traditional medicine. The use of traditional medicine is widespread and plants are large source of structurally novel compounds that serves as leads for novel drugs. Worldwide, about 85% of the traditional remedies used for primary health care are derived from plants (Prakash & Anpin, 2008).

The knowledge of the use of medicinal plants and their properties were transmitting from generation to generation. The multi-location and multi-ethnic use, *i.e.* application of some traditional herbal cures in several distant regions and among distant tribal ethnic group is suggested as a good criterion for credibility of folk claims and practices (Jain, 2004). *Dendrophthoe falcata* (L. f.) Ettingsh belongs to the family Loranthaceae,

is an evergreen parasitic plant grown on different host trees like *Boswellia serrata*, *Mangifera indica*, *Ficus religiosa*, *F. rumphii*, *Madhuca latifolia* etc. (Singh and Gupta, 2013) (Plate 1). It is also known as 'Vanda' in the Indian Ayurvedic system of medicine and 'Vrksadani' and 'Vrksaruha' in 'Sanskrit (Manthri *et al.*, 2011). It is indigenous to tropical regions especially in India, Srilanka, Thailand, China, Australia, Bangladesh, Malaysia and Myanmar (Manthri *et al.*, 2011).

Whole plant is used ethnomedicinally by various tribal communities in the world. Almost all parts of the plant *i.e.* stem bark, leaf, flower and fruit are reported to possess medicinal potential in various ethnobotanical studies (Sinoriya *et al.*, 2011).

This hemiparasite mostly used for the treatment of gynecological ailments, gastrointestinal diseases, urolithiasis, wound healing and

Plate 1



Dendrophthoe falcata growing on *Boswellia serrata* tree



Close view of *Dendrophthoe falcata* twig having flower

skin diseases. Many tribal communities have reported the folk medicinal claims of *D. falcata* worldwide, which increase the credibility level of this hemiparasite for medicinal properties and many of these folk claims have been validated scientifically both on animal as well as human studies worldwide. Thus the present work was undertaken to check the credibility of these folk medicinal claims in view of scientific studies carried out so far.

Methodology

Extensive literature survey was carried out to collect ethnomedicinal, pharmacological and biological information's about *D. falcata* for the present study,. For this, online data base namely, Pubmed and Google Scholar, scientific journal viz. Indian Journal of Traditional Knowledge, Journal of Ethnopharmacology, Journal of Ethnobiology and Ethnomedicine, Ethnobotanical Leaflets, Environmental Health

Perspectives, Asian Journal of Pharmacy and Life Science and Natural Product Radiance along with many books (Jain S K, 1991; Joshi P, 1995; Datt B, 1996; Singh and Pandey, 1998; Katewa and Jain, 2006) were searched thoroughly to know the folk medicinal claims of *D. falcata* and these folk medicinal claims have been validated scientifically and thus include for the assessment of credibility.

Validation of therapeutic claims - direct evidence

Sexual /Gynecological uses

Dendrophthoe falcata has high reputation as a therapeutic agent for the treatment of gynecological problems like uterine disorder, impotency, aphrodisiac, menstrual disorders, leucorrhoea, spermatorrhoea, settlement of foetus etc. and also used as contraceptive and for the abortion, also to treat postnatal disorder in animals etc. in the tribal communities of Nepal, Kerala, Tamilnadu, Jharkhand, Maharashtra, Rajasthan, Andhra Pradesh, Uttaranchal and West Bengal states of India. Whole plant and various part/s of this plant such as stem bark, leaves, root, fruits and stem are claimed to possess therapeutic potential to treat patients suffering from all these condition (Jain, 1991; Rothe, 2003; Singh, 2003; Pawar & Patil, 2004; Pawar & Patil, 2004; Kunwar *et al.*, 2005; Ganasen *et al.*, 2006; Malla & Chhetri, 2009; Vijigiri & Sharma, 2010; Sinoriya *et al.*, 2011; Shanavaskhan *et al.*, 2012; Saha *et al.*, 2014; Kaur & Mehta, 2014; Kumar, 2015).

Gupta and Kachhawaa (2007) studied contraceptive effect of stem of *D. falcata* in fertile male rats. Rats were gavaged methanol extract of stem of *D. falcata* at 50, 100 and 200 mg/rat/day for 60 days. On day 61 the animals were

autopsied and the testes, epididymides, seminal vesicle and ventral prostate were dissected out and weighed sperm motility and density and serum testosterone level were assessed. The sperm motility and density were significantly reduced. The histoarchitecture of testes revealed degenerative changes in the seminiferous tubules, arrest of spermatogenesis at the stage of round spermatid. Serum testosterone level was decreased significantly in all treated groups.

In male albino rats, oral administration of 70% methanolic extract of stem of *D. falcata* at dose of 100 mg/kg wt/day fed for 60 days showed antifertility effect without decreasing body weight, while the testes and epididymides were significantly reduced, and the seminal vesicles and ventral prostate also showed a significant reduction ($P < 0.01$). Treated animals showed a notable depression of spermatogenesis. The reduced sperm count and motility resulted in 100% negative fertility at 100 mg/kg dose level (Gupta *et al.*, 2008).

In female Wister rats, oral administration of hydroalcoholic extract of the aerial parts of *D. falcata* has antifertility effect and is safe at effective doses employed in the study. The LD (50) value was found to be 4.55 g/kg body weight. The extract also exhibited weak estrogenic activity when given alone, and when given along with ethinyl estradiol, it exhibited slight antiestrogenic activity in immature ovariectomized rats (Pattanayak & Mazumder, 2009).

Gastrointestinal disease

The tribe lives in unhygienic condition and therefore is prevalence of gastrointestinal disorders like diarrhoea, dysentery, worm

infestation etc. both among the tribals and their livestock's. In Central Nepal paste of whole plant of *D. falcata* is used as antihelmintic (Sigdel *et al.*, 2013) and it is also used to treat of diarrhoea, (Shanavaskhan *et al.*, 2012). Leaves of this parasitic plants are useful in diarrhoea, dewormification in cattle stomach and gastritis (Katewa and Jain, 2006; Kamble *et al.*, 2008; Meena and Yadav, 2011).

Urolithiasis

Sinoriya *et al.* (2011) reported that the entire plant is used extensively in traditional medicine to treat urinary diseases, calculi and used as diuretic.

Aqueous and alcoholic extracts of *D. falcata* were tested for their antilithiatic activity while aqueous extract for diuretic activity. Significant increase in the volume of urine and excretion of Na^+ , K^+ , Cl^- was recorded when aqueous extract (4 g/kg p.o.) administered to rats and compared with frusemide (4 mg/kg) and hydrochlorthiazide (10 mg/kg). Urolithiasis induced by implantation of zinc disc in the urinary bladder of rats developed magnesium ammonium phosphate stones. Ethylene glycol (1%) mixed in drinking water for 4 weeks caused a reduction in stone formation. Significant decrease in the weight of stones was observed after prophylactic or curative treatment in animals which received aqueous or alcoholic extracts of the test drug (4 g/kg, p.o.) in comparison with ethylene glycol or tap water treated control groups. Alcoholic extract was found to be more effective than aqueous extract (Aleykutty *et al.*, 1993).

Anti-Inflammatory activity

Different part/s (whole plant, bark, leaf, flower and fruit) of plant is used for the treatment

of various diseases like rheumatism, bone fracture, asthma and body swelling in various ethnic groups of Bangladesh, Nepal and India (Kunwar *et al.*, 2005; Meena & Yadav, 2006; Malla & Chhetri, 2009; Shahidullah *et al.*, 2009; Partha & Hossain, 2009; Vijigiri & Sharma, 2010; Shanavaskhan *et al.*, 2012; Kumar *et al.*, 2012). Anti-inflammatory action of the plant is possibly active for its beneficial effect in all these condition.

Analgesic activity

Different part/s of plant are used by the various ethnic group for its analgesic effect in different body parts like whole plant for abdominal pain (Joshi, 1995; Singh and Pandey, 1998), leaf for chest pain (Jagtap *et al.*, 2006; Sandhya *et al.*, 2006) and stem for headache (Jain S K, 1991).

The analgesic activity of the aqueous and alcohol shoot extracts of *D. falcata* was evaluated by using Eddy's hot plate and heat conduction method at the dose of 500 and 1000 mg/kg ($p < 0.001$). In heat conduction method both extract showed significant analgesics activity at the dose of 500 and 1000 mg/kg ($p < 0.001$) as compared to control group, when analyzed statistically by Tukey Kramer Multiple Comparison test. The results obtained shows that the aqueous and alcohol shoot extracts of *D. falcata* possesses significant analgesic activity, which confirms the Ayurvedic and traditional claims of the plant (Madhuri *et al.*, 2013).

Wound healing

Leaves and bark paste is applied locally while fruits is taken orally too for curing cut and wounds by the tribals (Singh *et al.*, 2002; Kunwar *et al.*, 2005; Vijigiri & Sharma, 2010; Subbaiah & Savithramma, 2012; Sharma *et al.*,

2014; Choudhury *et al.*, 2015).

A validation of the ethnotherapeutic claims of aerial part/s of plant was evaluated for healing efficiency on excision and incision wound models in rats. The results showed that extract has potent wound healing capacity as evident from the wound contraction and increased tensile strength. Hydroxyproline and hexosamine expressions were also well correlative with the healing pattern observed (Pattanayak & Sunita, 2008).

Validation of therapeutic claims- indirect evidence

Antimicrobial activity

Various parts (leaves, flower, root stem, bark) of *D. falcata* have been used to treat infective condition of human body like chicken pox, small pox, skin ulcer, skin allergy including rashes, pus, boils. Beside these it is also employed for treatment of leucorrhoea and diarrhoea as folk medicine in various ethnic groups (Jain, 1991; Bhandari *et al.*, 1995; Datt, 1996; Kunwar *et al.*, 2005; Kamble *et al.*, 2008; Ganasen *et al.*, 2009; Mairh *et al.*, 2010; Shanavaskhan *et al.*, 2012; Sharma *et al.*, 2013; Kumar S, 2015; Kumar S, 2015; O'Neill and Rana, 2016).

Pattanayak and Sunita (2008) studied antimicrobial activity of aerial parts of *D. falcata*. Petroleum ether, chloroform and ethanolic extract obtained from the crude powder shows significant antimicrobial sensitivity against bacterial species namely *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus*, *S. pyogenes*, *S. epidermidis*, *Micrococcus luteus*, *Bacillus subtilis*, *B. cereus*, *Klebsiella pneumoniae*, *Enterobacter aerogenes*, *Pseudomonas aeruginosa*, *Serratia marcescens*,

and fungal species namely *Candida albicans*, *C. tropicalis*, *Aspergillus fumigatus*, *A. niger* and *Fusarium oxysporum*. In all the three extracts, ethyl acetate extract has shows more significant antimicrobial action against all tested organisms.

Cholesterol reduction

Shanavaskhan *et al.* (2012) reported that whole plant powder of *D. falcata* reduces cholesterol level in blood and lipid lowering activity of leaves was studied by Tenpe, *et al.*, (2008). Ethanolic extract of leaves (300 mg/kg/day, p.o) was tested in high fat diet model for 42 days (six weeks). Treatment of *D. falcata* 70% for 42 days along with high fat diet and result showed significant ($p < 0.01$) reduction in serum total cholesterol (TC), triglyceride high density lipoprotein (HDL) when compared with hyperlipidemic control. The lowered atherogenic index of extract group suggests antihyperlipidemic and cardioprotective potential.

Tonic properties

Stem of *D. falcata* is employed as a brain tonic in Bastar district (Jain, 1991). Its antioxidant property might be the basis for its healthful benefits. Various scientific studies done world over have shown a very good antioxidant potential of almost all parts of *D. falcata* as compared to standard antioxidants.

Hasan *et al.*, (2006) studied the potent antioxidant activity (IC₅₀ 5.1 µg/ml) of ethanolic extract leaves *D. falcata* while Haque *et al.*, (2014) studied antioxidant activity of both aqueous and ethanol extracts using DPPH free radical scavenging assay. The leaf extract exhibited significant DPPH free radical scavenging effects compared to standard ascorbic acid. IC₅₀ (50% inhibition concentration) value of ascorbic acid

was $12.55 \pm 2.35 \mu\text{g/ml}$ where as aqueous and ethanol extracts showed $19.88 \pm 2.98 \mu\text{g/ml}$ and $33.60 \pm 2.15 \mu\text{g/ml}$ respectively.

Pattanayak and Sunita (2008) studied the antioxidant activity of ethanolic extract of aerial parts which shows that it possesses potent antioxidant activity by inhibiting lipid peroxidation, reduced glutathione and SOD levels while increasing the CAT activity. Decrease in SOD activity correlated with the scavenging action of extract. It reduces the superoxide radicals by non enzymatically and reduces the oxidative stress. Scavenged superoxides radical were converted into hydrogen peroxide, which stimulates the expression of catalase. This may be the reason for the enhanced activity of CAT in DFEE-treated group.

Dashora *et al.*, (2011) studied antioxidant activities of methanolic and aqueous extracts of the stem of *D. falcata* in different *in vitro* models. Both methanolic and aqueous extracts exhibited antioxidant activity, with IC₅₀ values at 18 and 26 $\mu\text{g/ml}$ for DPPH, 22 and 29 $\mu\text{g/ml}$ for ABTS, 62 and 75 $\mu\text{g/ml}$ for NO scavenging activities, 260 and 180 $\mu\text{g/ml}$ for total antioxidant capacity, respectively. Total phenolic content of methanolic and aqueous extracts were found to be 1.5 and 1.1 mg/g while total flavonoid content were found to be 0.140 and 0.029 mg/g. The overall antioxidant activity might be attributed to its polyphenolic, flavonoid and phytosterol constituents.

Scientific validation of efficacy and safety of folk medicinal knowledge is needed to establish and support the uses of traditional medicines. On the basis of modern scientific evidence

obtained for many traditional therapies; it has been provided that folk knowledge has resulted from some keen observations, intuitional science and age old experiences. However, it is always important that disease identity should be correctly interpreted in terms of its traditional therapeutic use and also in light of modern medicine before scientific validation of any folk medicinal claims. This paper will pay the way for researcher to further validate many of other traditional medicinal knowledge associated with *D. falcata* which have not yet scientifically evaluated : for example whole plant as antihelmintic (Sigdel *et al.*, 2013); contraceptive (Mairh *et al.*, 2010); reduce cholesterol in blood and to treat diarrhoea and rheumatism (Shanavaskhan *et al.*, 2012); leaves to treat diarrhoea (Kamble *et al.*, 2008); leucorrhoea (Rothe, 2003); skin diseases (Ganasen *et al.*, 2009); bone fractures and for abortion (Kunwar *et al.*, 2005); bark to cure asthma (Reddy *et al.*, 2006); rheumatism, menstrual problems, skin disease and for setting dislocated bones (Kunwar *et al.*, 2005); fruits are used to cure wounds, astringent, bone fractures (Kunwar *et al.*, 2005) and for settlement of foetus (Pawar & Patil 2004); stem for induce abortion (Mitra & Mukherjee, 2009) and also use to treat Schizophrenia (Mali & Bhadane, 2011); and flower in asthma and tubercululosis (Vijigiri & Sharma, 2010) etc. based on the research result, novel therapeutic drug could be developed and farmers can be benefited economically by growing and selling the plant at large scale. However, the benefit should also reach to the actual knowledge provider.

Conclusion

Scientific validation of folk medicinal knowledge on animal and human studied further

authenticate age old wisdom of indigenous communities who not only utilize various plants for their food and fuel but also use them for their traditional medicines. Many of the commercially available plant based drugs are result of systematic scientific researches done on the keen observation of native people. Various scientific studies world over have confirmed the scientific basis using various parts of *D. falcata* for different disease in human and animals as suggested in folk medicine. Compilation of these scientific studies in the present study provides direct and indirect evidences which authenticate the credibility of age old folk medicinal claims on *D. falcata*. Medicinal studies reports its effectiveness on some new and important diseases, further studies are being continued.

However, there is still need for further research to scientifically display its medicinal potential. It is hoped that the present study not only revealed the authenticity of traditional knowledge of ethnic people on utilitarian aspects of this hemiparasite but also indicate the possibility of utilizing it for greater medicinal use for treatment of many diseases of modern era safely and successfully.

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