



Review Article

AYURVEDIC PHARMACO-THERAPEUTIC ADOPTION OF *CESTRUM DIURNUM* L.

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ABSTRACT

Cestrum diurnum L. known as Day jasmine, day cestrum, wild jasmine, a Solanaceae member is a native of West Indies and introduced to India as an ornamental plant. The berries of the plant contain solanine, tropane-alkaloids and generally lead to acute toxicity, whereas the leaves have calcitriol (1,25-dihydroxycholecalciferol) which causes chronic toxicity in animals like cattle, horses with characteristic symptoms of vitamin D3 poisoning. However, external application of calcitriol has been approved for use in Psoriasis, and being the natural source of calcitriol *C. diurnum* L. becomes a potential candidate for the treatment of psoriasis. Based on the review of the literature and the field data available so far, it can be stated that, *C. diurnum* L. is being enthusiastically adopted by Ayurvedic physicians for the treatment of *Kitibhakushta* (psoriasis). An analysis of the medicine based on Ayurvedic *rasapancaka* (*Rasa*-taste, *Guna*-quality, *Virya*-potency, *Vipaka*-post-assimilation change, *Prabhava*-exclusive activity) parameters further confirms its utility as per Ayurvedic etymology. Based on the supporting evidence of *C. diurnum* L. extract's efficacy in psoriasis treatment its sure to take the center stage in the treatment of Psoriasis and related conditions hereafter.

KEYWORDS: *Cestrum diurnum* L, Day Jasmine, Dinamallika, Din ka raja, Calcitriol, Psoriasis, Kitibha, Ekakushta, Anukta dravya, Exotic drug, Non-native drug.

INTRODUCTION

The journey of Ayurveda through the ages is very long, dynamic. There are additions of new theories, practices, and medicines from time to time. Such interweaving of medical thought with constantly mutating religious, political, and cultural climates emerged into a rich corpus of knowledge. Ayurveda firmly advocates that "there is no substance, which is not useful as a drug. Properties of such drugs, which are not mentioned here (in Ayurvedic texts), may be determined by taking into account the attributes made for them by the people of that locality"^[1]

It is pertinent to note that, from time to time Ayurveda has gracefully allowed the inclusion of hitherto unknown medicinal entities into its pharmacopeia. For convenience all such medicinal or food substances, which were not part of the Ayurvedic Classics but have been included in later works or have the potential to be included here after can be termed as "Non-native drugs. Arbitrarily the phrase can be defines as "any substance which is medicinally useful but did not find a direct or indirect mention in Ayurveda texts at a certain period of time in a chronological manner (i.e., it may be absent in the older texts, but may find a place in the later texts). It also may be an altogether a new drug to Ayurveda which deserves a place in Ayurvedic pharmacopoeia by virtue of its effectiveness, availability and current usage by *Vaidya* community."^[2]

The workers in the domain of *Dravyagunavijnana* are well aware new drug inclusion into Ayurvedic pharmacopeia from time to time. Some of the works, **Which have enlisted such drugs, are as follows:**

1. *Ayurveda ka Vaijnakika Itihasa* provides details of 121 new therapeutic entities, which were introduced to Ayurveda in different phases. Among the reported 54-plant drugs, 7-flowers, 26-fruits, 12-vegetables, 14-food grains, 8-animal origin ingredients.^[3]
2. "Contribution of Madanapala nighanṭu to the knowledge of Indian Materia-medica with particular reference to Fig (*Anjira*)" published in Indian Journal of History of Science^[4] is a marvelous work depicting the transactions between western Asian countries and India in terms of active exchange of drugs and food substances.
3. "Uncommon plant drugs of Ayurveda" written by Gyanendra Pandey is an ethno-botanical text trying to provide information about hitherto unknown drugs to Ayurveda.^[5]
4. "Medicinal plants used in Ayurveda"^[6] has marked 145 drugs as new entries into Ayurvedic literature.
5. Elaborate lists of vegetable origin drugs mentioned in *Carakasamhita*^[7] additional drugs mentioned by *Sushrutasamhita*^[8] and *Ashtangahrudaya*^[9] are provided in the magnum opus "The history of Indian medical literature".

6. "Herbs in Vasavarajeeyam" a Ph.D research work by K. Nishteswar has provided list of 14 new Drugs introduced by Basavaraju to Ayurveda^[10] Among the list the plant *Jatropha glandulifera* Roxb., named as *Tundila* is a non-native drug.
7. The index of Shaligramanighantubhushana a modern Ayurvedic lexicon compiled in 19th century around provides details of 58 new plant drugs/food substances which were never mentioned in Ayurvedic classical texts before to this text. ^[11]
8. The article titled "Inclusion of new medicinal plants in *Dravyaguna*: its importance and utility" published in *Sacitra Ayurveda* attempted to narrate the attempts of introducing new drug in to Ayurveda in a chronological fashion, beginning with Sushruta samhita. ^[12]
9. P.V.Sharma in his Cakradatta Translation has given details of 59 new drugs introduced to Ayurveda by Cakradatta (11th A.D.). ^[13]
10. A commendable compilation by *Aryavaidyashala's* "The Indian Medicinal Plants" has tried to provide Ayurvedic description for 120 new plant drugs. ^[14]
11. The work *Dravyagunavijnana*^[15] has provided Ayurvedic description to 60 new drugs.

Keeping in view of the legacy of adopting new drug entities into Ayurveda as narrated above, an attempt is made here to review, analyze the existing information regarding an exotic plant "*Cestrum diurnum* L." with therapeutic potential to treat psoriasis known as *Kitibha kushtha*^[16], *Ekakushta*^[17] and adopt the same after thorough *Rasapancakaviveca* (fivefold pharmacological analysis) into Ayurveda.

Cestrum diurnum L.-Introduction

Day jasmine also known as day cestrum, wild jasmine, ink-bush, Chinese inkberry in English, ama día, rufiana, galán de día, and saucotintóreo (Spanish). ^[18] In Hindi, it is known as "cameli" in Bihar, "*din-ka-raj*"^[19] in Uttarpradesh^[20] and botanically *Cestrum diurnum* L. (syn. *Cestrum fastigiatum* Jacq., *Cestrum diurnum* L. var. *fastigiatum* (Jacq.) Stehlé in Fournet, *Cestrum diurnumportoricense* O.E. Schulz in Urban). ^[21]

The plant is considered as an invasive species occurring as a Weed of roadside and wasteland in Nepal. ^[22] Day jasmine is native to the Bahamas, Cuba, Jamaica, Hispaniola, and the Cayman Islands. It has been introduced as an ornamental into most of tropical and subtropical America, India. It has long been planted as an ornamental for its pleasing appearance, moderate size, ease of establishment, and fragrant flowers. ^[23]

Habit: The erect plant grows up to the height of 1-3 m, and it is a much-branched shrubs having lenticellate branches; leaves alternate, elliptic-oblong or elliptic-lanceolate; inflorescence in 1.5 - 6 cm long, axillary panicles; flower ivory white, sweet scented; Berries deep-purple or nearly black. ^[24]

Ethno-Botanical Importance of the Plant: The fruits of day jasmine are one of the three foods that make up the bulk of the diet of the endangered plain pigeon (*Columba inornata*) in Puerto Rico. ^[25] Avdabhai R. Modhvadia has

reported that, it is Cultivated as a ornamental plant in gardens in India and its Seeds have anti-fungal and inflammatory activity. ^[26]

Chemical Constituents, efficacy, safety of *Cestrum diurnum* L.

The leaves contain nicotine, nor nicotine, ursolic acid, tigonin and 1,25 dihydroxy vitamin D3-glucoside^[27] now known as calcitriol. *Cestrum diurnum* L leaves are considered best, reliable, natural source for calcitriol. ^[28] Further, The process patent for extracting the same from *Cestrum diurnum* L. leaves has been granted to Mitra Puccalapalli by World Intellectual Property Organization. ^[29] The oil was found to be an effective fungi toxicant against both plant and human pathogens. ^[30]

Toxicity: The leaves, seeds of the plant on ingestion can cause acute and long term poisoning. The plant is suspected of poisoning humans and domestic pets causing hallucinations and muscular and nervous irritability. ^[31] The Acute poisoning is due to the constitutens Solanine and tropane alkaloids. Whereas the chronic toxicity in the form of hypercalcinosis is due to a calcinogenic glycoside called 1, 25- dihydroxycholecalciferol.

A. Acute poisoning: Unripe berries of *Cestrum diurnum* L. contain Solanine, where as tropane alkaloids are prevalent in the ripe berry. Apart from these, Saponins, alkaloids, traces of nicotine, and 1,25-dihydroxyvitamin D3glucoside are found in this plant. ^[32]

Symptoms and signs: In general the symptoms of poisoning mimic atropine poisoning (mydriasis, tachycardia, xerostoma, dyspnea, ileus, urinary retention, CNS stimulation followed by depression, paralysis, seizures). If solanine predominates, mild to severe gastrointestinal signs may predominate. Normal to increased borborygmi may indicate predominance of solanine, whereas lack of bowel sounds may hint at an atropine-like toxin. ^[33]

Treatment: Rarely, fluid therapy to replace losses. In cases where atropine-like signs are life threatening, physostigmine may be carefully administered (**CAUTION:** physostigmine may cause asystole). Begin with 0.02 mg/kg administered TV over 5 minutes. If delirium or coma is abolished, use repeated doses as needed. If no effect is noted or gastrointestinal signs predominate, consider cautious administration of atropine and observe for signs of improvement. Tachydysrhythmias that do not respond to physostigmine may respond to administration of propranolol. if *Cestrum diurnum* is the plant involved, monitor for evidence of hypercalcemia and to be treated accordingly. ^[34]

B. Chronic poisoning: The plant is poisonous to livestock. The leaves contain a calcinogenic glycoside called 1, 25- dihydroxycholecalciferol that leads to a vitamin D toxicity that results in elevated serum calcium and deposition of calcium in soft tissues. Fifteen to 30 percent of day jasmine leaves in an animal's diet are sufficient to cause symptoms. ^[35]

The symptoms, signs of Hypercalcemia: Progressive weight loss and lameness of increasing severity,

Anatomical changes include dystrophic calcinosis of elastic tissues, viz. major arteries, tendons and ligaments in Horses grazing on *Cestrum diurnum* L. leaves. Chronic wasting and progressive lameness were observed in Cattle too along with other anatomical, biochemical changes observed in Horses.^[36]

***Cestrum diurnum* L.- Calcitriol and Utility in the treatment of Psoriasis and other skin ailments.**

The leaves of *Cestrum diurnum* are known to contain Calcitriol a naturally occurring active form of vitamin D₃^[37] and has been used for topical psoriasis therapy in Europe and other parts of the world. Further, Calcitriol 3 microg/g ointment has been extensively evaluated for the treatment of chronic plaque-type psoriasis and has been shown to be effective, safe and well-tolerated in a number of short-term and long-term clinical trials. Pharmacokinetic studies in patients with psoriasis and healthy control subjects have demonstrated that topical calcitriol ointment produces little systemic absorption of calcitriol and does not alter systemic calcium homeostasis significantly even when applied to approximately one third of the body surface area. Calcitriol ointment is associated with a low rate of cutaneous irritation and does not increase the sensitivity of treated skin to phototoxicity following treatment with ultraviolet treatment.^[38] Further, the efficacy of utilizing naturally occurring calcitriol from *Cestrum diurnum* L in the treatment of psoriasis has been ascertained clinically in India by G. Raghurama Rao.^[39]

Ayurvedic Adoption of *Cestrum diurnum* L.

It is interesting to note that in recent times Ayurvedic practitioners have started to show interest to employ the leaves of this plant in the treatment of different skin ailments, of which it is found to be effective in the treatment of Psoriasis on external application. Though the specific mechanism is unknown on the external application of extract of the leaves reduce itching, roughness and scaling in psoriatic patches. Keeping in view of the day blooming nature and the popular English name "Day Jasmine"^[40] the plant can be named as "*Dinamallika*".

Analysis and attribution of *Rasapancaka* (Rasa - Taste, Guna - Quality, Virya - Potency, Vipaka - Post assimilatory taste, Prabhava - Exclusive therapeutic property) & Vishaktata (toxicity)

A. Determination of Rasa, Guna, Virya, Vipaka: Based on the observations made by the authors of this paper after ingesting the plant leaves (for a short period of two days in succession) and also based on the acute toxicity profile of this plant^[41] it is inferred that, the *Cestrum diurnum* L plant leaves, stem bark have *Tiktarasa* (bitter taste), *Shitaguna* (cold), *Shlakshnaguna* (smoothness), *Shitavirya* (cold potency), *Katuvipaka* (pungent post-assimilatory taste/change). During the study all the attributes pertaining to *Tikta*-bitter taste viz., *Chedana* (cutting apart the vitiated *Doshas* such as *Kapha*), *Rocana* (appetizing), *Dipana* (stimulates), *Shodhana* (cleanses), therapeutic properties viz., alleys *Kandu* (itching), *Kotha* (tissue rotting), *Trishna* (thirst), *Murcha* (swooning) and *Jvara* (fever), *Stanyashodhana* (cleanses breast milk),

promoting the movement of *Vit* (faces), *Mutra* (urine), *Kleda* (wetness), *Medas* (fat), *Vasa* (facia) and *Puya* (pus)^[42] etc., as described in the classical texts of Ayurveda have been thoroughly observed and inferences were drawn.

B. Determination of Karma, Pabhava: Based on the published literature pertaining to the efficacy of the plant as fungicide^[43] and effective agent in the management of psoriasis^[44] it can be inferred that the plant leaves have *Kushtaharaprabhava* (exclusive ability to treat skin ailments such as *Kitibha*) on external application.

C. Vishaktata (Toxicity): As per the acute toxicity profile of the plant it can be inferred that, the ingestion of plant leaves/ berries causes mydriasis, *Hrudrava* (tachycardia), *Asyashosha* (xerostoma), *Shvasa* (dyspnea), *Adhmana/Vibandha* (ileus), *Mutraghata* (urinary retention), *Arati* (CNS stimulation) followed by *Avasada* (depression), *Pakshaghata* (paralysis) and *Apatanaka* (seizures) which happens due the atropine-like toxin in the plant berries. On the contrary, if solanine predominates, mild to severe gastrointestinal signs such as *Atopa* (increased borborygmi) may result^[45] Further, as per the earlier studies it is known to be toxic to animals on chronic ingestion, it is observed that, on long term ingestion the *Cestrum diurnum* L. leaves cause poisonous symptoms due to "*Asthikshaya*" and lead to *Panguta* (lameness), *Kshaya* (weight loss, debility) in animals.^[46] Keeping view of the same it can be deduced that, on oral ingestion *Cestrum diurnum* L. leaves for a long period cause severe *Vataprakopa* and lead to *Asthikshaya* (bone resorption) leading to the development of "*Pangu* (lameness)", *Balakshaya* (weight loss, debility).

The symptoms/signs enlisted here are in conformity with the excess consumption of *Tikta*-bitter taste (the taste of the plant leaves) as narrated in Ayurveda viz., *Gatra*, *Manyastambha* (stiffness or a rigidity of the body and the neck), *Akshepa* (convulsion and a palpitation), *Ardita* (facial paralysis), *Shirahshula* (headache), *Bhrama* (dizziness), *Toda* (pain as if a needle is pricking) or *Bheda/Cheda* (the region is being split) and *Asyavairasya* (insipidity in the mouth).^[47]

CONCLUSION

To conclude, it can be stated that *Cestrum diurnum* L christened as *dinamallika*, has already found a place into Ayurvedic clinical practice with its usage being employing leaf extracts in the management of *Kitibhakushta* (psoriasis) and related conditions (psoriasis).^[48] However, the review presented here has the limitations in terms of lack of more number of clinical trials to facilitate meta-analysis. Therefore, need arises for the learned Ayurvedic physicians, scientists, others working in this field to take note of the same and to take up further studies based on the leads presented here.

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