

The Botany, phytochemistry, pharmacological and therapeutic applications of *Diplocyclos palmatus* (L.) C. Jeffrey: A review

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Abstract:

Exploration of the phytochemical constituents and screening of pharmacological activities of the plants provide us the basis for developing the leads for development of novel agents. Diplocyclos palmatus (L.) C. Jeffrey (shivalingi) commonly known as lollipop climber is a lesser heard perennial climber widely distributed throughout the world. In traditional systems of medicine, all plant parts had medicinal importance and widely used by traditional healers to treat inflammation, jaundice cytotoxic, analgesic, jaundice and fever conditions. In Ayurvedic system of medicine this species was well known for treating reproductive disorders, male and female infertility, increasing spermatogenesis and prevent miscarriage and conception. The present communication reveals that wide ranges of phytochemical constituents have been isolated from the plant viz. goniothalamine, bryonin, punicic acid, lipids and phenolics markers viz. chlorogenic acid, gallic acid, caffeic acid and protocatechuic acid. Hence, the present attempt was undertaken to briefly

review the botany, pharmacology, phytochemistry and therapeutic application of the plant. This is an attempt to compile and document information on different aspects of Diplocyclos palmatus and highlight the need for research and development.

Keywords: *Diplocyclos palmatus (L.) C. Jeffrey, Pharmacological, phytochemicals, ethnomedicinal, traditional*

Introduction:

Medicinal plants, since times immemorial, have been widely used by the traditional medicinal practitioners for curing various diseases in their primary health care needs and a number of modern drugs have been isolated from natural sources. These isolations were based on the uses of these agents in traditional medicines (1). In ancient texts such as the Vedas and the Bible, the widespread use of herbal remedies and healthcare preparations from commonly used medicinal plants has been traced because of them having natural products with medicinal properties (2). Large proportions of world's population depend on traditional medicine

because of scarcity, high cost of allopathic medicines medicine and various side effects (3) as compared to herbal medicine as these are safer, less damaging to the human body, cheaper and more effective than synthetic drugs. Around the world, laboratories are engaged in screening of plants for biological activities with therapeutics potential. In most of the developing countries like India, wide traditional use of medicinal plants forms a basis for the maintenance of good health (4). Due to this, there is an ever increasing dependance of industries and traditional healers on the extraction of medicinal plants for the development of several drugs and chemotherapeutics remedies (5). As per World Health Organization, 80% of the world's population use herbal medicine for their day to day practice (6). Today there is great need to understand the knowledge regarding new food sources and exploitation of large number of lesser known plant resources present in nature (7).

Diplocyclos belonging to family Cucurbitaceae, tribe Benincaseae is a small genus comprising of four species. Of four species, three namely *Diplocyclos leiocarpus* (Hook. f.) C. Jeffrey, *Diplocyclos schliebenii* (Harms) C. Jeffrey and *Diplocyclos tenuis* C. Jeffrey are confined to tropical Africa whereas

last one i.e. *Diplocyclos palmatus* (L.) C. Jeffrey extends from tropical Africa to Malaysia (www.tropicos.org). In India the genus *Diplocyclos* is only represented by *D. palmatus* which is growing wild on bushes, trees and hedges (8). *D. palmatus* syn *Bryonia lacinosa* locally known as “Shivalingi” is a lesser heard, perennial climber having bright red fruit. It is widely distributed throughout India on village hedges, edges and bushes up to 1200m elevation and is naturally propagated by seeds. (9). The plant is reported to be highly medicinal (10) and included in Vrishya rasayana category in Ayurvedic texts (11). However with the passage of time, importance of this plant declined due to availability of various other potential natural dietary sources/ medicinal herb and due to extinction/ concentration of tribals and their associated knowledge (12)

D. palmatus a known ayurvedic drug is described in *Rajanighantu* and *Nighantu ratnakara* with its fruit being used as an aphrodisiac, tonic and antipyretic in Ayurveda whereas whole plant is used as a laxative in Siddha system of medicine (9). Warriar *et al.* (13) reported the plant has a foetid smell (*durgandha*), is acrid (*katu rasa*), thermogenic (*Ushna*), anti-inflammatory (*vrana ropana*), alterative, depurative and tonic & rejuvenative (*rasayani*) properties, and is useful in vitiated

conditions of *vata* & *pitta doshas*, cough, flatulence, skin diseases, inflammations and general debility and also useful in *sidhma kushta* (psoriasis). The fruit is bitter, aperients and is considered to have tonic properties (14).

This article briefly reviews the botany, photochemistry, pharmacology, biochemistry,

traditional knowledge and therapeutic application of the plant. This is an attempt to compile and document information on different aspects of *Diplocyclos palmatus* and highlight the need for research and development.

Table 1. Vernacular names of *D. palmatus*

Region/Language	Vernacular names
Hindi	Shivalingi, Put logult, Bankakra
Kannada	Lingatondikai, Linga, Konde balli, Mahaalingana balli
Malayalam	Shivalingakkaya, Nehoemeka, Neyyunni, Sivavalli, Neyyunni
Tamil	Aiviralkkovai, Shivalingakkay, Iyveli
Telugu	Lingadonda
Gujarathi & Marathi	Shivalingi

A. Botanical aspects



Fig. 1: a) Leaf and flower; b) Fruits; c) Vine with fruits and leaves.

1. Stem: It is a perennial climber with hairless stem, becoming thickened and white dotted on the ridges when older having much branched tendrils (bifid) and thick permanent tuberous rootstock producing annual stems (15).

2. Leaves (Fig. 1a, c): The palmately 3-7 lobed (lobes shallow to deep) leaves are simple, alternate with green, scabrid and glabrate upper surface and paler, smooth and hispid lower surface. Broadly ovate blades (3.5-14 x 4- 14.5 cm) bear 3-8 glands near attachment of petiole and major vein branchings, margins denticulate, apex obtuse, mucronate, petioles 1-3 cm long (9, 15).

3. Flowers (Fig. 1a): Flowers are small, white or yellowish in color, pedicellate (15-50 mm long) and unisexual. Female flowers solitary and staminate flowers in axillary clusters of 3-6, with male flowers larger than female. Calyx lobes subulate, recurved, 2-5 mm long, corolla lobes white, ovate, 15-20 mm long; pistillate flowers solitary on stalks 10-30 mm long, hypanthium 10-15 mm long. Sepal cup is 3-4 mm long in male, 1.5-2.5 mm long in female, sepals smaller than tube (9, 15). It generally flowers between the months of August and September and fruits in September and October in central India (15)

4. Fruits (Fig. 1b-c): Fruit is solitary or in clusters of 2-5, smooth berry, ovoid to ellipsoid

(25-60×15-35 mm) in diameter, glabrous, on stalks 10-40 mm long. When ripe, it is brick-red with longitudinal white stripes, and reminds one of lollipop, hence the common name lollipop cucumber (9, 15). Unripened fruits are used as vegetable whereas ripened fruits are sweet in taste and a good source of protein, sugar and starch

5. Seeds: Seeds yellowish brown, similar to baccate, sub sessile, globose, smooth, bluish green, streaked with broad vertical lines and resemble with that of *Shivlinga* [Phallus of Lord Shiva in Hindu mythology] (9, 11).

B. Phytochemical constituents

The main active constituents of *D. palmatus* are Bryonin, a bitter principle (16) punicic acid, source of seed oil (17) non ionic glucomannon 3 and goniothalamine (18). A bioactive molecule called Goniothalamine, isolated from it was highly effective against the larvae of the mosquito *Culex quinquefasciatus* (19). Fatimah *et al.* (20) reported cytotoxic activity of (S) goniothalamine and analogues isolated from *Bryonopsis* against eight human cancer cells. Phytochemical studies on *D. palmatus* shows the presence of alkaloids, flavonoids, triterpenoids saponins, steroids and proteins, resins with, sugars, starch. Seeds are reported to contain 12% oil; protein also

contains goniotalamin, bryonin, punicicacid and lipids. (15).

Kumar and Rao (21) extracted phytochemicals using various solvents. Alkaloids were identified in chloroform, methanol, and aqueous extracts; flavonoids were found in chloroform, methanol, and aqueous extracts; qualitative test for tannins was positive in pet ether, chloroform ethyl acetate and methanol; positive results were obtained for the presence of saponins in methanol and aqueous extracts; cardiac glycosides were detected by modified Borntrager's test in pet ether, ethyl acetate, chloroform, methanol, and aqueous extracts; di and triterpenoids were noticed in chloroform and methanol extracts; phenols were found in only methanol extracts; steroids were present in chloroform, methanol, and aqueous extracts; proteins were identified in only methanol extracts.

Misra *et al.* (12) investigated aerial parts of *D. palmatus* and reported high content of phenolic acid(s) in the plant extract that were characterized by the presence of therapeutically valuable phenolics markers *viz.* chlorogenic acid, gallic acid, caeffic acid and protocatechic acid; confirmed by high phenolic content and antioxidant activity. These workers, however, revealed highest concentration of gallic acid

followed by caffeic acid and proto catechuic acid.

C. Pharmacological activity

1. Gynaecological activity

Abraham (22) reported fruits of *D. palmatus* having important use in the area of reproductive medicine i.e. female infertility, aphrodisiac, tonic, leucorrhoea etc. Shivlingi seeds, Sonth, Kalimirch, Putrajivi and root bark of Vat is made in powder and 2-5 gms of it is taken with water or milk at night once daily for 21 days, after completion or beginning of menstrual cycle (23-24).

2. Antiasthmatic activity

To determine the antiasthmatic activity of *Diplocyclos palmatus* 70% alcoholic extract was used by mesenteric mast cell count by Atopic allergy method in rats. Ten randomly selected fields for each tissue were used to count the number of intact and disrupted mast cells. Three slides per each animal were studied (25).

3. Analgesic Activity

70% alcoholic extract of dried aerial parts of *Diplocyclos palmatus* were used to carry out analgesic activity in mice using Eddy's hot plate analgesio meter. After administration of test and standard drug, the test for analgesia was carried out by placing the mice on electrically heated plate at 55degreeC +/- 0.5 degree C followed by noting the signs of discomfort (licking of fore

paws or jump out of the plate) and noting time in seconds. Similar test were carried out for animals of control group and the observations were made at 30' and 60'. Compared with standard drug, *Diplocyclos palmatus* showed good analgesic activity at 30 and 60 minutes (25).

4. Anticonvulsant Activity

A rectangular pulse current of high voltage (150 mA) was employed for inducing convulsion by electro shock and given to each rat for 0.2 seconds with the help of convulsion meter through pinna electrodes. In animals protection against electrically induced convulsion is conferred by drugs likely to be effective in Grandmal epilepsy. Group I received 40mg/kg body weight of carbamazepine and Group II received 0.2ml of 1% Tween 80 solution and served as standard and control respectively. Similarly Group III received 500mg/kg body weight of 70% alcoholic extract of *Diplocyclos palmatus*. The electro shock was given to each rat for 0.2 seconds with the help of convulsion meter through pinna electrode and the effects were observed (25)

5. Antimicrobial activity

Diffusion method was used to obtain ethanol extracts of different parts of *D. palmatus* and the fine responses of the organisms were compared with standard antibiotics. Organisms did not

show any susceptibilities to fruit and seed extracts. While, *P. aeruginosa* for 10 mg/ml. *E. coli* and *S. typhimurium* were resistant to all extracts of shivalingi whereas *S. aureus*, *M. luteus*, *B. cereus* and *P. aeruginosa* were susceptible to leaf and stem extract at all concentrations. It was also reported that antibacterial activity increases with increase in concentration of extract as evident by the zone of inhibition (26-28).

6. Antivenom and Antidote activity

50g of leaves ground to paste and 1-2 spoonfuls of paste with betel leaves administered immediately after bite are given thrice a day until the patient gets relief followed by avoiding sleep and head bath till relief from bite (29).

7. Anti-inflammatory Activity

Dried powdered plant material was extracted with chloroform in a Soxhlet extraction apparatus and under reduced pressure the solvent was removed followed by measuring the semisolid mass (yield 14.25%). Steroids, triterpenoids and lipids showed positive test for the extract. For carrying these studies, extract at different doses (50, 100 and 200 mg/kg) was suspended in aqueous Tween 80 solution (2%) and indomethacin (10 mg/kg) in saline (29). Gupta *et al.* (29) later evaluated experimental animal models for anti-inflammatory effect of the leaves of *Bryonopsis laciniosa*.

8. Anti-diabetic activity

Seeds of *D. palmatus* have antidiabetic potential. A dose of 150 mg/Kg results in 53.8% decrease in fasting blood glucose level (30).

D. Ethnomedicinal uses

Medicinally it is useful for skin diseases, inflammations and general debility (31-33). Shivalingi has a number of useful medicinal properties and usages. It is considered bitter, aperient and tonic and it is commonly used for relieving bilious attack. The leaves of the plant are applied topically for getting relief from inflammations. The Indian women sometimes take the seeds in combination with other plant drugs for helping conception and prevent miscarriage. The practitioners of Ayurvedic medicine use the plant's fruit as an aphrodisiac and tonic, while in Siddha; the entire plant is used for getting relief from constipation. Seeds are use in sterility due to blocked tubes in women Snake bite Root Fever Stomach ache External abscess Fruits are used for Diarrhoea (34).

E. Indian Folklore/Traditional use

D. palmatus, a lesser heard medicinal plant of Ayurveda has considerable reputation as a potent adjunct and different parts of viz. leaves; stem, flower, seeds and even whole plant have been used in traditional system of medicine and is widely used by traditional

healers for antimicrobial, larvicidal, anti-inflammatory, cytotoxic, analgesic, jaundice, fever and antipyretic activities (15, 29, 35-38).

The leaves of the plant are used as an ingredient in special dietary preparation by tribals of Chhattisgarh region, as a tonic and as antidote in snake bite (9). Pankaj Oudhia *et al.* (39) has reported tribal people of Chhattisgarh using leaves of this plant as an ingredient along with Bengal gram flour in a special dietary preparation as a tonic. Some workers (40, 41) carried out *in vitro* studies in *D. palmatus* and revealed that its aerial parts contain anti-oxidant and anti-microbial activity. Leaves and seeds of this plant have immense folklore usage; extract having anti-inflammatory, analgesic, and antiarthritic activity (42-44). Besides, Patil *et al.* (45) has reported its seeds having abortifacient properties are used by combining them with equal amount of root extract/powder of ashwagandha and consumed with sugar or milk. Root decoction is used for treatment of asthma (44) and bronchitis by the Akole tribes of Maharashtra (46). Extract of root and fruit is applied externally to treat various skin infections (30).

In Ayurvedic system of medicine, *D. palmatus* is reported as a constituent of ayurvedic formulation 'Strirativallabhugpak' described in ancient text that improves sexual

behavior, treats reproductive disorders and used as a general tonic (22, 47). Later, Pankaj Oudhia *et al.*, (39) reported that local traditional healers of Gulgul village of Chhattisgarh recommend women to use 3-4 seeds daily on empty stomach for a period of 1-2 months to beget a male child. Similarly various workers (11, 40, 48-49) have also reported Shivalingi seeds being aphrodisiac and used for increasing spermatogenesis (sperm count), helping conception and preventing miscarriage. Traditional healers of Gaildubba also use mixture of Shivalingi seeds with leaves of tulsi and Jaggery to treat infertility in women (50). While, Shukla *et al.* (51) reported shivalingi seeds to be potentially contraceptive and used in combination with dried ginger, pepper, root bark of *Ficus benghalensis* (Putrajivi) with milk; Chauhan and Dixit's (11) studies validate the effects of Shivalingi as a reproductive tonic thereby supporting the traditional uses of its seeds as a vajkaran rasayan. Kamble *et al.* (52) also reported the use of seed powder in gynecological problems by the Bhilla tribe of Maharashtra. Besides, Corley *et al.* (53) reported these drugs to produce serious harmful side effects viz. gastrointestinal bleeding and peptic ulcers.

Conclusion:

Diplocyclos palmatus is found world-wide and reported to have multiple phytochemical

components and pharmacological activities because of which this plant has variety of ethnomedicinal uses. Present article briefly reviews the botany, photochemistry, traditional knowledge, pharmacological and therapeutic application of the *D. palmatus*. Therefore, further advanced studies on isolation of efficacious therapeutic agents from this highly important plant especially fruits will prove beneficial and expose its vast medicinal potential.

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