

A Comprehensive Study on an Endemic Indian Genus - *Strobilanthes*

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ABSTRACT

Plants are used in different traditional systems of Indian medicine. *Strobilanthes* is the second largest genus in the family Acanthaceae with 350 species restricted to the hills in tropical Asia of which 150 species are distributed in the Indian subcontinent with 44 are endemic to the Western Ghats. Most are frost-tender and require protection in frost-prone areas. The present study reveals certain salient features of a few plants endemic to India.

INTRODUCTION

Plants are used in different traditional systems of Indian medicine. In India, the different traditional medicine systems make use of a number of plants in the treatment of a number of ailments. Herbal medicines represent probably the first and certainly the oldest system of human healthcare. Practices of traditional medicine are based on hundreds of years of belief and observations, which predate the development of modern medicine. Plants had been used for medicinal purposes long before recorded history. Ancient Chinese and Egyptian papyrus writings describe medicinal uses for plants. Indigenous cultures (such as African and Native American) used herbs in their healing rituals, while others developed traditional medical systems (such as Ayurveda and Traditional Chinese Medicine) in which herbal therapies were used. Researchers found that people in different parts of the world tended to use the same or similar plants for the same purposes. The medicinal value of plants lies in some chemical substrates that produce a definitive physiological action on the human body

Strobilanthes is a genus of perennial flowering herbs and shrubs with about 350 species, at least 46 of which are native to India. *Strobilanthes* is the second largest genus in the family Acanthaceae with 350 species restricted to the hills in tropical Asia of which c. 150 species are distributed in the Indian subcontinent. The name *strobilanthes* is derived from the latin words 'strobilos' meaning cone and 'anthos' meaning flower or shoot. The genus *Strobilanthes* was first scientifically described by Christian Gottfried Daniel Nees von Esenbeck in the 19th century. The of flowering plants of this species belongs to the family Acanthaceae. Plants that bloom after long intervals belonging to the Genus *Strobilanthes*. While some *Strobilanthes* species bloom yearly, others are plietesials, with a cycle of 8-16years. All species are native to Asia, mostly native to tropical Asia and Madagascar, but with a few species extending north into temperate regions of Asia. Many species are cultivated

for their 2-lipped, hooded flowers in shades of blue, pink, white and purple. Most are frost-tender and require protection in frost-prone areas. Most of these species show an unusual flowering behaviour, varying from annual to 16-year blooming cycles^{1,2}.

Scientific Classification

Kingdom : Plantae
Subkingdom : Phanerogamia
Division : Angiospermia
Class : Eudicots
Subclass : Asterids
Order : Lamiales
Family : Acanthaceae
Genus : *Strobilanthus*

General Genus Morphology: Herbs, subshrubs, shrubs, [or small trees], isophyllous or weakly to strongly anisophyllous, woody species commonly pliestesial (living for several years then dying after flowering and fruiting). Stems and branches usually 4-angled, often sulcate, basally becoming woody and hollow with age. Leaves opposite, petiolate or sessile; leaf blade adaxially usually with prominent linear cystoliths and sometimes also abaxially, margin variously dentate, serrate, crenate, undulate, or entire. Inflorescences axillary and/or terminal, bracteate heads, headlike clusters, spikes (sometimes distinctly secund), or less commonly of pedicellate flowers forming an open panicle; sterile bracts usually resembling reduced leaves and often present in compound inflorescences; floral bracts usually different from leaves, persistent or caducous as flowers open, very variable in size and shape, sometimes of two types with basal sterile bracts (outermost bracts in a capitate inflorescence) differing from inner or apical fertile ones; bracteoles 2 per pedicel, usually small, sometimes absent.

Calyx usually 5-lobed to base, commonly accrescent in fruit; lobes equal or with middle one distinctly longer than others, sometimes partially fused to form a bipartite or tripartite calyx. Corolla nearly always bluish, rarely white, yellow, or pink, tubular or funnel-shaped, inside glabrous;

Table 1: Indian Strobilanthes genus plants

Sl. No	Botanical Name	Local Names				Habitat	Medicinal Uses
		Malayalam	Tamil	Hindi	Others		
1.	<i>S.ciliatus</i>	Karimkurinji Cherukurunji	Sinnkurunji , Rommulli	Karavi, Kara		Kerala Tamilnadu	Gout, inflammation, jaundice, rheumatism
2.	<i>S.kunthiana</i>	Neelakurinji					
3.	<i>S.cusia</i>	---	---		Kum (Manipuri) Da-Ching- Yeh (Chinese)	India, Myanmar, Thailand and China.	Anti viral, antibacterial & antifungal Acute respiratory syndrome
4.	<i>S.callosus</i>	---	---	Karoi	Karvy (Marathi)	Western ghats; Madhya pradesh	Inflammation, rheumatism, stomach ailments
5.	<i>S.crispus</i>	---	---	---	enyoh kelo, jin batu (Malaya)	Madagascar , Indonesia, Malaysia	antidiabetic, anxiolytic, laxative, anticancer diuretic
6.	<i>S.ixiocephala</i>	---	---	---	Patri, Waiti. (Marathi)	Maharashtra Konkan, Deccan, Kanara	Antiarthritic Antiinflammatory
7.	<i>S.auriculatus</i>	---	Kurinji	Kumtrukpee	er ye ma la (Chinese) Saingnan (Manipuri) cha hua cao (Chinese)	Manipur, Madhya Pradesh China	In intermittent fever
8.	<i>S.hamiltonia</i>	Palkurinji				India, China Nepal, Bhutan Myanmar	In spider poisoning
9.	<i>S.wallichii</i>	---	---	Kandali	Kashmir Acanthus, Kandali (Kashmiri)	Himalaya, Kashmir, Taiwan, China	

trichomes retaining ; tube either gradually widened from base or narrowly cylindrical and then abruptly widened, campanulate or gibbous; limb 5-lobed; lobes usually ovate, equal or subequal, spreading, contorted in bud. Stamens usually 4 and didynamous (rarely 2, 2 fertile with 2 staminodes, or 4 fertile with a central staminode), basally monadelphous; usually 2 filaments distinctly longer than other 2; anthers included or exerted, 2-theous; thecae oblong or subspherical, parallel, erect or incurved, glabrous, basally muticous, rarely with connective extended to a mucronate tip; pollen spherical or ellipsoid, echinulate and/or variously ribbed, usually tricolporate. Ovary oblong to obovoid, 2-locular, with 2(–8) ovules per locule; style filiform, long, slender, simple, sometimes persistent after corolla falls, retained in place by trichomes on one side of corolla tube; stigma 2-cleft with one branch longer. Capsule characteristically oblong to narrowly obovoid but sometimes fusiform to narrowly ellipsoid, (2–)4(–16)-seeded; retinacula strong, curved. Seeds usually ovate or orbicular in outline and lenticular by being

flattened, usually pubescent with appressed mucilaginous trichomes

Strobilanthes ciliates

Synonym : *Nilgirianthus ciliates*

Habitat : Southern Western Ghats, Kerala, Karnataka

Medicinal Uses: Antiinflammatory, antiarthritic, In gout A slender shrub with adventitious roots arises from basal nodes and has a height of 1-2m. Stems obtusely quadrangular to terete, diffusely branched, sulcate on two sides when young, glabrous, lenticulate, swollen above the nodes. Nodes are jointed, prominent, often fimbriate. Leaves opposite, unequal, broadly elliptic to elliptic-lanceolate, 3.5–16 × 2–7 cm, attenuate at base, subentire to serrate at margins, acute-acuminate to acuminate at apex. Flowers 4-seriate. Calyx 5–6.5 mm long, divided to 2/3rd of its length; segments unequal, linear-lanceolate, acute at apex, almost glabrous but with a few glandular hairs. This plant flowers annually. The flowering and fruiting is observed during the months of October to February^{4,5}.



Fig. 1: *Strobilanthes ciliates*(whole plant)



Fig. 2: *Strobilanthes ciliates* (Flowers)



Fig.3: *Strobilanthes callosus*(flower)



Fig.4: *Strobilanthes callosus*(whole plant)



Fig.5: *Strobilanthes ixiocephala*

The reported works on this plant are M. Srinivasan et al carried out the isolation of constituents from the leaf and studied its antioxidant activity⁶. Usha Rani et al performed the hepatoprotective activity of the plant extract⁷. Venkatachalapathi et al isolated the constituents and studied its antimicrobial activity^{8,9}. Reneela et al isolated important constituents and elucidated their structures^{10,11}.

Strobilanthes callosus:

Synonym: *Carvia callosa*

Habitat: Western ghats, Madhya Pradesh, Andhra Pradesh, Maharashtra & Karnataka

Medicinal Uses: Anti-inflammatory, Antimicrobial, In stomach ailments, rheumatism

It is a large shrub, sometimes attaining 6–20 ft in height and 2½ inches in diameter. Its flowering cycle is 10 years. Branches often warted or scabrous-tubercled. Leaves opposite, 7 by 3 in., sometimes much larger, crenate, rough, conspicuously marked with five lines above, nerves 8-16 pair; petiole 2-3 in. Flowers in strobiliform spikes 1-

4 in. long, often densely or laxly cymose; bracts 1/2 - 1 in. long, orbicular or elliptic. Calyx 1/2 in., in fruit often exceeding 3/4 in., sub-equally 5-lobed to the base; segments oblong, obtuse, softly hairy. Corolla tubular-ventricose, 1½ in., glabrous without, very hairy within, deep blue; lobes 5, nearly equal, contorted in bud. Stamens 4; filaments hairy downwards; anthers blunt; not spurred at the base. Ovary 4-ovuled; style linear; stigma of one long linear-lanceolate branch the other minute. Capsule 3/4 by 1/3 in., seeds more than 1/3 in. long, thin, obovate, acute, densely shaggy with white inelastic pressed hair, except on the large oblong areoles^{12,13,14}.

Works done on this plant so far are Agrawal & Rangari studies the anti inflammatory and Antiarthritic activity of the root extract¹⁴. Singh B et al performed the anti inflammatory and antimicrobial activity of the isolated constituents¹⁵. The characteristic glycosides were isolated from the plant by Anaka et al¹⁶. Sarpate et al evaluated the antiarthritic potential of the plant extract¹⁷.

Strobilanthes ixiocephala

Synonym : *Thelepaepale ixiocephala*

Habitat : Konkan, Deccan and Kanara, Brahmagiri hills, Maharashtra

common name : Sky Blue Karvy

Medicinal uses : inflammatory disorders. Arthritis

It is a small straggling shrub found in India. It is a much branched, aromatic bushy shrub; stem is viscid, glandular-hairy, swollen above the nodes. Leaves opposite, unequal, elliptic-lanceolate, crenate, sharp tip. Flowers 2.5-3 cm long, white or pale blue, in axillary or terminal condensed spikes as. Calyx 1 cm long, connate, lobes 5, linear, obtuse. Corolla tube broad and swelling out on one side, 6-7 mm above the base. Stamens 4, filaments basally united, margin of stamina-tube hairy, anther cells oblong. Ovary 2-loculed, ovules 2, style broad at middle, pubescent upwards, stigma obscurely 2-lobed. Twigs and floral heads of the plant yield about 0.5% of an essential oil. Flowering starts from December to January¹⁷.

The works done on this plant are Sarpate R & Tupkari S were carried out the pharmacognostic evaluation, anti-inflammatory and antiarthritis activity studies of the plant^{17,18,19}. Agarwal RB & Rangari VD were also studies the anti-inflammatory activity of the plant²⁰.

Strobilanthes crispus

Habitat : Madagascar, Indonesia, Malaysia

Medicinal uses : Antidiabetic, wound healing, antiulcer, antimicrobial, laxative, anticancer and as a diuretic agent

This is a bush-like plant attaining a maximum height 0.5-1.0 m. It can be found on riverbanks or abandoned fields.

The leaves are oblong-lanceolate, rather obtuse and shallowly crenate crispate and have rough surface, covered



Fig.6: *Strobilanthes hamiltonia*



Fig.7: *S.crispus*



Fig.8: *Strobilanthes wallichi*



Fig.9: *Strobilanthes cusia*

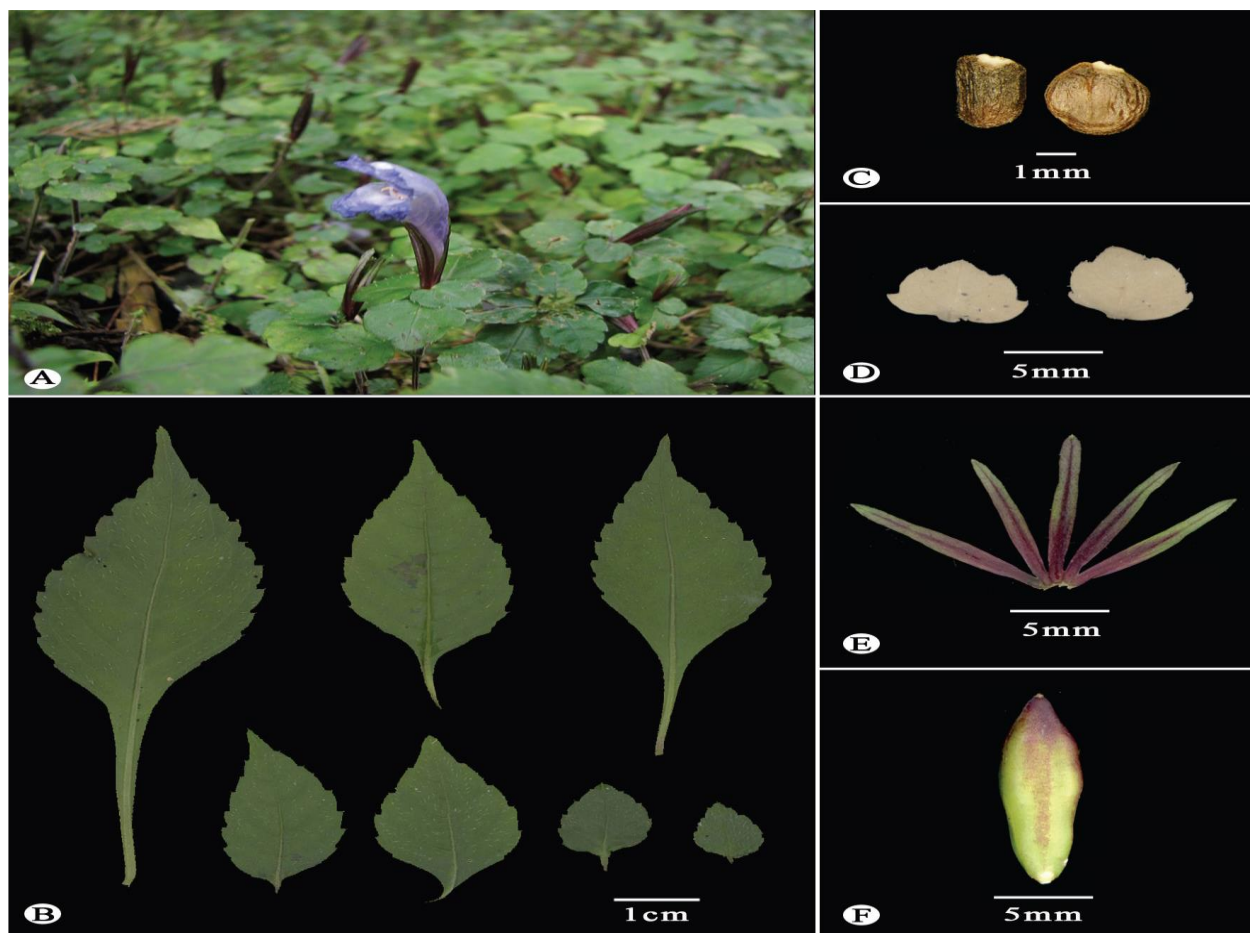


Fig.10: *Strobilanthes wallichii*. A: Habit. B: Leaves. C: Seeds. D: Bracts. E: Calyx. F: Capsule.

with short hairs. The upper surface of the leaves is darker green in colour and less rough as compared to undersid. Flowers of this plant are short, dense and paniced spikes. The flowers are yellow in colour²⁰. Phytochemical investigations have revealed that the plant contain polyphenols, flavonoids, catechins, alkaloids, caffeine, tannins, compounds known to possess multiple health beneficial effects²¹.

The works done on this plant are Norfarizan-Hanoon et al performed antioxidant, hypoglycemic, hypolipidemic and wound healing activities of this plant^{22,23,24,25}. Maznah et al carried out the isolation of phenolic contents and performed the antioxidant and anticancer activity of the constituents^{26,27}. Mahmood et al studied the gastro-protective activity of the plant²⁸. Chong, H. Z et al & Fauziah O et al studied the anticancer activity of the plant extracts^{29,30}.

Strobilanthes hamiltonia

Habitat : Himalaya, Bhutan, Myanmar, Nepal, China

Synonyms : *Ruellia hamiltonia*, *S. colorata*, *S. flaccidifolia*, *Difflugosa colorata*, *Goldfusia colorata*

Medicinal uses: In spider poisoning

These are shrubs of 0.5-1.5 m tall, much branched, anisophyllous. Stems 4-angled, sulcate, glabrous. Leaves petiolate or apical ones sessile or subsessile; petiole (0-) 0.8-5(-8) cm, glabrous; leaf blade lanceolate to ovate, smaller pair at least 2/3 size of larger one, 5-19 × 2-8.5 cm, glabrous, densely covered with linear cystoliths, secondary

veins 4-7 on each side of midvein, base oblique to rarely slightly oblique and attenuate or on very large leaves subcordate, margin serrulate, apex acuminate. Inflorescences axillary or terminal, panicles, to 30 cm, much branched; rachis angled at ca. 60°, glabrous or rarely pubescent, gland-tipped in fruit; bracts green, broadly obovate, 3-5 × ca. 2 mm, concave, caducous, glabrous, becoming gland-tipped in fruit, margin entire, apex retuse; bracteoles green, oblanceolate to narrowly elliptic, 3-4 × ca. 1 mm, concave, caducous, glabrous, margin entire, apex retuse. Flowers solitary on each node, distant on rachis. Pedicel 1.5-5 mm, glabrous. Calyx 8-10 mm, accrescent to ca. 1.3 cm in fruit, glabrous, sometimes apically gland-tipped pubescent, becoming densely gland-tipped in fruit, 5-lobed almost to base; lobes narrowly elliptic with one longer than others, apex acute to sometimes retuse. Corolla white, lilac, or (in cultivated forms) deep pink with a white tube, 3.5-4 cm, subventricose, outside glabrous, inside glabrous except for trichomes retaining style; tube basally cylindrical and ca. 2 mm wide for ca. 1.3 cm then slightly ventricose and gradually widened to 1.4-1.8 cm at mouth; lobes ovate, 4-5 × ca. 6 mm, apex rounded to retuse. Stamens 4, included; filaments glabrous; shorter filament pair ca. 1 mm, equal; longer filament pair 7-9 mm, unequal, erect; anther thecae white, spherical, ca. 1.2 mm in diam., partially recurved; pollen type 3. Ovary ca. 2.5 mm, glabrous; style ca. 3.8 cm, sparsely pubescent. Capsule green then dark purple, fusiform, 1-1.5 cm, glabrous or with gland-tipped



Fig.11: *Strobilanthes auriculatus nees*

trichomes, 4-seeded. Seeds ovate in outline, ca. 3 × 2 mm, with long trichomes; areola small³¹.

Strobilanthes cusia

Habitat : India (Manipur), Myanmar, Thailand and China

Medicinal uses : influenza epidemic, cerebrospinal meningitis, encephalitis B, viral pneumonia mumps, Acute respiratory Syndrome, Anti Fungal, Antiviral, & Antibacterial

These are herbs of 0.5–1.5 m tall, erect, branched, drying blackish, isophyllous to weakly anisophyllous. Stems glabrous or minutely brown puberulent. Petiole 0.5–7 cm; leaf blade elliptic to ovate, 4–20 × 2–9 cm, both surfaces glabrous or abaxially minutely puberulent along veins, abaxially paler green, adaxially dark green, secondary veins 7–9 on each side of midvein, base attenuate, margin serrate, apex acute. Inflorescences terminal or axillary, bracteate spikes, 1–6 cm, often aggregated to form a leafy branched panicle; peduncle 1–12 cm; bracts leaflike, petiolate, oblanceolate, obovate, or spatulate, 1.2–2.5 cm, basally usually sterile; bracteoles linear-oblanceolate, 2–3 mm, deciduous before bracts. Calyx 0.8–1.5 mm in flower, accrescent to ca. 2.5 cm in fruit, minutely puberulent, 5-lobed almost to base; 4 lobes linear-lanceolate, apex acute to obtuse; 1 lobe oblanceolate and much longer. Corolla blue, 3.5–5 cm, straight to slightly bent, outside glabrous; tube basally cylindric and ca. 3 mm wide for 1–1.5 cm then slightly curved and gradually widened to ca. 1.5 cm at mouth; lobes oblong, ca. 9 × 9 mm, subequal. Stamens 4, included; filaments glabrous, shorter pair ca. 3 mm, longer pair ca. 7 mm; anther thecae oblong, ca. 3 mm; pollentype 4. Ovary oblong, apex puberulent with few gland-tipped trichomes; style ca. 3.2 cm, glabrous. Capsule 1.5–2.2 cm, glabrous, 4-seeded. Seeds ovate in outline, ca. 3.5 mm, covered with appressed trichomes; areola small. It is often cultivated for the dye in Manipur valley^{3,32}.

The works done are Tanaka et al Isolated the Lignan glycosides from the plant³². Rubani et al carried out the antibacterial activity of the leaf extract³³. Yu-Ling Ho et al studies the antinociceptive, anti inflammatory and antipyretic activity of the leaf extract of the plant³⁴. Yanmei et al and Ko HC et al were performed the antitviral activity of the extract on different groups of viral infected cell lines^{35,36}.



Strobilanthes wallichii

Habitat : Himalaya, Kashmir, Taiwan, China

Synonyms : *Pteracanthus alatus* Nees, *Ruellia alata* Wall Nees, *Strobilanthes atropurpureus* Nees³⁷

It is a Perennial herb of 40 cm tall. Stems erect, sometimes decumbent, rooting at nodes, much branched. Leaves chartaceous, ovate-oblong, subsophyllous, 3.5-10 cm long, apex acuminate to obtuse, base gradually narrowed, margins serrate. petioles 5-15 mm long. 1-3-flowered. Calyx 1-1.8 cm long, elongated to 2 cm when fruiting, deeply 5-divided, segments linear, glabrous, fused at the base. Corolla purple, campanulate with 3.5cm long Stamens 4, didynamous, longer filaments base coherent to corolla with membrane, free part ca. 4 mm long, hirsute, glabrous near top; shorter filaments 2 mm long, glabrous; anthers oblong-linear, 2 mm long. Style filiform, ca. 1.3 cm long; stigma subulate, pubescent with glandular hairs. Capsules linear-fusiform, 1.5-1.8cm long, glabrous. Seeds 4, compressed-ovate, ca. 2-3mm long, appressed pilose³⁸.

Strobilanthes auriculatus nees

Habitat : Rajpur, Manipur, M.P, Gujrat, China

Synonym : *Perilepta auriculata*

Medicinal use : Leaves are used in intermittent fever³⁹

These are subshrubs 0.5–2 m tall, much branched, weakly to strongly anisophyllous. Stems 4-angled, sometimes zigzag, glabrous or sparsely hirsute. Leaves sessile; leaf blade narrowly to broadly oblong-elliptic or oblong-oblanceolate, rarely ovate for small leaves, 2–20 × 1.5–6 cm, both surfaces sparsely pilose, abaxially pale green or reddish when young, adaxially green, secondary veins 12–15 on each side of midvein, base attenuate, cuneate, rounded, or auriculate, margin serrate to undulate, apex acuminate. Inflorescences axillary or terminal, spikes, 3–10 cm, sometimes branched; peduncle 2–4 cm, 4-angled, sulcate, bracteate; sterile bracts ovate, 0.8–2 × ca. 1.5 cm; floral bracts imbricate, broadly ovate to obovate-spatulate, 4–9 mm, often becoming recurved, persistent, densely villous and ciliate, apex usually apiculate but sometimes rounded or emarginate; bracteoles absent. Calyx 6–12 mm, gland-tipped pilose, 5-lobed almost to base; lobes linear, unequal with 2 slightly shorter than others, margin usually ciliate, apex subacute. Corolla pale purple to violet, funnel-shaped, 2.5–3 cm, curved, outside glandtipped pilose on lobes, inside glabrous; tube basally cylindric and narrow

for ca. 4 mm then weakly to strongly bent, abruptly inflated, and widened to ca. 2.5 cm at mouth; limb weakly 2-lipped, lower lip 3lobed, upper lip 2-lobed; lobes ca. 3 mm. Stamens 4, included; filaments glabrous, shorter pair ca. 2 mm, longer pair ca. 4mm; anther thecae oblong, ca. 1.5 × 1 mm; pollen type 3. Ovary glabrous; style ca. 3.2 cm. Capsule narrowly oblong obovoid, 8–10 × ca. 2 mm, glabrous, 4-seeded, apex apiculate. Seeds ovate-suborbicular in outline, ca. 2 × 1.8mm, pubescent; areola very small³⁹. Locally it is called Kumtrukpee, which means flowering after six years^{40,41}. About 22 constituents were isolated and characterized from the plant⁴².

CONCLUSION

India is a country with an enormous wealth of medicinal plants. But most of these plants are not properly exploited. If these plants were properly exploited, we could have a large number of natural remedies for digits of ailments. The above study is meant to reveal some of the most available shrubs in the genus, *Strobilanthes*. It is the second largest genus under the family Acanthaceae. This genus shows a peculiar flowering pattern with the flowering cycle varies from 1-16 years in different species. Most of the plants in this species have a tremendous medicinal value. But still there is a need to reveal more number of plants in this genus. Also the phytochemical and pharmacological evaluation should be done on these plants.

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