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## Establishing the correct botanical identity of Śivaliṅgī plant in India: A critical analysis based on various literatures

**Acharya Balkrishna, Amita Singh, Rama Shankar, Rajesh Kumar Mishra, Anupam Srivastava, Bhasker Joshi and Abhilasha Chauhan**

#### Abstract

The name Śivaliṅgī is used in Āyurveda against the two plants, named as *Cayaponia laciniosa* (L.) C. Jeffrey and *Diplocyclos palmatus* (L.) C. Jeffrey of family Cucurbitaceae. In appearance both the plants are having identical morphological characters with minor difference in the shape and size of leaf and seed characters, whereas according to Renner & Pandey, 2013, *Cayaponia laciniosa* (L.) C. Jeffrey is a local Jamaican endemic plant which is not found in India, but *Diplocyclos palmatus* (L.) C. Jeffrey is distributed all over India, Bhutan, China, Nepal, Pakistan, Thailand, South Japan, Sri Lanka, Philippines, Indonesia, Peninsular Malaysia, Papua New Guinea, NE Australia. So the study of Śivaliṅgī is focused on a comprehensive analysis of ancient Ayurvedic literatures, Research papers and authentic websites of plants. As per the morphology of seed, the plant *Diplocyclos palmatus* (L.) C. Jeffrey is more suitable and near to the Ayurvedic plant Śivaliṅgī however, as per various studies made on various aspects of medicinal uses of *Cayaponia laciniosa* (L.) C. Jeffrey has also been described in the name of Śivaliṅgī. Accordingly, the present review study based on literatures available, on traditional use, distribution, taxonomic identification, phytochemical studies, pharmacological actions and clinical trials, has been carried out and supports the name Śivaliṅgī for *Diplocyclos palmatus* (L.) C. Jeffrey as a drug for female infertility and other uses.

**Keywords:** Bryonin, *Cayaponia laciniosa*, *Diplocyclos palmatus*, Endemic, Infertility, Śivaliṅgī

#### Introduction

India is one of the richest sources of biodiversity in the world which is used as a live resource of the medicinal plants. Due to the availability of large number of traditional systems of healing since Vedic period the knowledge of utilizing these natural resources are increasing regularly. From time immemorial, human beings were depending upon the forests for food, shelter, clothing, ornamentation, religious beliefs and most importantly for health care. Different tribal communities have their own endemic system of treatment of ailments who are mostly residing in the forest areas and hilly terrains and they rely on these wild medicinal resources because, firstly lack of modern medical facilities, the effectiveness of their method of treatment without any side effects and their diverse knowledge of traditional method of treatment by the use of indigenous plants and also for basic healthcare for safety measures [1]. India has the huge reservoir of herbs used in various kind of treatment and formulations which are commonly used in Āyurveda, Unani, Siddha, Sowa Rigpa and Homoeopathy. In India, around 25,000 effective plant-based formulations are practised in traditional and folk medicine used by over 1.5 million healing practitioners in India. Over 7800 manufacturing units are involved in the production of natural health care formulations and traditional plant-based formulations in India which have the annual demand of over 2000 tons of medicinal plant raw material every year [2].

Amongst these herbs *Diplocyclos palmatus* (L.) C. Jeffrey belonging to family Cucurbitaceae is distributed all over India, Africa, Indo-China and some parts of Australia. Its seeds are used for the treatment of female infertility in Ayurveda as Śivaliṅgī. It is a uterine tonic and improves the chances of conception in women suffering from infertility [3-5, 68]. In Ayurvedic System of medicines Śivaliṅgī is used along with Putrajīvaka Bija (*Putranjiva roxburghii* Wall.). Due to pollution, modern lifestyle and mental pressure on human beings the infertility problems are being prevalently increasing day by day in the entire world. Infertility records

vary from one region to the other in the world and it has been estimated to affect 8-12% couples worldwide. As per WHO records the cases of occurrence of primary infertility in India is between 3.9 and 16.8%. In the modern time people on its own turning to the traditional medicines, which are in use for over the centuries as a remedy for different ailments and Āyurveda comprises largest faith in this field [1].

In Ayurvedic and related literatures of India the plant of Śivaliṅgī has been identified as *Diplocyclos palmatus* (L.) C. Jeffrey as well as *Cayaponia laciniosa* (L.) C. Jeffrey. *Diplocyclos palmatus* (L.) C. Jeffrey is the only species distributed all over India and is the actual Śivaliṅgī of Ayurveda. In India *Cayaponia laciniosa* (L.) C. Jeffrey has also been described in the various research papers, Ayurvedic and pharmacological literatures as Śivaliṅgī. This problem came into existence due to wrong identification of the *Diplocyclos palmatus* (L.) C. Jeffrey by Linnaeus himself as *Cayaponia laciniosa* (L.) C. Jeffrey. Linnaeus erroneously equated syntypes of this plant with literature of a different genus and species from Asia [106]. *Cayaponia laciniosa* (L.) C. Jeffrey seems to be the correct name for the widespread West Indian, Central and South American plant hitherto known as *C. racemosa* (Mill.) Cogn. The Linnean epithet has long been erroneously applied to a widespread plant of the Old World tropics (India and neighbouring countries) in the combination *Bryonopsis laciniosa* (L.) Naud., for which species the correct name appears to be *Diplocyclos palmatus*. This erroneous use has resulted from Linnaeus' wrong identification of this old-world species, which he knew at the time only from descriptions by Hermann, Boerhaave and Tournefort, with the plant he saw in cultivation at Hartekamp [107].

Occurrence of these two plants from the same family has developed immense scope for comparative studies on various aspects i.e. morphotaxonomy, phytochemical and pharmacological action studies as well as clinical trials to establish the two plants as the source medicine on similar action used in the name of Śivaliṅgī. Accordingly, the required studies were made at various experimental level and the present communication deals with the review of all the studies conducted in past from time to time.

## Methodology

The present study is focused on a qualitative and quantitative screening of various literatures like The Ayurvedic Formulary and Pharmacopoeia of India (API & API), Materia Medica, Medicinal plants used in Āyurveda, Auśadhanāmarūpavijnānam and peer reviewed Research papers from Google Scholar, Pub Med and other authentic websites by using keywords like Śivaliṅgī, *Diplocyclos palmatus* (L.) C. Jeffrey, *Cayaponia laciniosa* (L.) C. Jeffrey, *Bryonia laciniosa* L., pharmacology, infertility, medicinal uses etc. Papers considered for evaluation till January 2021. The present paper deals with a comparative study of two medicinal plants *Cayaponia laciniosa* (L.) C. Jeffrey and *Diplocyclos palmatus* (L.) C. Jeffrey, which are called as Śivaliṅgī in different areas of India according to various literatures are as following:

## Morphology of plants

### 1. *Cayaponia laciniosa* (L.) C. Jeffrey

**Family** - Cucurbitaceae

**Genus etymology** - Name based on the block of Ge-speaking people of highlands of eastern Brazil, the Northwestern Ge, Northern Cayapo, Southern Cayapo and Suya [16].

**Species etymology** - Derived from Latin word *laciniosa*

means 'jagged, fringed, and slashed, with many flaps' [7, 8].

**Common English Names**- Bryony [5, 9], Palmate diplocyclos [10], Indian bryony [3, 11], Lollipop climber [12, 13], Lollipop plant [14]. **Hindi**- Bahuputara [15], Bajguriya [16-18], Ghargu-naru [16], Bilanja [3, 15], Bguriya, Lingikaa, Linginee [3], Gargullaru [9], Gargumaru [3, 19-21], Gargu-naru [3, 15, 22], Ishwaralingi [23], Isvaralingi [10], Śivaliṅgī [18, 23-28], Sivalingi [3, 10, 18], Shivaling [29], Śivaliṅgī [13, 14, 18, 30]. **Bengali** - Mala [3, 9, 18, 19, 22, 31], Shivalingani [18, 23], Mahakaal [32]. **Chhattisgarhi**-Huringhaupudki [23]. **Gujrati** - Śivaliṅgī [23]. **Malayalam** - Nehoemeka [16], Neohmaka [3, 19, 23]. **Marathi** - Kavdoli [3], Kavadori, Kavale-che-dole [16], Kawala [3, 19, 23], Kawalechedole [22], Kaumdali [3, 15, 18, 23], Śivaliṅgī, Vaduballi [3, 15, 18], Śivaliṅgī [21]. **Sanskrit** - Liṅganī [32], Bahupatrā [32, 33], Śaivamallikā [32, 33], Liṅgasambhūtā [32, 33], Devī [32, 33], Caṇḍā [32, 33], Śivalī [33], Citraphalā [18, 33], Svayambhūh [32], Liṅgī [32], Paṇḍolī [33], Liṅgajā [32, 33], Āpastambhinī [32, 33], Śivajā [32, 33], Śivamallikā [32], Vakapuspā [32], Tutthinī [32]. **Kannada**-Lingatondi (Kannada) [16].

## Botanical Description

*Cayaponia laciniosa* (L.) Jeffrey in Kew Bull. 15:346. 1962. *Bryonia laciniosa* L., Sp. Pl.:1013. 1753: C.B. Clarke in Hook. f., Fl. Brit. India 2:622. 1879. *Bryonopsis laciniosa* (L.) Naudin in Ann. Sci. Nat., Bot. ser.12, 4: 141. 1859; Duthie, Fl. Gangetic Plain 1: 381. 1903; Chakrav., Fasc. Fl. Ind. 11: 16. 1982; Singh *et al.*, Fl. Uttar Pradesh 1:985. 2016.

Herbs, stem branched, slender, grooved, glabrous; tendrils 2-fid. Leaves palmately 5 lobed, 8-12 cm long; lobes orbicular-ovate; denticulate, undulate, subcrenulate margins, upper surface scabrous, lower smooth; petioles 3-6 cm long. Flowers monoecious, 1-1.5 cm across, fasciculate cyme, greenish yellow. Male flowers; calyx tube 2-4 mm long, 3-6 mm across; lobes spreading, 1.5 mm long. Petals shortly papillose, 4-10 mm broad; lobes ovate, apex acute. Stamens 3, free, inserted in the calyx tube; filaments short, 1-1.5 mm long; anthers ovate, 2 mm long, one unilocular and other bilocular. Female flowers; staminodes 3, short; ovary globose, 1.5-2 mm diameter, yellowish green; style slender; stigmas 3, papillose. Fruits spherical 1.5-2 cm diameter yellowish green, 6-striped; seeds attenuate, scrobiculate, 4 mm diameter, grey or yellowish brown.

*Fl. & Fr. Cayaponia laciniosa*: August- December

## Distribution

*Cayaponia laciniosa* is the native plant of Jamaica, North America.

## 2. *Diplocyclos palmatus* (L.) C. Jeffrey

**Family** - Cucurbitaceae

**Genus etymology** - Derived from Greek words *diploos* means 'double' and *kyklos* means 'a circle, ring'; alluding to the tendrils [6, 33].

**Species etymology** - Derived from Latin word *palmatus* means 'with five or more veins arising from one point (usually on divided leaves), hand-shaped, palmate' [7].

**Common English Names** - Lollipopclimber [35-37], Marblevine [35, 36], Nativebryony [35, 37, 38], Red-stripedcucumber [35, 38], Striped cucumber [37]. **Hindi**-Bankakra [35, 36], Bonkakra, Isvaralingi [35], Putloguli [36]. **Gujrati** - Śivaliṅgī [36]. **Tamil** - Aivirali [35, 38], Aiviralkkovai [35, 36], Iyveli [35, 36], Iyviralī [35], Sivalingakkay [35, 36], Shivalingakkay [35]. **Kannada** - Angathondeballi [35], Limgatomdeballi [35, 38], Lingakonde Balli [35, 36], Lingatondeballi [35], Mahaalinganaballi [35, 36],

Maaninganaballi [35], Panchaguriya [35], Śivaliṅgī [35]. **Konkani** – Karta [36]. **Malayalam** – Aiviralikkova [35, 36], Iyiviralikkova [38], Kakkakothi [35], Naiunnikkai, Namakai [38], Nehoemeka [35, 36], Neysatti [35], Neyyuni [35, 36, 38], Neyyuruni [35], Pambukodi [38], Sivalingakkaya [35, 38], Sivavalli [35, 38]. **Marathi** – Kavdoli [35, 36], Mahadevi [35, 38], Shivlinge [35, 36]. **Sanskrit** – Apashtambhini [36], Chitrphala [36, 39], Lingaja [36], Linguini [36], Shivavalli [36], Putrada [36], **Telugu**- Lingadonda [35, 36, 38]. **Garhaawal**- Put-loguli [39].

### Botanical Description

*Diplocyclos palmatus* (L.) Jeffrey in Kew Bull. 15: 354. 1962; Babu, Herb. Fl. Dehradun. 97. 1977; Swami & Gupta, Fl. Udampur 160. 1998. *Bryonia palmata* L., Sp. Pl. 1012. 1753. *Bryonopsis laciniosa* auct. non (L.) Naudin, 1959;

Chakravarty in Rec. Bot. Surv. India 17: 138. 1959 (as var. *walker* (Chakrav.) Babu).

Herb, perennial, climber. Stem several metres long, glabrous. Leaves scabrous; lamina 5-13 × 6.5-14 cm, cordate at base; lobes 3-5, lateral lobes usually shallowly 2-lobed, narrowly lanceolate-elliptic, subserrate, acute to subacuminate. Male flowers 2-8, fascicles mixed with 0-4 female flowers; calyx lobes subulate, 0.5-1 mm long; corolla lobes ovate, 5-10 mm long, white to greenish yellow. Female flowers with pedicels 1-5 mm long; staminodes 1 mm long; ovary 3-4 mm long. Fruit 2-2.5 cm long, solitary or clustered, red, ellipsoidal, 7 longitudinal white stripes. Seed 5 mm long, ellipsoidal, beaked (Plate 1 & 2)

*Fl & Fr. Diplocyclos palmatus*: September- December



Plate 1: Flower and Fruits of *Diplocyclos palmatus* (L.) Jeffrey



Plate 2: Herbarium and Seed of *Diplocyclos palmatus* (L.) Jeffrey

### Distribution

*Diplocyclos palmatus* (L.) C. Jeffrey is distributed all over India, Bhutan, China, Nepal, Pakistan, Thailand, South Japan, Sri Lanka, Philippines, Indonesia, Peninsular Malaysia, Papua New Guinea, NE Australia.

### Chemical composition

*Cayaponia laciniosa* (L.) C. Jeffrey: Whole plant contain Bryonin [3, 11, 17, 19, 40, 43], Goniotalamin [3, 43-46], Punicic acid [43, 45, 46], lipids [45, 47], Glucomannan; Arabinoglucomannan; Goniotalamin [43, 47-49] and Terpenoids, Triterpenoids, Anthroquinone, Polyphenols, Glycosides, Anthocyanins, Tannins, Coumarins, Emodins, Saponins, total Alkaloids, total Flavonoids, Lignin and Serpentine [50, 51]. **Leaves:**

contain Steroids and Polyphenolic compounds. Vitamins and minerals include boron, calcium, chloride, carbon, copper, magnesium, manganese, molybdenum potassium, phosphorous, sodium, sulphur, sulphate, selenium, sodium, zinc [51, 52].

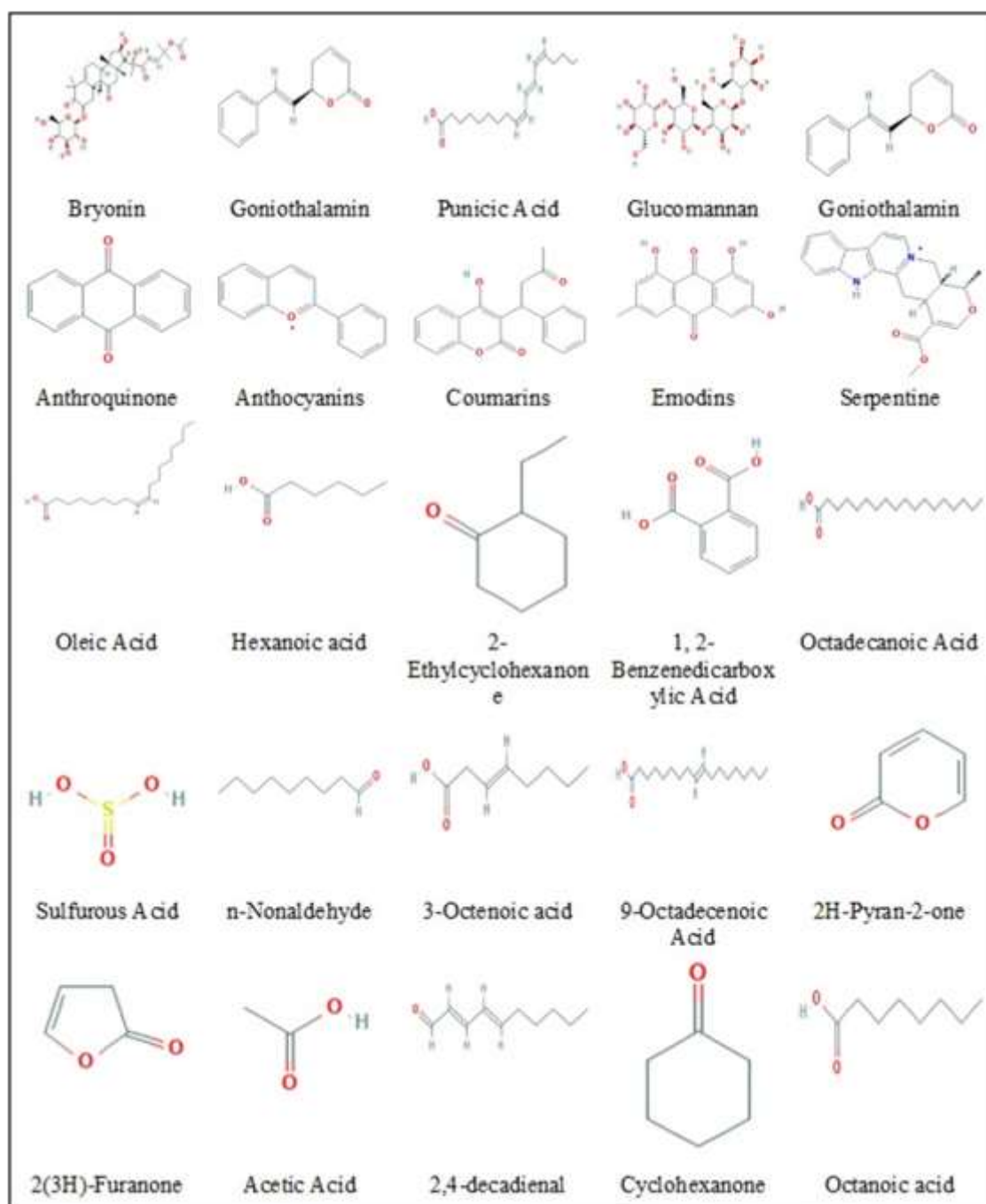
**Fruits:** contain reducing sugars, Terpenoids, Triterpenoids, Aminoacids, Anthroquinone, Polyphenols, Glycosides, Anthocyanins, Tannins, Coumarins, Emodins, Saponins, total Alkaloids, total Flavonoids, Lignin and Serpentine [53]. Phytochemicals especially Flavonoids and Polyphenols [54]. Oleic Acid; Hexanoic acid; 2-Ethylcyclohexanone; 2-Methyltetracosane; 2-Undecenal; 1, 2-Benzenedicarboxylic acid; Ascorbic acid 2,6-dihexadecanoate; Octadecanoic acid; (2E)-2-Decenal; Sulphurous acid; n-Nonaldehyde; 2-Hepten-3-



ol; Decadienal, 3-Octenoic acid; 1-[2-(acetyloxy)ethyl]-3-oxooctyl acetate acetic acid 3-acetoxy-5-oxo-decyl ester; 9-Octadecenoic acid; 2H-Pyran-2-one, Z,Z-4,15-Octadecadien-1-ol acetate; Z,Z-4,15-Octadecadien-1-ol acetate (4Z,15Z)-4,15-Octadecadienyl acetate; 2(3H)-Furanone, dihydro-5-tetradecyl- gamma; Z,Z-4,15-Octadecadien-1-ol acetate (4Z,15Z)-4,15-Octadecadienyl acetate; Octadecanoic acid, Stearic acid; 2H-Pyran-2-one, tetrahydro-6-tridecyl-Octadecanoic acid; Oleic Acid 9-Octadecenoic acid (Z) DELTA; 2(3H)-Furanone, 5-dodecyl-dihydro-Hexadecanoic acid; 1-(+)-Ascorbic acid 2,6-dihexadecanoate; Diethyl Phthalate 1,2-Benzenedicarboxylic acid, diethyl ester; Acetic acid, 3-methylhept-3-yl ester; 9-octadecenoic acid (z)-octadec-9-enoic acid (9e)-9-octadecenoic acid; Dimethyl phthalate 1,2-Benzenedicarboxylic acid; 1-[2-(acetyloxy)ethyl]-3-oxooctyl acetate acetic acid 3-acetoxy-5-

oxo-decyl ester; Butyl 3-hydroxy-2-methylene-butanoate Isobutylester; 3-Octenoic acid; trans-4,5-Epoxy-(E)-2-decenal; 2-Undecenal Undec-2-enal 2-Undecen-1-2-methyltetracosane; 2-undecenal, e-(2e)-2-undecenal; Decadienal; 2,4-decadienal, (e,e)- (2e,4e)-2,4-decadienal; Nonanoic acid calcium pelargonate; 2-decenal, (e)- (2e)-2-decenal; Cyclohexanone, 2-ethyl- 2-Ethylcyclohexanone; 2-Octenoic acid Oct-2-enoic acid; Octanoic acid; Nonanal; 2-Hepten-3-ol, 4,5-dimethyl; Sulfurous acid, hexyl heptyl ester; Hexanoic acid Caproic acid [54]. **Seed** oil contains Punicic acid [3, 11, 25, 43, 44, 55].

**Diplocyclos palmatus (L.) C. Jeffrey:** Whole Plant contain Bryonin [56] and Fatty acid [57]. **Fruits** contain Chlorogenic acid, Gallic acid and Protocatechuic acid [58]. **Seed** oil contains Punicic acid [55]. (Plate 3 & 4)



**Plate 3:** Chemical Compounds Structures of *C. lasiniosa* and *D. palmatus* on the basis of various texts [105]

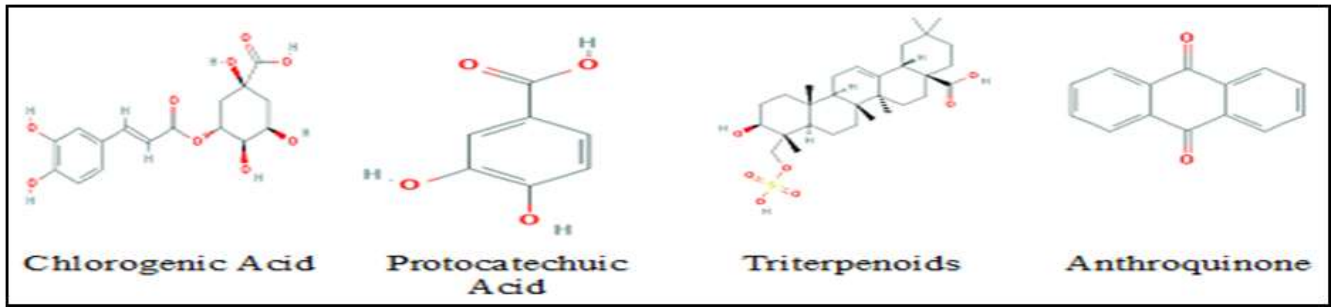


Plate 4: Chemical Compounds Structures of *C. lasiniosa* and *D. palmatus* <sup>[105]</sup>

**Pharmacological action and medicinal uses:** According to ancient ayurvedaic and various modern scripiter's both plants used to treat various disorders. (Table 1, 2 & Table 3) (Figure 1 & Figure 2)

**Table 1:** Comparative study of Pharmacological Action of *Cayaponia laciniosa* (L.) C. Jeffrey and *Diplocyclos palmatus* (L.) C. Jeffrey on the basis of various texts

Pharmacological Action	<i>Cayaponia laciniosa</i> (L.) C. Jeffrey	<i>Diplocyclos palmatus</i> (L.) C. Jeffrey
Acute toxicity study	The acute toxicity study of alcoholic extract of <i>Bryonia laciniosa</i> L. was investigated that the drug was found to be nontoxic <sup>[59]</sup> .	-
Analgesic and antiarthritic activity	The analgesic activity of methanol leaves extract of <i>Bryonia laciniosa</i> L. showed significant analgesic activity <sup>[60]</sup> .	Ethanol extract of <i>Diplocyclos palmatus</i> (L.) C. Jeffrey seeds reported analgesic, and antiarthritic activities <sup>[61]</sup> .
Androgenic activity	The ethanolic extract of seeds of <i>Bryonia laciniosa</i> L. was evaluated for androgenic activity on male Albino rats and showed inhibitory effects on hypothalamo-pituitary gonadal axis <sup>[62]</sup> .	-
Anti-asthmatic activity	70% alcoholic extract of <i>Bryonia laciniosa</i> L. increased the anti-asthmatic activity <sup>[59]</sup> .	70% alcoholic extract of <i>Diplocyclos palmatus</i> (L.) C. Jeffrey reported Antiasthmatic effects <sup>[63]</sup> .
Anti-cancer/ Anti-tumor/ Cytotoxic activity	The methanol extract of <i>Bryonia laciniosa</i> L. exhibited significant antitumor and antioxidant activity in vivo <sup>[64]</sup> .	
Anti-convulsant activity	70% alcoholic extract of <i>Bryonia laciniosa</i> L. increased the anticonvulsant activity <sup>[59]</sup> .	70% alcoholic extract of of <i>Diplocyclos palmatus</i> (L.) C. Jeffrey increased the anticonvulsant activity <sup>[63]</sup> .
Anti-diabetic activity	The methanolic leaf extract of <i>Bryonia laciniosa</i> L. was evaluated for antidiabetic activity through its hypolipidemic effect in alloxan induced diabetic rats <sup>[43]</sup> .	Antidiabetic activity recorded in <i>Diplocyclos palmatus</i> in streptozotocin induced diabetic mice <sup>[65]</sup> .
Anti-inflammatory activity	The chloroform extract of <i>Bryonia laciniosa</i> L. exhibited significant anti-inflammatory activity <sup>[66]</sup> .	Ethanol extract of <i>Diplocyclos palmatus</i> (L.) C. Jeffrey seeds Anti inflammatory activities in animal models <sup>[61]</sup> .
Anti-fertility activity	The ethanolic extract of seeds of <i>Bryonia laciniosa</i> L. was evaluated for anti-fertility activity <sup>[42]</sup> .	-
Anti-microbial activity	<i>Bryonia laciniosa</i> L. showed weak antibacterial and significant antifungal activity against a wide range of gram positive and gram negative bacteria and fungi <sup>[67]</sup> .	Ethanol extracts of leaf and stem parts of <i>Diplocyclos palmatus</i> through well diffusion method shows Antimicrobial activity <sup>[68]</sup> .
Anti-oxidant activity	The methanolic extract of <i>Bryonia laciniosa</i> L. showed antioxidant activity <sup>[54]</sup> .	Fruit extract reported <i>Diplocyclos palmatus</i> (L.) C. Jeffrey as a noval antioxidant <sup>[69]</sup> .
Anti-proliferative effects	-	Seed extracts of <i>Diplocyclos palmatus</i> (L.) C. Jeffrey exhibited remarkable inhibitory effect toward the growth of MCF-7 with IC50 61.43±0.05 mg/ml <sup>[70]</sup> .
Anti-pyretic activity	The methanol extract of the leaves of <i>Bryonia laciniosa</i> L. showed significant antipyretic activity <sup>[42]</sup> .	-
Antivenom and Antidote activity	-	Leaves paste of <i>Diplocyclos palmatus</i> with betel leaves reported Antivenom and Antidote activity <sup>[68]</sup> .
Mosquito larvicidal activity	The goniotalamin, isolated from the <i>Bryonopsis laciniosa</i> (L.) Naudin was investigated for mosquito larvicidal activity against the larvae of the mosquito, <i>Culex quinquefasciatus</i> say as a mosquitocide <sup>[49]</sup> .	-
Mosquitocidal activity	The crude extract of <i>Bryonopsis laciniosa</i> (L.) Naudin whole plant exhibited mosquitocidal activity against <i>Culex quinquefasciatus</i> <sup>[71]</sup> .	-

**Table 2:** Comparative study of Medicinal uses of *Cayaponia laciniosa* (L.) C. Jeffrey and *Diplocyclos palmatus* (L.) C. Jeffrey on the basis of various texts

Name of disorders	<i>Cayaponia laciniosa</i> (L.) C. Jeffrey	<i>Diplocyclos palmatus</i> (L.) C. Jeffrey
Abscesses	The paste of leaves is applied for the treatment of abscesses [4].	-
Adenitis	The plant is used for the treatment of adenitis [55].	<i>D. palmatus</i> is recommended in the treatment of adenitis [55, 56].
Ague	Various parts of the plant are used for ague [55, 66, 72].	Plant is used to treat ague [55, 56].
Animal bite	Whole plant is used for the treatment of snakebite from saw-scaled viper [21, 55, 72-74].	Leaf juice is used to applied on scorpion sting. Moreover, it is also used in the treatment of snake bite [55, 56, 75].
Asthma	Leaf, stem, fruit and seeds is used for the treatment of asthma [42, 66, 72].	-
Adenopathy	Leaf, stem, fruit and seeds are used as potent medication in adenopathy [66, 72].	-
Alzheimer's disease	Traditionally, leaves and roots can bind to mercury for the treatment of Alzheimer's disease [3].	-
Boils	The paste of leaves are employed in boils [9, 29, 76, 77].	-
Biliousness	Whole plant is used for the treatment of bilious attack [9, 16, 17, 19, 20, 40].	-
Burns	The tender twig extract is used for healing burns [4, 78].	-
Bronchitis	Leaf, stem, fruit and seeds are used as potent medication in bronchitis [54, 66, 72].	-
Cancer	Fruits are used for the treatment of stomach swelling or tumour [54, 55, 64].	-
Carbuncle	The plant is applied topically for the treatment of carbuncles [4, 40, 55, 72].	-
Cephalalgia	-	Plant is used to alleviate cephalalgia [55].
Conception Promotor	In Folk medicine, 45 seeds with jaggery are administered immediately after menstruation on 4 consecutive days or alternate days for 8 days to conceive [3, 4, 42]. Powered seeds from fruits are given to bring about conception in women [5, 40, 55]. for 3 days after menstrual period to increase chances for pregnancy mostly by the Bhils [14]. The ripe fruits or 6-9 seeds are given to the woman for 5 days to bring about pregnancy [4, 79].	-
Colic	The plant is used to alleviate colic pain [55, 66, 72].	-
Colitis	The plant is used for the treatment of colitis [40].	-
Convulsions	It is used for the treating convulsions in neurological disorders [4, 55, 66, 72].	-
Constipation	The plant is used to relieve constipation [16, 40, 41, 55]. It is also used as aperients [19, 20, 23, 40]. Seeds of the plant are used to alleviate sterility in women by Satpura plateau region of Central India [66, 80]. The leaves and roots extracts of the plant can bind to mercury and traditionally used to promote fertility and for menstrual disorders [3-5, 47, 72]. Hot aqueous extract of the roots and seeds has an effect on conception in barren women [42].	One seed with spoonful of animal ghee is used in conception [81]. It is used in leucorrhoea and strengthen vaginal muscles [82] and milk sterility in women [83].
Cholera	Leaf, stem, fruit and seeds are used for treating cholera [66, 72].	-
Delirium	The plant is used to treat delirium (confusional state of mind) [40, 55, 72].	-
Diabetes	The leaves or fruits are given in case of diabetes to control blood sugar [4, 54] and diabetes mellitus [43].	Seed is given to treat diabetes [27].
Drizzling	The plant is used to reduce foaming at the mouth [55].	-
Dymock	Extract of the young twigs is given along with a glass of hot goat milk at bedtime or at the morning as a dymock [31].	-
Dyspepsia	Extract of the leaves is given twice a day, 1-2 teaspoonful each time to cure dyspepsia [31].	-
Dysmenorrhoea	In homoeopathy, root tincture is employed in dysmenorrhoea [4, 11].	-
Dysentery	Plant is valued as remedy for diarrhoea and dysentery [4].	-
Earache	-	Fruit juice is poured in ear to alleviate ear ache [84].
Endometritis	The tincture of roots is used for an inflammation of uterus [11].	-
Febrifuge	Leaves and seeds are used as for the treatment of fever [54, 66, 72]. Whole plant or paste of leaves are used as febrifuge [9, 16, 19, 20, 22, 40, 76, 77, 85]. Bitter tonic from seeds is used in fever or 2gm of seed paste should be taken twice a day for consecutive 5 days [4, 24]. Its juice is given with milk, honey or sugar in commencement of fever [41], temperature [4].	-
Flatulence	Bitter tonic from seeds or plant is used against flatulence [9, 16, 19, 24, 40, 41].	-
Gastro-intestinal disarray	-	Plant is used to treat flatulence, constipation, colic pain, stomach disorder and dysentery and intestinal worms [55, 63, 81, 82, 86].
General debility	-	Plant is given in the treatment of general debility [86].
Headache	The various parts of the plant are used to ameliorate headache [40, 55, 72].	-
Hepatic disorder	-	Plant is used to treat bilious attack and jaundice [56, 82].
Inflammation	Traditionally leaves and roots are mixed with mercury and applied topically against inflammation [3, 43, 87]. In inflammations, a bitter principle bryonin is extracted and applied externally [40]. Boiled leaves are eaten or tied on affected area [19, 20, 23, 78, 85]. Whole plant or fruits are used against inflammation [46, 54].	Plant is used to alleviate inflammation [56].
Impotency	Whole plant is used for the treatment of impotency [28, 66, 72].	-
Insect bite	Leaf juice applied on inflammation after scorpion sting [10] and a chemical goniotalmin	-

	found to be highly effective against the larvae of Mosquito [3].	
Jaundice	Whole plant is used for the treatment of jaundice [45].	-
Leprosy	Juice of leaves and roots can bind to mercury and used traditionally against leprosy [3].	-
Leukorrhoea	The seeds are used to alleviate white discharge [4].	-
Male Fertility	-	Fruits are used in the treatment of impotency [88].
Miscarriage	The roots are also prescribed in threatened abortion [11]. Seeds are used to treat reproductive disorders of females and prevent miscarriage [4].	-
Mouth Sores	The plant is used for the treatment of mouth sores [40, 55].	-
Myalgia	The two handful mixture of leaves and fruit are grounded and their juice squeezed and applied on pain in legs or arms twice a day [21].	-
Ophthalmic disorder	-	Leaves are recommended to treat eye infection [89].
Oral disorder	-	Plant is used to treat foaming at mouth and paralysis of tongue [55, 56].
Overeating	It clears out the bowels and is often sufficient when the symptoms are due to overeating [16, 41].	-
Oligospermia	The seed powder is used for increasing sperm count [4].	-
Pain	The root tincture are used for ovarian pain [11].	Fruits are used to alleviate body ache [90].
Pelvic Inflammatory Disease	The tincture prepared from the roots are used for inflammation of uterus or burning pain in the fundus of the uterus [4].	-
Phthisis	The plant is used for the treatment of phthisis [40, 55, 66, 72].	-
Pharyngitis	-	Plant is used to relieve sore throat [83].
Psychological disorder	-	Plant is used in the treatment of delirium and convulse [55, 56].
Pyrexia	-	Plant is recommended to treat bilious fever, yellow fever and in fever with flatulence [27, 82].
Rheumatism	Leaf paste is applied for chronic rheumatism [10, 47].	-
Respiratory problems	Leaves are fried in coconut oil and taken in respiratory disorders like asthma [4, 47, 54].	-
Scrofulosa colli	The plant is used for the treatment of scrofulosa colli [55].	-
Skin disorder	Tender twig extract is used to ameliorate skin infections [78].	Plant is recommended to treat abscess, sores, carbuncle and various skin disorders. Leaves paste is applied topically on boils [27, 82, 86].
Splenomegaly	-	Plant is given in the treatment of enlarged spleen [55, 56].
Stomach ache	Leaf extract is administered orally in stomach ache [4, 10].	-
Splenomegaly	The plant is used for treating enlarged spleen [40, 55].	-
Swelling	The leaves are pasted over swelling [30].	-
Syphilis	Root, fruits and seeds are used for treating sexually transmitted diseases like syphilis [55, 91].	-
Tongue paralysis	The plant is used for the treating paralysis of tongue [40, 55, 72].	-
Tuberculosis	-	Plant is used to treat phthisis and scrofulous colli [55, 56].
Tumour	-	Plant is used to alleviate stomach swelling or tumour [55, 56].
Venereal disorder	Plant is used for the treatment of venereal diseases [4, 5].	Plant is recommended in the treatment of syphilis [55, 56].
Vaginal dysfunction	In homoeopathy, tincture of the root is procured before flowering, is used extensively for treating vaginal disorders [11, 4].	-
Waist Pain	Tender twigs are fried along with onion and eaten to ameliorate waist pain [13].	-
Wound	The paste of whole plant is employed in cuts and wounds by the Tribes of Koraput District [92]. Tender twig extract is used to heal cuts and wounds [78]. The paste of leaves is applied to wounds [4]. Fruits are used in sharp cutting, lancinating or tearing pain [54].	Warm poultice of fruit pulp is used to tied on wound [84].
Veterinary medicine	-	Plant is used to alleviate rheumatic swellings in cattle [93].

**Table 3:** Compretive study of plant part use, dosages and toxicity of *Cayaponia laciniosa* (L.) C. Jeffrey and *Diplocyclos palmatus* (L.) C. Jeffrey on the basis of various texts

	<i>Cayaponia laciniosa</i> (L.) C. Jeffrey	<i>Diplocyclos palmatus</i> (L.) C. Jeffrey
Plant Part use	Whole plant [3, 22, 93, 94], (panchang) [27], leaves [3, 4, 9, 10, 29, 31, 93], twigs [31, 78], seeds [3, 4, 11, 24-26], roots [3, 4], herb [9], flowers [93], Fruits [4, 93].	Leaves [27], Seed [27, 81], Fruit [88].
Dosages	45 seeds as a single dose [3, 11]. Tincture of the subterranean part (Class C) [95].	Powder-3 to 6 g [96].

form along with methods	Powdered seeds are recommended for 3-5gm <sup>[30]</sup> . Take 1 gram powder of Śivaliṅgī beej, 1 gram powder of Putrajivak giri with milk of mulching cow having a calf daily early morning before eating anything is recommended for increasing chances of conception. For promoting pregnancy, take seeds of the plant and make small pills with jaggery, or else take 2 pills twice in a day for half month or take 3 seeds or ripe fruits and chew or take ripe fruits of the plant and chew. Do this twice a day for half month <sup>[4]</sup> .	Take seeds with Saunth, Kalimirch, Putranjivi and root bark of Vat is made in powder is taken with water or milk at night once daily for 21 days, after completion or beginning of menstrual cycle <sup>[63]</sup> .
Toxicity	-----	Plant is toxic and stock poisoner <sup>[97]</sup> .

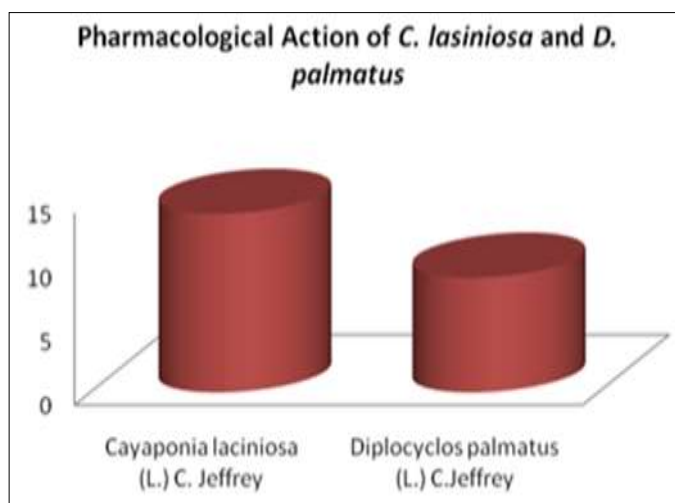


Fig 1: Pharmacological activities comparison between *C. lasiniosa* and *D. palmatus*

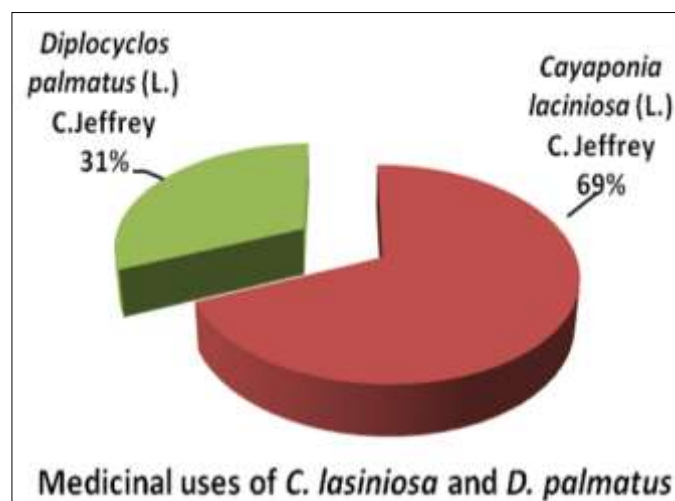


Fig 2: Medicinal uses comparison between *C. laciniosa* and *D. palmatus*

### Ayurvedic Properties and Action

#### *Cayaponia laciniosa* (L.) C. Jeffrey

**Raspanchak:** Rasa: Katu, tikta<sup>[30]</sup>; Guna: Laghu, ruksa<sup>[30]</sup>; Virya: Usna<sup>[30]</sup>; Vipaka: Katu<sup>[30]</sup>; Dosakarma: Pittakaphahara<sup>[30]</sup>.

**Karma** (action): Apatyakara-putrajanana; Prajasthapana; Rasayana; Balya; Sidhmahara; Vaatakaphajwara<sup>[30]</sup>.

Vaajikarana (aphrodisiac)<sup>[11, 44]</sup>; Shukravardhaka (semen promoting)<sup>[44]</sup>; Diptaagni (digestive stimulant)<sup>[44]</sup>; rejuvenating<sup>[33]</sup>.

**Roghanata:** Bandhyatva<sup>[30]</sup>; Carmaroga; Jvara<sup>[30]</sup>; Adhmana<sup>[30]</sup>; Dourbalya<sup>[30]</sup>.

According to *Bhavapraakasha*, the seeds of Śivaliṅgī (*C. laciniosa*) is taken with milk, promote the conception of a male child<sup>[11, 30]</sup>. It is reported to be foetid<sup>[33]</sup> and useful in Sidhma<sup>[32]</sup>. Śivaliṅgī (*C. laciniosa*) cleanses and nourishes the Artavavaha Shrotas<sup>[13]</sup>.

#### *Diplocyclos palmatus* (L.) C. Jeffrey

**Raspanchak:** Rasa: Katu, tikta<sup>[98]</sup>.

According to Venkateshwarlu *et al.* *D. palmatus* is a known ayurvedic drug used as an aphrodisiac, tonic, leucorrhoea and as an antipyretic in Āyurveda<sup>[99]</sup>. The plant shows different properties like foetid smell (durgandha), thermogenic (Tapakara), anti inflammatory (Shotha rodhi), alterative, depurative and tonic & rejuvenative (rasayani) and useful in vitiated conditions of Vata & Pitta doshas, cough, flatulence, skin diseases, inflammations and general debility and also useful in sidhma kushta (A type of leprosy)<sup>[98]</sup>.

### Discussion and Conclusion

After going through the literature, it is found that both the plants are similar in morphological appearance i.e. herb, annual, scandent monoecious with minute difference in shape and size of leaf, leaves 5-lobed, membranous, scabrid above, smooth or so beneath, denticulate or sub serrate in *C. laciniata*, leaves 3-lobed, cordate, at base, upper surface being punctuate, lobes acute or subacuminate at apex, entire or distantly serrate in *D. palmata*. Corolla being broadly campanulate, 5-partite; segments greenish yellow, ovate,



acute, pubescent in *C. laciniosa* and yellow, campanulate, 5-partite, stamens 3, free; one anther 1-locular, 2 anthers 2-locular, loculi linear, slightly flexuose in *D. palmata*, seeds are being many, subpyriform, with raised projections on either side, margin strongly belted without partition wall in *C. laciniosa* and many, ovoid, smooth attenuate, conspicuous belted with partition wall in *D. palmata* cause the major differences in both the plants<sup>[100]</sup>.

Śivaliṅgī is mentioned in old treatise like *Rajanighantu*, *Nigantu aadarsh* and *Shaligram nighantu*. The description of Shivlingi is not found in The Ayurvedic Formulary of India (AFI) and Ayurvedic Pharmacopoeia of India (API).

According to some literatures like *Indian Materia Medica*, *Aushadhopyayogi Ayurvediya Vanaspati Kosh*, *Ausadhnamarupavijnanam*, *Medicinal plants used in Āyurveda*, *A Scientific Review on Śivaliṅgī Beej (Bryonia laciniosa): A Mystical Ethno-Medicine for Infertility*, the name Śivaliṅgī has come into existence in the name of *Bryonia laciniosa* L.<sup>[5, 69, 101-103]</sup>, where as after thoroughly checking the taxonomic literature it was found that this plant is endemic to Jamaica and it does not exist in India<sup>[106, 107]</sup>. Few authors considered *Diplocyclos palmatus* as synonym of *Bryonia laciniosa*<sup>[62]</sup>, which is taxonomically not possible because both the plants are separate species as clarified in the introduction part.

Shantha *et al.* considered *Diplocyclos palmatus* as the actual Śivaliṅgī<sup>[104]</sup> and Jeffrey (1962, 1971)<sup>[107, 108]</sup> and Renner & Pandey (2013)<sup>[106]</sup> gave taxonomic evidence in support of this view.

The phytochemical constituent i.e. the presence of a common alkaloid bryonin which is said to be responsible for the clinical activity for the treating ailments support the use of *D. palmata* for the treatment of the related diseases against the name of Śivaliṅgī, and the modern literature supports *D. palmata* as Śivaliṅgī<sup>[104]</sup>.

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