

DIVERSITY, DISTRIBUTION PATTERN OF GENUS *Strobilanthes* BLUME IN SRI LANKA AND THEIR IMPLICATIONS FOR CONSERVATION PLANNING

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ABSTRACT: Thirty three species of *Strobilanthes* BLUME in Sri Lanka and varieties of some species are illustrated with information on distribution pattern, elevation range, habitat and distinguishing characters useful for individual identification. All species have a rather restricted distribution in undisturbed montane and sub-montane forests and lowland rain forests of the island. Recorded locations of all species were mapped on floristic zones in Sri Lanka. Among the floristic zones, Foothills of Adam's Peak and Ambagamuwa has the highest species richness, whereas dry zone is the lowest compared to *Strobilanthes* recorded zones. Furthermore diversity and distribution of plants were affected by altitude. About 66% of *Strobilanthes* species from Sri Lanka belong to a threatened category, mainly because of the continued loss and fragmentation of natural habitats. Therefore special conservation plans should be implanted. This will help reduce the pressure on the forest and thus conserving the natural environment. More research should be geared towards effects of climate and land use changes factors on vegetation establishment in this area as this will help in the management of landslide activities in these ecosystems.

KEY WORDS: Acanthaceae, elevavation, habitats, species delimitation

INTRODUCTION

Strobilanthes is the most species-rich genus coming under Family *Acanthaceae*, first described by Blume (1826) from specimens collected in West Java (Bennett and Scotland, 2003). This is one of the largest genera in the flora of Sri Lanka and most interesting for its diversified habits, gregarious occurrence and elegant flowering (Dassanayake and Clayton, 1998). The genus *Strobilanthes* Blume consists of around 450 species, is mostly distributed in the tropical Asia and Australia (Mabberley 2005).

Most of the species of this genus have anti-inflammatory, antimicrobial, antidiabetic, and anticancer and wound healing properties. Extract of some species of *Strobilanthes* has been commonly used to treat infections by respiratory virus, such as influenza viruses, hepatitis B virus, mumps virus, and severe acute respiratory syndrome (SARS), corona virus and

are used in spider poisoning, snake bites, cerebrospinal meningitis, viral pneumonia etc. (Yu-Chi Tsai *et al.*, 2020, Ismail *et al.*, 2012). Leaf extraction of this species is generally used for the production of indigo dyes.

Strobilanthes can be distinguished from other members of *Acanthaceae* by a combination of floral characteristics: filaments united to form a membranous sheath, a bifid stigma with a reduced posterior lobe, and two bundles or rows of hairs on the inner posterior corolla wall that retain the style (Bremekamp, 1944; Carine and Scotland, 2000a; Manktelow, 2000). However, this character combination is not found in all species, and their relationship with other taxa remains to be rigorously examined. Several aspects of the systematics of the *Strobilanthes* have recently been addressed including species delimitation (Wood, 1994, 1995, 1998; Scotland, 1998; Carine and Scotland, 2000a; Carine *et al.*, 2000; Moylan

and Scotland, 2000; Moylan *et al.*, 2002; Bennett and Scotland, 2003; Wood and Scotland, 2003; Wood *et al.*, 2003), investigations of floral anatomy (Manktelow, 2000), pollen morphology (Scotland, 1993; Carine and Scotland, 1998), life history strategy (van Steenis, 1942; Matthew, 1971; Wood, 1994; Carine and Scotland, 2000a), and phylogeny and generic classification (Carine and Scotland, 2000b, 2002). Recent molecular and combined morphological/molecular phylogenetic analyses have confirmed the monophyly of the *Strobilanthes* (Moylan *et al.* 2004).

Shrubs of the genus *Strobilanthes* dominate the montane forest understory in Sri Lanka (Gunatilleke, 1996). The species of *Strobilanthes* range in habit from short perennial herbs to densely branched, erect shrubs and many species are reported to be plietesial; plants which grow for several years before flowering, setting seed and dying.

Some *Strobilanthes* species in Sri Lanka are known only from collections made many years ago and they may have become already extinct as a result of their habitats being lost by a combination of factors; unsustainable agriculture & forestry practices, urbanization, pollution, land use changes, & the spread of invasive alien species & climate change. However, the species delimitation remains problematic, essentially because many species are poorly known and rarely collected, mainly because of their seasonal flowering pattern. Nevertheless, new species still remain to be discovered. The aim of this study was to illustrate genus *Strobilanthes* in Sri Lanka with their distribution pattern and implications for conservation. Further taxonomic reviews would be resulted with discovering of new species in future.

and photographs and comparison with properly identified herbarium specimens on consultation with herbarium personnel. For all newly collected material, voucher specimens have been prepared and deposited at the National Herbarium, Royal Botanic Garden, Peradeniya.

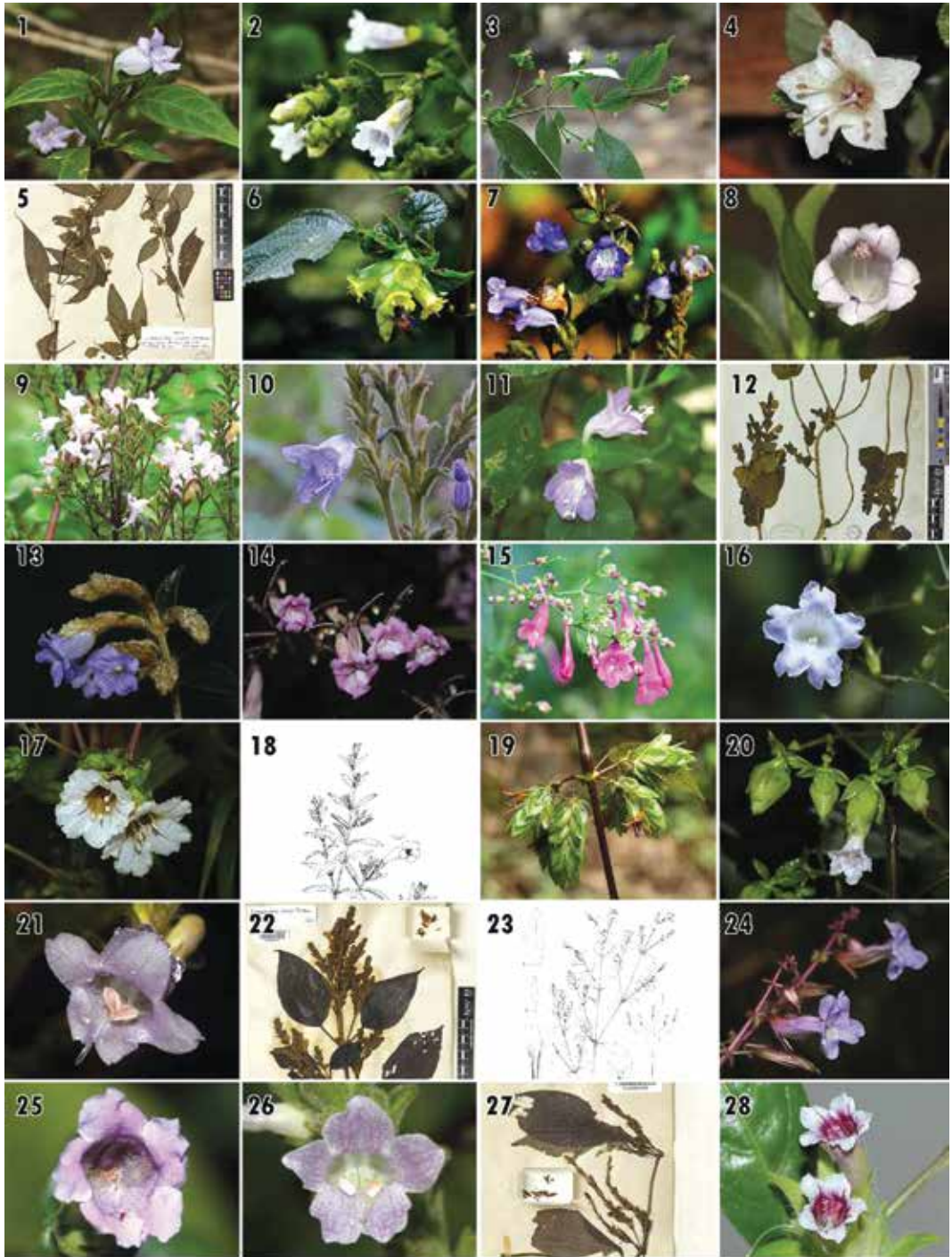
Locality and distributional data from field studies and from herbarium sheets were taken to make interpretations on the ecology, habitat and distribution of the taxa. GIS data for mapping the distributions were taken in my field studies and all herbarium material of *Strobilanthes* in national herbarium, Peradeniya were examined. Many recent herbarium specimens examined include GIS information, which was incorporated directly; however the majority of specimens lacked this, so GIS data were extracted using Google Earth based on location information on the herbarium sheets. Recorded locations of all species were mapped on floristic zones in Sri Lanka. [Base map from: Environmental Foundation Limited (EFL) (The zones are modified from Ashton and Gunathilleke (1987)]. Distribution maps were prepared using ARC GIS version 10.2 (ESRI, 2013).

MATERIALS AND METHODS

Field sampling was conducted in Sri Lanka from January 2012 to December 2019. The identification of unknown plant material was accomplished with the use of dichotomous keys; published plant descriptions, illustrations

TABLE 01 : Genus *Strobilanthes* BLUME in Sri Lanka

#	Species	Red list 2012	Origin
1	<i>Strobilanthes adenophora</i> Nees	VU	Endemic
2	<i>Strobilanthes anceps</i> Nees var. <i>anceps</i>	LC	Endemic
3	<i>Strobilanthes</i> sp (similar to <i>S. anceps</i>)		
4	<i>Strobilanthes arnottiana</i> Nees	CR (PE)	Endemic
5	<i>Strobilanthes calycina</i> Nees	LC	Endemic
6	<i>Strobilanthes caudata</i> T. Anderson	EX	Endemic
7	<i>Strobilanthes cordifolia</i> (Vahl) J.R.I. Wood	LC	Native
8	<i>Strobilanthes deflexa</i> T. Anderson	CR (PE)	Endemic
9	<i>Strobilanthes diandra</i> (Nees) Alston var. <i>diandra</i> (Nees)	NT	Endemic
10	<i>Strobilanthes diandra</i> (Nees) Alston var. <i>densa</i> (C.B. Clarke) J.R.I. Wood	NT	Endemic
11	<i>Strobilanthes exserta</i> C.B. Clarke	EN	Endemic
12	<i>Strobilanthes gardneriana</i> (Nees)	CR (PE)	Native
13	<i>Strobilanthes gossypina</i> T. Anderson		Introduced
14	<i>Strobilanthes habracanthoides</i> J.R.I. Wood	EN	Endemic
15	<i>Strobilanthes hamiltoniana</i> (Steud.) Bosser & Heine		Introduced
16	<i>Strobilanthes helicoides</i> T. Anderson	EN	Endemic
17	<i>Strobilanthes hookeri</i> Nees	LC	Endemic
18	<i>Strobilanthes hypericoides</i> J.R.I. Wood	CR (PE)	Endemic
19	<i>Strobilanthes laxa</i> T. Anderson	EN	Endemic
20	<i>Strobilanthes lupulina</i> Nees	LC	Native
21	<i>Strobilanthes nigrescens</i> T. Anderson	CR (PE)	Endemic
22	<i>Strobilanthes nockii</i> Trimen	EN	Endemic
23	<i>Strobilanthes pentandra</i> J.R.I. Wood	CR	Endemic
24	<i>Strobilanthes pulcherrima</i> T. Anderson	LC	Endemic
25	<i>Strobilanthes punctata</i> Nees	CR	Endemic
26	<i>Strobilanthes rhamnifolia</i> (Nees)	CR	Endemic
27	<i>Strobilanthes rhytisperma</i> C.B. Clarke	CR	Endemic
28	<i>Strobilanthes schomburgkii</i> (Craib) J.R.I. Wood		Introduced
29	<i>Strobilanthes sexennis</i> Nees T. Anders var. <i>sexennis</i>	LC	Endemic
30	<i>Strobilanthes sexennis</i> Nees var. <i>cerinthoixes</i>		Endemic
31	<i>Strobilanthes sexennis</i> Nees var. <i>glaberrima</i> J.R.I. Wood		Endemic
32	<i>Strobilanthes sexennis</i> Nees var. <i>hirsutissima</i> (Nees) T. Anders		Endemic
33	<i>Strobilanthes stenodon</i> C.B. Clarke	EN	Endemic
34	<i>Strobilanthes thwaitesii</i> T. Anderson	CR (PE)	Endemic
35	<i>Strobilanthes vestita</i> Nees	EN	Endemic
36	<i>Strobilanthes viscosa</i> (Arn. ex Nees) T. Anderson var. <i>viscosa</i>	LC	Endemic
37	<i>Strobilanthes viscosa</i> (Arn. ex Nees) T. Anderson var. <i>digitalis</i>		Endemic
38	<i>Strobilanthes walkeri</i> Arn. ex Nees var. <i>walkeri</i>	NT	Native
39	<i>Strobilanthes walkeri</i> Arn. ex Nees var. <i>macrosperma</i> J.R.I. Wood		Endemic
40	<i>Strobilanthes willsii</i> Canine	CR	Endemic
41	<i>Strobilanthes zeylanica</i> T. Anderson	CR	Endemic
42	<i>Strobilanthes</i> sp		



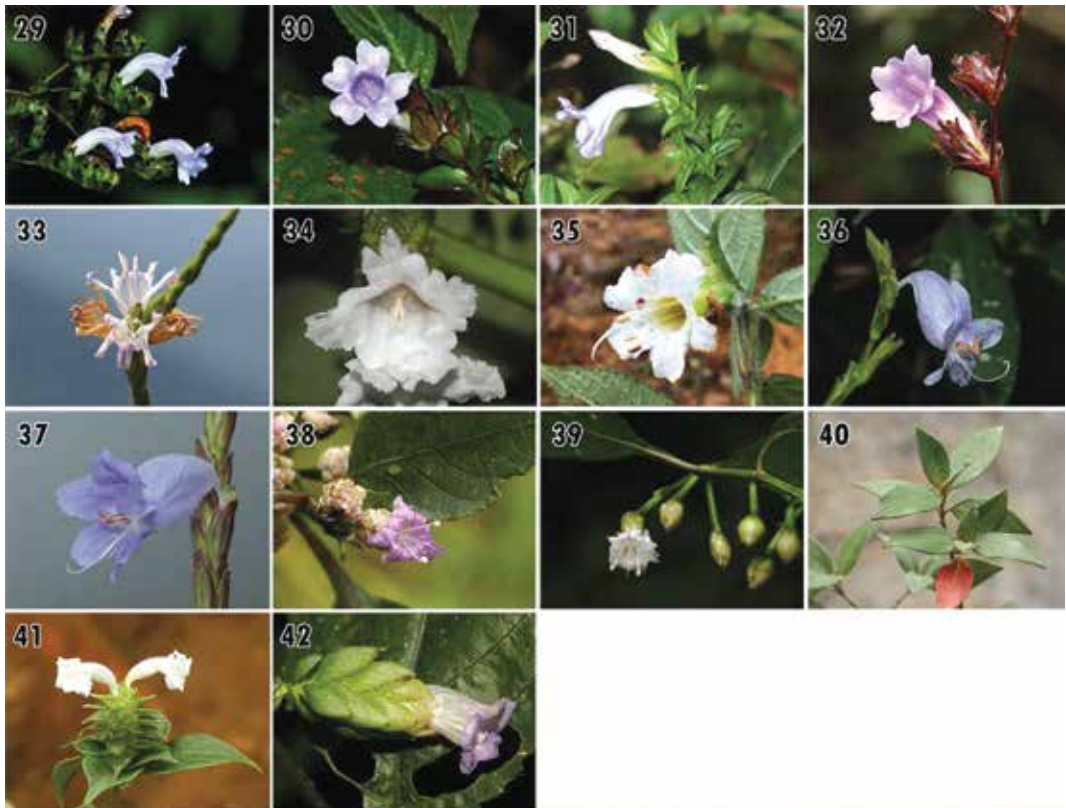
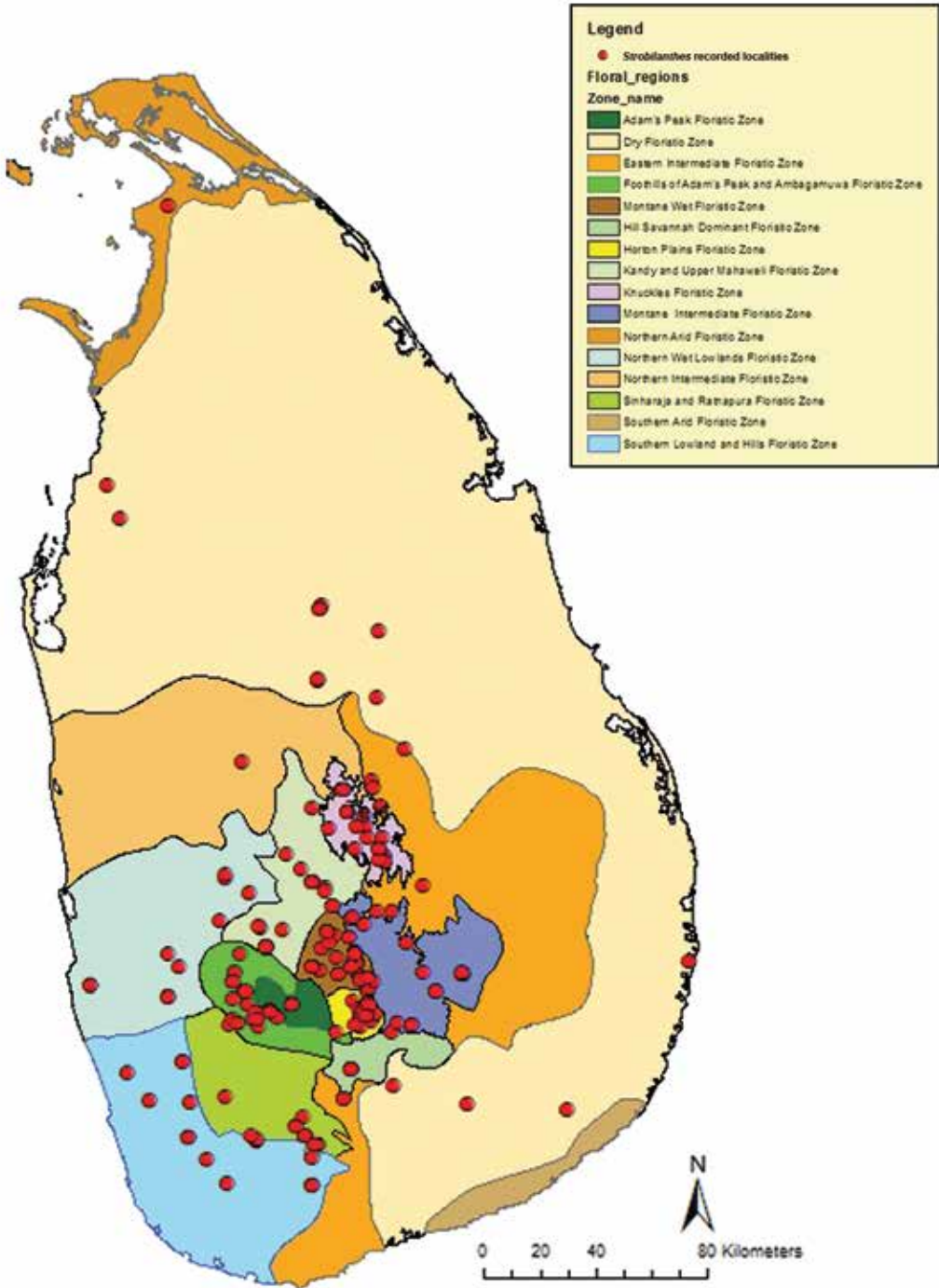


FIGURE 1: *Strobilanthes* flowers

1. *S. adenophora*; 2. *S. anceps* var. *anceps*; 3. *Strobilanthes* sp. Similar to *anceps*; 4. *S. arnottiana*; 5. *S. caudate*; 6. *S. calycina*; 7. *S. cordifolia*; 8. *S. deflexa*; 9. *S. diandra* var. *diandra*; 10. *S. diandra* var. *densa*; 11. *S. exserta*; 12. *S. gardneriana*; 13. *S. gossypina*; 14. *S. habracanthoides*; 15. *S. hamiltoniana*; 16. *S. helicoides*; 17. *S. hookeri*; 18. *S. hypericoides*; 19. *S. laxa*; 20. *S. lupulina*; 21. *S. nigrescens*. 22. *S. nockii*; 23. *S. pentandra*; 24. *S. pulcherrima*; 25. *S. punctata*; 26. *S. rhamnifolia*; 27. *S. rhytisperma*; 28. *S. schomburgkii*; 29. *S. sexennis* var. *sexennis*; 30. *sexennis* var. *cerinthoides*; 31. *sexennis* var. *glaberrima*; 32. *sexennis* var. *hirsutissima*; 33. *S. stenodon*; 34. *S. thwaitesii*; 35. *S. vestita*; 36. *S. viscosa* var. *viscosa*; 37. *S. viscosa* var. *digitalis*; 38. *S. walkeri* var. *walkeri*; 39. *S. walkeri* var. *macrosperma*; 40. *S. willisii*; 41. *S. zeylanica*; 42. *Strobilanthes* sp. (Rambukoluwa)



Source: Base map from: Environmental Foundation Limited (EFL) [The zones are modified from Ashton and Gunathilleke (1987)
 Prepared by: R.M.R. Nilanthi (data from herbarium sheets in national herbarium, Peradeniya (1836-2012) and field data during (2012-2019)]

FIGURE 2: *Strobilanthes* distribution on Floristic Zones in Sri Lanka

RESULTS AND DISCUSSION

Thirty three *Strobilanthes* species have been reported in Sri Lanka (Table 1, Figure 1) and out of them 27 species are endemic.

Description includes the current scientific name in accordance with those on the website on Plants of the World Online 2020 of the Royal Botanic Gardens, Kew, conservation status according to National Red List 2012 of Sri Lanka (MOE, 2012), states of endemic, synonyms, habit, description with identification features (mostly field observations referring the Revised Handbook to the Flora of Ceylon, comparison with specimens in National Herbarium, Royal Botanic Gardens, Peradeniya) habitat, localities, flowering period and distribution map.

Strobilanthes adenophora Nees

Synonyms

- *Didyplosandra lanceolata* (Hook. ex Nees) Bremek
- *Goldfussia myrtinia* Nees
- *Strobilanthes lanceolata* Hook. ex Nees

Subshrub, 0.5-1.0 m high.

Leaves lanceolate, tip – long acuminate, base – attenuate, margin – entire, glabrous, above dark, cytoliths numerous, beneath paler.

Inflorescence – shortly pedunculate heads - Corolla pale purple and outside is softly covered with sessile and subsessile glands. Corolla tube narrowly cylindrical and then abruptly widened. Stamens 4, 2 short, included 2 longer, exerted. Pollen globose, chinulate. 4-seeded, glabrous.

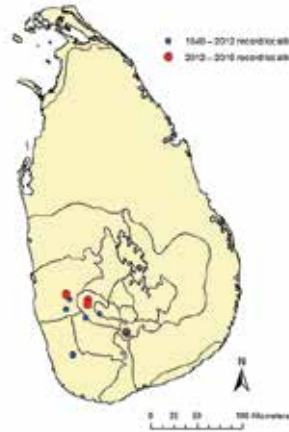
Flowering October to December

Habitat:

Along streams in lowland rain forest in wet zone, 30-500 m.

Localities:

Kitulgala, Deraniyagala, Meethirigala,
Maliboda, Avissawella, Mathugama,
Labugama, Pahala Hewessa, Kuruwita.



Strobilanthes anceps Nees var. *anceps*

Shrub with aromatic smell, 0.5–1 m high.

Leaves ovate, tip - long acuminate, base - rounded, margin - entire, ciliate, above dark green, beneath paler, pubescent, gland-dotted, long petioles with villous.

Inflorescence – dense pedunculate heads borne on axillary branchlets. Corolla white with purple lines on the tube, outside glandular-pubescent. Corolla tube gradually widened from the base. Stamens 4. included. Pollen ellipsoid, smooth ribs. 4-seeded, pilose.

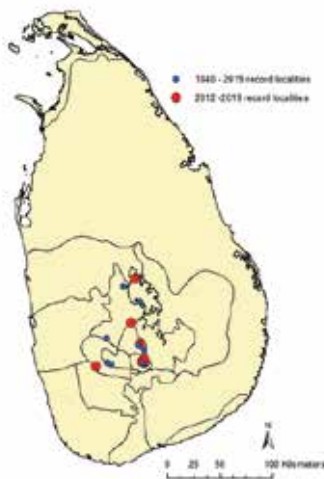
Flowering October to December

Habitat:

Road sides or forest edges of montane and sub-montane forests, 1000-2300 m

Localities:

Horton plains, Hakgala, Adam's Peak, Mandaram Nuwara, Galways land N.P. , Sudugalle kande- Matale, Ambagamuwa, Rangala, Riverstone – Knuckles, Fishing Hut – Maskeliya, Lookandura.

***Strobilanthes* sp. (similar to *S. anceps*)**

Shrub, 0.5–1.0 m high.

This shrub has similar morphological characters with *S. anceps* Nees var. *anceps* to certain extent. Inflorescence - elongated, pedunculate heads borne on axillary branchlets. Branchlets are longer than *S. anceps* Nees var. *anceps*. Corolla White. Corolla tube gradually widened from the base. Stamens 4. included. Distribution is geographically different with above sub species. *S. anceps* var. *microstichya* Clark occurs in southern India and this may be it.

Flowering October to December

Habitat:

Growing in the shade in lowland rain forest, 600-900 m

Localities:

Palabaddala, Handapan ella, Sinharajaya, Demodara , Dehenekanda, Eknaligoda, Erathna

***Strobilanthes arnotiana* Nees**

Shrub, 0.5–1 m high.

Leaves ovate, tip - acuminate, base – cuneate , margin - entire, above dark green, young leaves hispid-pilose, petioles pubescent.

Flowers in pedunculate leafy heads. Corolla white, pubescent, filaments whitish, tube gradually widened from the base. Stamens 4, Exserted. Pollen globose, echinulate. 4-seeded, glabrous.

Flowering October to December

Habitat:

Growing in the shade in montane forest, 2000 m

Localities:

Galways land National park, Nuwara Eliya.



Strobilanthes calycina* Nees*Synonyms***Echinacanthus calycinus* Nees

Shrub, 1-3 m high.

Leaves elliptical, tip - acuminate, base - cuneate, margin - serrate, both surfaces of young leaves densely hispid-hairy, above stem and petioles hispid hairy.

Inflorescence – short, dense, drooping spike. Calyx – glabrous. Corolla pale yellow, glabrous. Corolla tube narrowly cylindrical and then abruptly widened.

Stamens 4, shortly exerted. Pollen globose, echinulate. 4-seeded, glabrous.

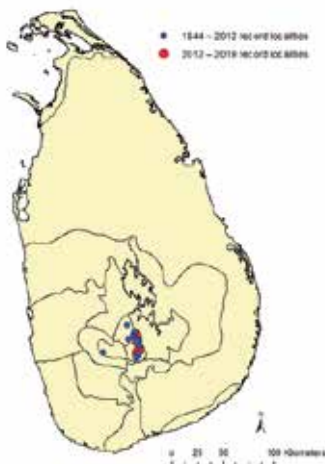
Flowering October to December

Habitat:

Gregarious in montane forest, 1800-2400 m

Localities:

Adam's peak, Horton Plains, Kande Ela, Ramboda, Nuwara eliya, Hakgala, Ambewela, Piduruthalagala, Nonperial Estate, Rdella.

***Strobilanthes caudata* T. Anderson**

Shrub, 1-1.5 m high.

Leaves narrowly elliptic, tip - caudate, base - cuneate, margin – entire, both surfaces green, cystoliths numerous, pubescent on the veins, eventually glabrescent above.

Inflorescence of pedunculate spike, Corolla - Yellow with a Pink line on the tube

Stamens 4, included. 2-seeded, glabrous.

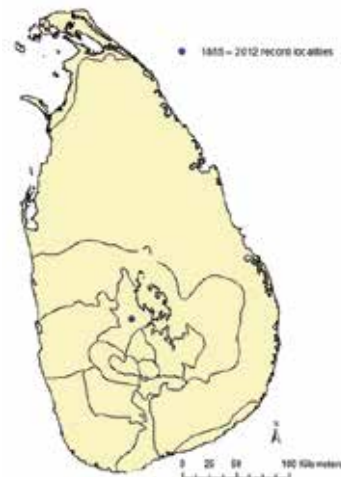
This shrub, only known from the type specimen was collected from Watagoda, Hantane, in 1855. Certainly much of the forests in Hantane have been cleared for tea plantations and there can be no doubt that many suitable habitats and this species have disappeared. This plant has been extinct according to National Red List, 2012.

Habitat:

sub-montane forest, 1200 m

Localities:

Only known from Watagoda, Hantane in 1855 (Dassanayake 1998)



Strobilanthes cordifolia* (Vahl) J.R.I. Wood*Synonyms**

- *Ruellia cordifolia* Vahl
- *Stenosiphonium confertum* Nees
- *Stenosiphonium cordifolium* (Vahl) Alston
- *Stenosiphonium russelianum* Nees
- *Stenosiphonium subsericeum* Nees

Shrub, 1.0 – 1.5 m high

Leaves ovate, tip – acuminate, base – cuneate, margin – serrate, glabrous on both surfaces. Flowers on terminal or axillary panicle. Corolla bluish violet. Corolla tube narrowly cylindrical and then abruptly widened. Stamens 4, anthers much exerted. Style exerted. 6- seeded.

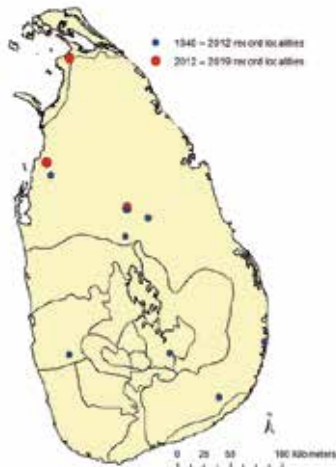
Flowering January to March

Habitat:

Along streams and river banks in dry and intermediate zone, 30-500 m

Localities:

Ritigala, Wilpaththu National park, Minneriya National Park, Jaffna, Yala National Park, Ampara, Labugama, Dambulla, Udawalawa National Park.

***Strobilanthes deflexa* T.Anderson**

Shrub, 0.5-1.5m high

Leaves lanceolate, tip - acuminate, base – cuneate, margin serrulate, glabrous and with many cystoliths on both surfaces, the veins prominent beneath.

Flowers in small, narrowly ovoid, glabrous heads, peduncle deflexed in flower, becoming erect in fruit. Corolla pale purple. Corolla tube narrowly cylindrical and then abruptly widened. stamens 2, pollen globose, echinulate. 4-seeded, pilose.

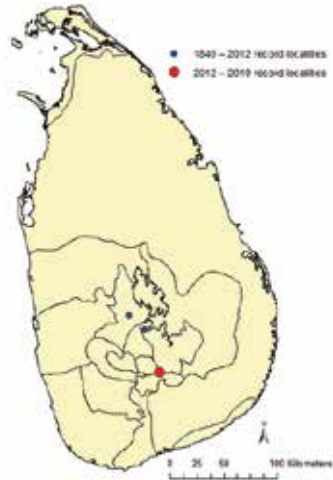
Flowering October to December

Habitat:

Rocky areas along streambeds in lowland rain forest, 500-1000 m

Localities:

Hanthana, Hawaheta and Haldummulla – Soragune



Strobilanthes diandra* (Nees) Alston var. *diandra* (Nees)*Synonyms**

- *Pseudostenosiphonium diandrum* (Nees) Bremek
- *Stenosiphonium diandrum* Nees
- *Strobilanthes consanguinea* C.B.Clarke
- *Strobilanthes neglecta* T.Anderson ex H.O.Saxena & Brahmam

Shrub, 1 m high

Leaves broadly elliptic, tip - acuminate, base - cuneate, margin - serrulate, above dark green, smooth, beneath paler. Corolla pale violet, pubescent on the lobes only. Corolla tube narrowly cylindrical and then abruptly widened. Stamens 2, shortly exerted. Pollen globose, echinulate. 4-seeded, glabrous.

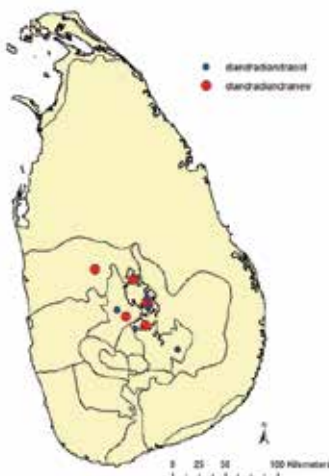
Flowering February to April

Habitat:

Road sides or forest edges of sub-montane forests, 1000-1800 m

Localities:

Peradeniya, Madugoda, Dehigolla, Hewaheta, Namunukula, Riverstern, Hunnasingiriya, Keerthibandarapura, Balangoda, Dothalugala.

***Strobilanthes diandra* (Nees) Alston var. *densa* (C.B.Clarke) J.R.I.Wood**

Shrub, 1 m -1.5 m high.

Leaves broadly elliptic, tip - acuminate, base - cuneate, margin - serrulate, above dark green, scabrid, beneath paler, Corolla pale blue, pubescent on the tube as well as the lobes. Corolla tube narrowly cylindrical and then abruptly widened. Stamens 2, shortly exerted. Pollen globose, echinulate. 4-seeded, glabrous.

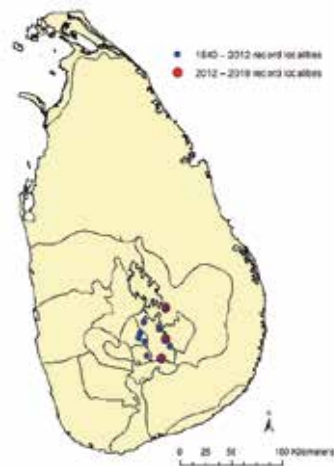
Flowering October to December

Habitat:

Road sides or forest edges of montane and sub-montane forests, 1000-2000 m

Localities:

Atampitiya, Bandarawela, Haputhale, ella, Maspanna, Maturata, Hakgala, Welimada, Piduruthalagala, Ohiya.



Strobilanthes exserta* C.B. Clarke*Synonyms**

- *Stenosiphonium zeylanicum* T.Anderson

Prostrate herb, rooting at the nodes. Leaves ovate, tip - acute, base - long-cuneate, margin serrate, above green, beneath paler, both surfaces hispid and cystoliths numerous, petioles pubescent. Inflorescence of pedunculate heads borne on short axillary branchlets. Corolla pale violet. Corolla tube narrowly cylindrical and then abruptly widened. Stamens 4, exserted, 2 included. Pollen globose, echinulate.

Flowering February to April

Habitat:

Growing in the shade in dry zone secondary forest, 600-900 m

Localities:

Dambulla, Galpitiya (Kottapitiya), Kudaoya-Thanamalwila, Udawalawa National Park

***Strobilanthes gardneriana* (Nees)****Synonyms**

Endopogon gardnerianus Nees

Shrub, 0.6 m high.

Stem much branched and persistent scars.

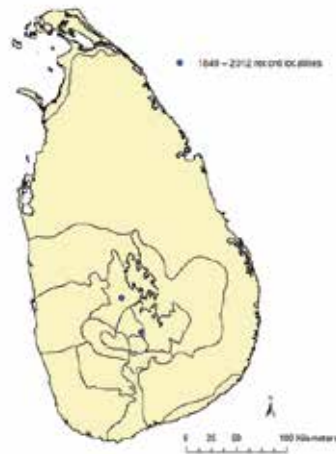
Leaves ovate, tip - obtuse, base - rounded, margin - crenate, above bullate, hispid-hairy, beneath hispid-hairy, sessile. flowers in opposite pairs in interrupted spikes. Stameas 4, 2 - shorter included, 2 - longer exserted. Pollen globose,echinulate. 4-seeded,glabrous.

Habitat:

Among rocks in montane and sub-montane forest, 1000-2000 m

Localities:

Hantane, Hakgala



***Strobilanthes gossypina* T. Anderson**

Ornamental plant

A rounded dense evergreen shrub 1.5 -2 m high. Leaves elliptic, tip – acute, base – rounded, margin – entire, roughly silver hairs on the lower surface and pubescent on the upper surface with prominent yellowish veins.

Flowers in elongated panicles, bright violet in colour. Corolla tube gradually widened from the base. Stamens 2, included. Pollen ellipsoid, ribbed.

Flowering October to December

Habitat:

Home gardens at around 1800 m

Localities:

Nuwareliya, Blackpool

***Strobilanthes habracanthoides* J.R.I. Wood*****Synonyms***

- *Leptacanthus paniculatus* Bremek.

Shrub, 1.5-2 m high.

Leaves oblong-elliptic, tip – acuminate, base – cuneate, margin – entire, glabrous with numerous cystoliths. Inflorescence a large open panicle. Bracteoles absent. Long glandular hairs on calyx and the middle lobe distinctly longer than the others. Corolla pink and corolla tube gradually widened from the base. Stamens 4, included. Pollen ellipsoid, ribbed. 4-seeded, glabrous.

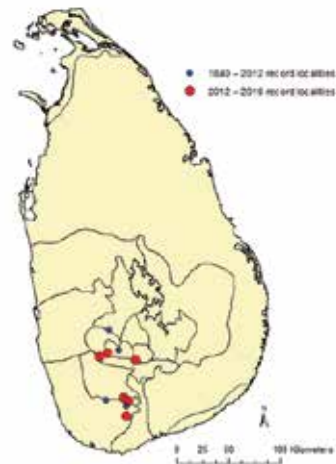
Flowering July to October

Habitat:

Near streams and roadsides of lowland rain forest, 400-1000 m.

Localities:

Palabaddala, Bogawantalawa, Batadombalena, Sinharaja Forest, Morningside, Gongala, Ranmale Kanda, Ambagamuwa, Dotale kanda – Maskeliya, Panikanda.



***Strobilanthes hamiltoniana* (Steud.) Bosser & Heine**

Ornamental plant.

Synonyms

- *Difflugossa colorata* (Nees) Bremek.
- *Difflugossa crinita* (Nees) Bremek.
- *Goldfussia colorata* Nees
- *Goldfussia crinita* Nees
- *Ruellia hamiltoniana* Steud.
- *Strobilanthes crinita* T.Anderson
- *Strobilanthes laevigata* C.B.Clarke

Shrub ,1.5 -2 m high.

Leaves elliptic, tip - acuminate, base – acute, margin - serrate, above dark green, beneath paler glabrous, prominent vein on upper surface. Inflorescence – open panicle. No distinction can be made between leaves and inflorescence bracts. Corolla bright violet. Corolla tube narrowly cylindrical and then abruptly widened. Stamens 4, included. Pollen ellipsoid, ribbed. 4-seeded, pilose with hairs.

Flowering throughout the year

Habitat:

Commonly cultivated as a garden plant and naturalized in lowland rain forests

Localities:

Nallathanniya, Erathna, Baduraliya, Thangamale, Ambagamuwa.



***Strobilanthes helicoides* T. Anderson**

Synonyms

- *Leptacanthus helicoides* Nees

Shrub, 1- 1.5 m.

Entirely glabrous. Leaves - elliptic, tip - acuminate, base - cuneate, margin - serrulate, above glabrous with numerous cystoliths, beneath paler.

Inflorescence a large open glabrous panicle of indeterminate shape. The branches Zigzag. Corolla narrowly funnel – shaped. Corolla tube gradually widened from the base. Pale violet. Lobes suborbicular. Stamens 4, included. Pollen ellipsoid, ribbed. 2-seeded. Seeds covered with hairs.

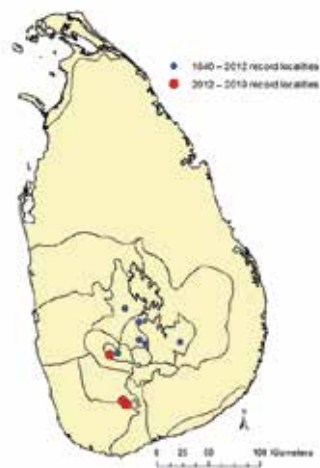
Flowering September to November

Habitat:

Growing in scattered places in sub montane forest, 1000-1800 m.

Localities:

Sripada Hatton Trail, Morningside, Gongala, Hantane, Gartmore estate – Maskeliya, Nuwara eliya, Hewaheta, Hakgala, Namunukula.



Strobilanthes hookeri* Nees*Synonyms**

- *Didyplosandra hookeri* (Nees) Bremek.

Shrub, 1.5-2 m high.

Leaves narrowly elliptic. . tip - acuminate, base - cuneate, margin - serrulate, above hispid-hairy but eventually glabrescent, beneath hispid-hairy
Stem, leaves bracts, corolla, capsule, seeds glabrescent.

Inflorescence dense, drooping, pedunculate heads borne singly on short axillary branchlets. Corolla white with few purple veins, exserted from the bracts. Corolla tube narrowly cylindrical and then abruptly widened. Stamens 4, exserted. Pollen globose, echinulate. 4-seeded, glabrous. 4-seeded, glabrous.

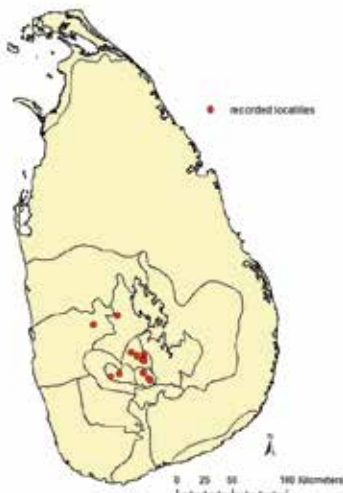
Flowering August to November

Habitat:

Near streams in montane and sub-montane forest, 900-2400 m

Localities:

Horton plains ,Adam's peak, Morningside, Gongala, Coodegala, Gartmore, Nuwara eliya, Piduruthalagala, Pundaluoya, Black pool, Nonpariel estate, Palagalla, Kikiliyamana.

***Strobilanthes hypericoides* J.R.I. Wood**

Shrub

Leaves lanceolate, tip - acute, base - cuneate, margin - entire, sessile.

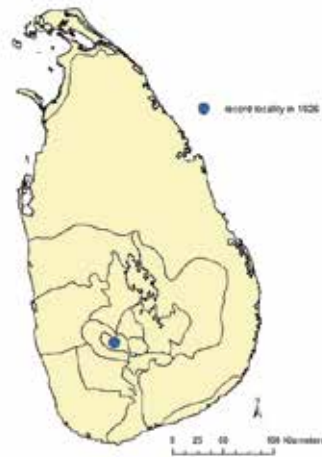
Inflorescence of terminal spikes with the flowers arranged in opposite pairs. Calyx lobes are strongly acute bracts. Glabrous, Corolla funnel - shaped. Corolla tube narrowly cylindrical and then abruptly widened. Stamens 4, included. 2-seeded, pilose with hairs.

Habitat:

Montane forest, 1900 m

Localities:

Gartmore Estate - Maskeliya



Strobilanthes laxa* T. Anderson*Synonyms**

- *Didyplosandra laxa* (T.Anderson) Bremek.

Shrub, 1-2 m high.

Leaves ovate, tip - acute, base - cordate, margin – serrate, above dark green with numerous cystoliths, beneath purple. Inflorescence pedunculate spike. Bracts ciliate and with a line of hairs along the midrib. Corolla dark orange, glabrous. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 4, filaments black, exserted. Pollen globose, echinulate. 4-seeded, glabrous.

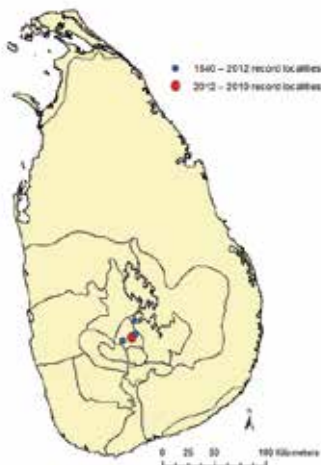
Flowering September to November

Habitat:

Near streams in shade in sub-montane forest, 1200-1800 m.

Localities:

Bogawanthalawa, Riverstern, Talwakele, Hewaheta, Piduruthalagala

***Strobilanthes lupulina* Nees****Synonyms**

- *Nilgirianthus lupulinus* (Nees) Bremek.

Shrubs, 0.8 - 2 m high.

Leaves broadly elliptic, tip - bluntly acuminate, base - attenuate, margin – serrate. bracteoles absent. Stamens 4 included. Inflorescence of heads borne on simple or trichotomously branched axillary branchlets. Corolla white or purple. Corolla tube gradually widened from the base. Pollen ellipsoid, ribbed. 4-seeded, pilose.

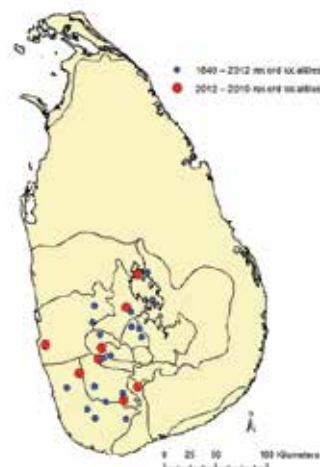
Flowering September to November

Habitat:

Widespread in lowland rain forest and sub montane forest, 100-1800 m

Localities:

Pahiyangala, Hanthane, Laggala, Kalugala, Kithulgala, Adam's Peak, Madugoda, Riversterne, Thalawakele, Kanneliya, Ramboda, Rakwana, Demodara – Dehenakanda, Mathugama, Deraniyagala, Maliboda, Palabeddala, Bulathkohupitya, Ambarawella, delto, Kalawana- Agalawatta, pahala Hewessa, sinharaja forest, Waturawa, Ramboda, Nuwara eliya, Gonapitiya, Hiniduma.



Strobilanthes nigrescens* T. Anders*Synonyms**

- *Pseudostenosiphonium nigrescens*

Shrub, 1m high.

Leaves narrowly oblong - lanceolate, tip - acuminate, base - attenuate, margin - serrulate, both surfaces glabrous. spikes glandular pubescent, moderately dense. Corolla pale purple. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 2, shortly exerted. Pollen globose, echinulate. 4-seeded, glabrous.

Flowering September to November

Habitat:

Riverbank of secondary forests of lowland rain forest, 500-1000 m.

Localities:

Ambagamuwa, Deraniyagala-Udamaliboda

***Strobilanthes nockii* Trimen**

Shrub, 1m high

Leaves elliptic, tip - acuminate, base - cuneate, margin - serrate, above dark green, beneath paler, roughly pubescent on both surfaces.

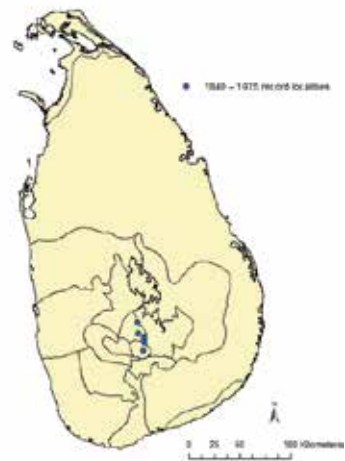
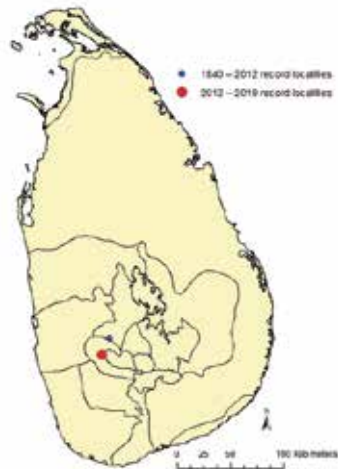
Inflorescence long sticky - glandular - pubescent, musk smelling spike. Bracts, calyx - glandular pubescent. Corolla bright violet, glabrous. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 2, included. Pollen ellipsoid, ribbed. 2-seeded, glabrous.

Habitat:

Highland forest at around 1800m

Localities:

Central highland. Nuwara Eliya, Hakgala



***Strobilanthes pentandra* J.R.I. Wood**

Leaves elliptic, tip - acute, base - cuneate, margin - serrulate, both surfaces green, glabrous.

Inflorescence – small, dense bracteate head. Inflorescence, bracts, calyx, corolla, glabrous, Corolla pale violet. Corolla tube abruptly campanulate from a narrow cylindrical base. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 5, strongly exerted. Pollen globose, echinulate. 4-seeded, pu

Localities:

Only known from the Knuckles Mountains

***Strobilanthes pulcherrima* T. Anderson*****Synonyms***

Leptacanthus walkeri Nees

Undershrub, 2 m high.

Leaves elliptic, tip - acuminate, base - cuneate, margin - serrulate, above glabrous, with numerous cystoliths, beneath purplish-pubescent on the veins, petioles pubescent.

Inflorescence a large open terminal panicle covered with purplish glandular hairs. Calyx densely glandular – pilose. Corolla pale pinkish purple. Corolla tube gradually widened from the base. Bracteoles absent. Stamens 4, included. Pollen ellipsoid, ribbed. 4-seeded, seeds covered with hairs.

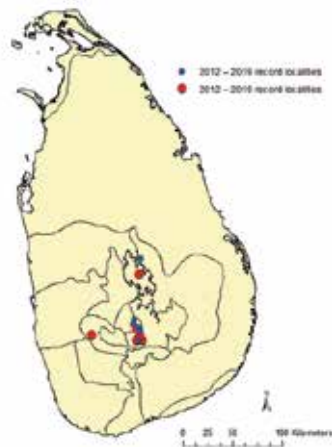
Flowering September to November

Habitat:

gregarious in montane and sub-montane forests, 1000-2200 m

Localities:

Horton plains, Kande ela, Knuckles, Laggala, Nuwara Eliya, Hakgala peak, Piduruthalagala, Ambewela.



Strobilanthes punctata* Nees*Synonyms**

- *Strobilanthes macrostachya* C.B. Clarke

Shrub. 0.5 – 1 m height.

Stem slender, glabrous with prominent swellings above the nodes.

Leaves ovate, tip - acute, base - subcordate, margin - entire, above dark green, cystoliths numerous, beneath paler, gland-dotted. Inflorescence - small head. Bracts shorter than the calyx, bracteoles linear- oblong. Corolla Purple. Corolla tube gradually widened from the base. Stamens 4, included. Pollen ellipsoid.

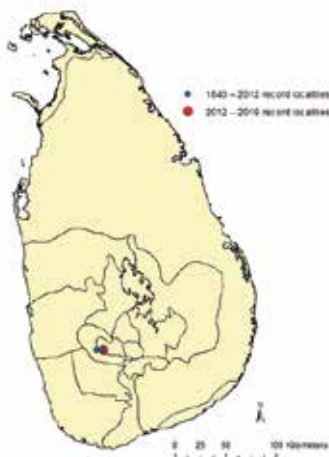
Flowering September to November

Habitat:

Montane and sub-montane forests 1500-2000 m

Localities:

Adams peak sandagalathenna, Kunudiya parvathaya

***Strobilanthes rhamnifolia* (Nees)****Synonyms**

- *Buteraea rhamnifolia* Nees
- *Endopogon rhamnifolius* (Nees) Wight

Shrub, 1.5-2 m high.

Leaves elliptic, tip - acuminate, base - cuneate, margin - serrate above dark green, beneath paler, glabrous. Peduncles, rachis, bracts and calyx glandular - pilose. Bracts longer than the calyx bracteoles shorter than the calyx. Inflorescence terminal or axillary spike. Corolla pale purple, pubescent. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 2, shortly exerted. Pollen globose, echinulate. 4-seeded.

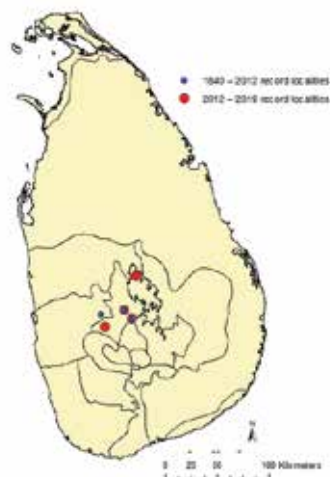
Flowering April to May

Habitat:

Roadside of sub- montane forest, 1000-1500 m.

Localities:

Riverstern, Hantane, Loolecondara Estate, Deltota, Hewawisse korale, Dolosbage.



Strobilanthes rhytisperma* C.B. Clarke*Synonyms**

- *Strobilanthes hypoleuca* T. Anderson

Shrub, 1- 1.5m high.

Leaves elliptic, tip - acuminate, base - cuneate, margin - crenate, above dark green, glabrous, cystoliths numerous, beneath cottony- pilose.

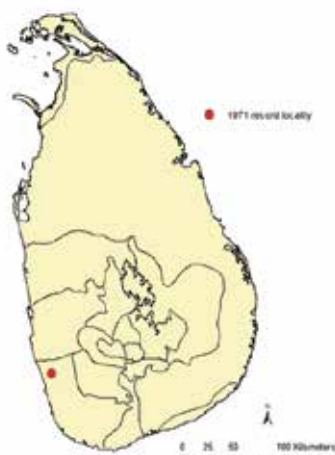
Stem white cottony hairy when young becoming brown and glabrous when older. Leaves equal elliptic. Inflorescence – elongate spike. Corolla pink, glabrous. Corolla tube abruptly campanulate from a narrow cylindrical base. stamen 2, included. 4- seeded, seeds glabrous.

Habitat:

Highland forest at around 1800 m.

Localities:

Ranwalakelle, Kaluthara

***Strobilanthes schomburgkii* (Craib) J.R.I. Wood**

Ornamental plant

Synonyms

- *Hemigraphis schomburgkii* Craib
- *Sericocalyx schomburgkii* (Craib) Bremek.

Shrub 1.5-2.0 m high.

Leaves lanceolate, tip – long acuminate, base – attenuate, margin – entire

Inflorescence – shortly pedunculate heads. Bracts and calyx densely pubescent. Corolla white with purple markings inside. Corolla tube gradually widened from the base. This species seems to be sterile and is spread by cuttings. Stamens 4 included.

Pollon ellipsoid, ribbed.

Flowering November to February

Habitat:

Commonly cultivated in hedges in moist lowlands and hills.

Localities:

Ratnapura, Battaramulla, Kaduwela, Kandy



Strobilanthes sexennis* Nees T. Anders var. *sexennis**Synonyms**

- *Mackenzia sexennis* (Nees) Bremek

Shrub with a strong resinous smell, 1-8 m high. Largest one of the most variable species of *Strobilanthes* in Sri Lanka.

Leaves elliptic, tip – acuminate, base – acuminate, margin - serrate, pubescent on both surfaces.

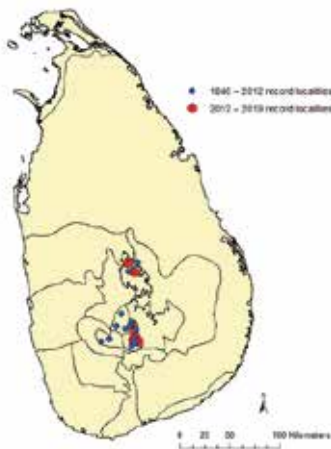
Inflorescence of one sided spikes arising from the upper leaf axils forming a branched terminal panicle. Corolla funnel-shaped, pale purple or white. Corolla tube gradually widened from the base. Stamens 4, included, Pollen ellipsoid, ribbed. 2-seeded, seeds densely hirsute.

Flowering September to November

Habitat: gregarious in montane and sub-montane forests, 1000-2400 m

Localities:

Nuwara Eliya, Horton Plains, Hakgala, Pidurutalagala, Mandaram nuwara

***Strobilanthes sexennis* var. *cerinthoides* (Nees) Clarke**

Small shrub 0.5 m high.

Stem glabrous, without transverse ridges. Leaves oblong, tip - acute, base – rounded, margin – entire, glabrous on both surfaces. Inflorescence densely glandular pubescent, Bracts broadly elliptic. Corolla pale purple. Corolla tube gradually widened from the base. Stamens 4, included. Pollen ellipsoid, ribbed.

Flowering August to October

Habitat:

Restricted to area around Adam's Peak, 2000 m.

Localities:

Adam's Peak



***Strobilanthes sexennis* Nees var. *glaberrima*
J.R.I. Wood**

Shrub, 1.5 – 2 m height.

Stem glabrous with prominent transverse ridging. Leaves oblong, tip - acute, base - rounded, margins - serrate, entirely glabrous. Inflorescence completely glabrous. Corolla pale purple. Corolla tube gradually widened from the base. Stamens 4, included. Pollen ellipsoid, ribbed.

Habitat:

Sub-montane forest, 1200 m

Localities:

Riverstern, Laggala, Mudulkele



***Strobilanthes sexennis* Nees var. *hirsutissima*
(Nees) T. Anders**

Shrub, 1.5 – 2 m height.

Stem glandular-pubescent, without transverse ridges. Leaves oblong, tip - acute, base - truncate, margins serrate, hispid-pilose on both surfaces, sessile. Inflorescence densely glandular-pilose even on the branches, lax. Bracts broadly elliptic, distinctly shorter than the calyx. Corolla purple. Corolla tube gradually widened from the base. Stamens 4, included. Pollen ellipsoid, ribbed.

Flowering September to November

Habitat:

Restricted to area around Adam's Peak, 2000 m

Localities:

Nuwara Eliya, Horton Plains, Pidurutalagala



***Strobilanthes stenodon* C.B. Clarke**

Shrub, 1.5 -2 m high.

Leaves equal, ovate, tip acuminate, base narrowly cuneate, margin dentate. Inflorescence elongate spike. Bracteoles absent. Corolla pale violet with purple lines inside. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 2, shortly exerted. Pollen ellipsoid, ribbed. 4-seeded, glabrous.

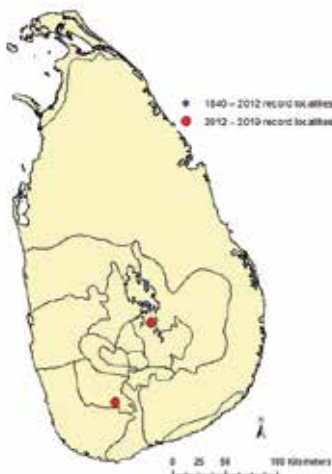
Flowering August to October

Habitat:

Growing in rocky scrub in dry areas, 600 - 1000 m

Localities:

Lakegala, Hunnagiriya, Nildandawa, Handapan Ella

***Strobilanthes thwaitesii* T. Anderson**

Shrub, 1m high.

Leaves elliptic, tip - acuminate, base - cuneate, margin - serrate, above glabrous, scabrid, cystoliths numerous, beneath hispid-pubescent. Inflorescence - small heads, few-flowered. Bracts variable in size and shape, bullate. Bracteoles oblong. Calyx linear. Corolla White, glabrous. Corolla tube gradually widened from the base, Stamens 4, included, ellipsoid, ribbed.

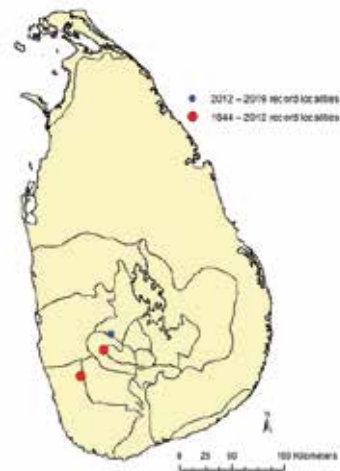
Flowering January to March

Habitat:

Very rare in low altitudes, 200-800 m

Localities:

Ambagamuwa, Pahiyangala, Deraniyagala



Strobilanthes vestita* Nees*Synonyms**

- *Didyplosandra vestita* (Nees) Bremek

Shrub, 1-2 m high.

Leaves elliptic, tip - acuminate, base - cuneate, margin - serrate, both surfaces hispid-pubescent beneath paler, gland-dotted; petioles, hirsute. Inflorescence - dense pedunculate spike, Bracts imbricate, bracteoles spatulate. Corolla white, yellowish in the middle. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 4, exserted, pollen globose, echinulate. 4-seeded, glabrous.

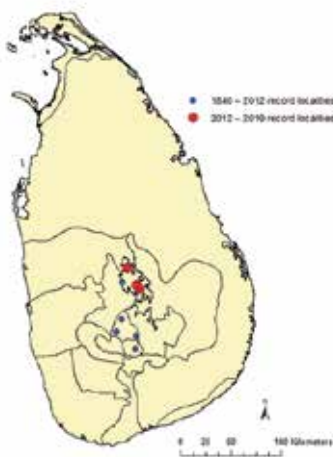
Flowering November to January

Habitat:

Gregarious in montane and sub-montane forests, 1000-2000 m

Localities:

Hunnas Falls, Knuckles, Maturata, Dimbula, Horton Plains, Hakgala, Dothalugala, Riverston, Thangappuwa.

***Strobilanthes viscosa* (Arn. ex Nees) T. Anderson var. *viscosa*****Synonyms**

- *Endopogon argutus* Nees
- *Endopogon viscosus* Arn. ex Nees
- *Pseudostenosiphonium argutum* (Nees) Bremek.
- *Pseudostenosiphonium viscosum* (Arn. ex Nees) Lindau

Shrub, 0.3-2.5 m high.

Leaves - elliptic, tip - acuminate, base - cuneate, margin - serrate, scabrid on upper surface. Inflorescence glandular-pubescent spike, branched, often bearing a pair of leaflets at the branching point, bracts longer the calyx. Corolla White or pale Purple. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 2. Exserted, Pollen globose, echinulate. 4-seeded, glabrous.

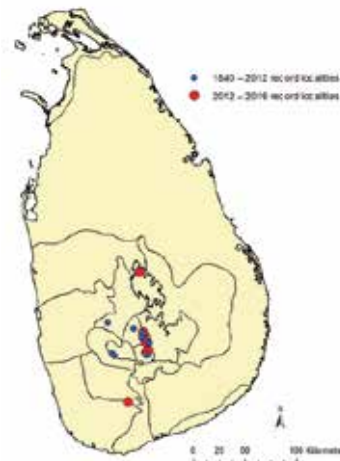
Flowering September to November

Habitat:

Gregarious in montane and sub-montane forests, 1000-2400 m

Localities:

Adam's Peak, Fishing Hut, Nuwara Eliya, Hakgala, Horton plains, Mandaram nuwara, Pidurutalagala, Kabaragala Estate



Strobilanthes viscosa* (Arn. ex Nees) T. Anderson var. *digitalis

Shrub, 0.5-1 m high.

Leaves - elliptic, tip - acuminate, base - cuneate, margin - serrate, above smooth and glabrous, beneath pubescent on the veins. Spikes usually solitary, axillary only, bracts shorter than the calyx. Corolla bluish violet. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 2. Exserted. Pollen globose, echinulate.

Flowering September to November

Habitat:

Rocky area in Lowland rain forest, 900-1000 m

Localities:

Lebanon Estate, Madulkelle, Bambarella, Knuckles, Gongala, Adam's Peak



Strobilanthes walkeri* Arn. ex Nees var. *walkeri

Undershrub 1-2 m high.

Leaves broadly elliptic, tip - acuminate, base - attenuate, margin - crenate, above darker glabrous, cystoliths numerous, beneath paler. Inflorescence - small dense head. Bracts ovate, obtuse tip, bullate, Corolla violet. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 4, exserted, pollen globose, echinulate. 4-seeded, seeds pilose with hairs.

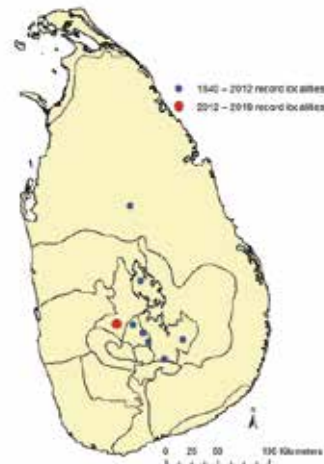
Flowering January to March

Habitat:

Near streams in low altitude and hill forests, 700-2200 m

Localities:

Ritigala, Haputale, Namunukula, Madulkele, Maturata, Hakgala, Piduratalagala, Haldummulla



***Strobilanthes walkeri* Arn. ex Nees var. *macroperma* J.R.I. Wood**

Shrub 0.5 - 1 m high.

Leaves lanceolate, tip – long acuminate, base – attenuate, margin – entire, above darker glabrous, cystoliths numerous, beneath paler. Inflorescence - small dense head. Bracts ovate, acute tip, bullate, Corolla White. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 4, exserted, pollen globose, echinulate.

Flowering October to November

Habitat:

Near streams in hill forests, 1200-1300 m

Localities:

Adam's Peak, Bogawanthalawa, Dothalugala

***Strobilanthes willsii* Canine**

Shrub, 1-1.5 m height.

Stem terete, nodes swollen. Leaves elliptic, tip – obtuse, base – decurrent, margin – serrate, mature leaves reddish above, above glabrous, below prominent white.

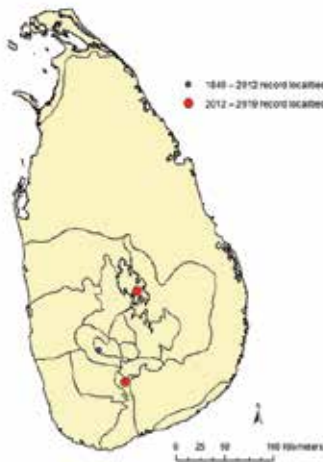
Inflorescence – terminal and axillary spikes. Flowers sessile. Bracts in opposite pairs, apex obtuse, longer than the calyx. Corolla white with prominent pink veins. Stamens 2, exserted. Pollen ellipsoid, ribbed.

Habitat:

Growing in rocky scrub in dry areas, 750 m

Localities:

Ritigala



***Strobilanthes zeylanica* T. Anderson**

Undershrub, 0.5 - 1 m high.

Stems stout, quadrangular, glabrous. Leaves broadly elliptic, tip – acute, base - cuneate, margin serrulate, above glabrous, beneath paler and smoother. Inflorescence of short dense pedunculate spike. Bracts glabrous, variable in shape and size. Corolla white with cobwebby hairs. Corolla tube abruptly campanulate from a narrow cylindrical base. Stamens 4, included, pollen ellipsoid, ribs.

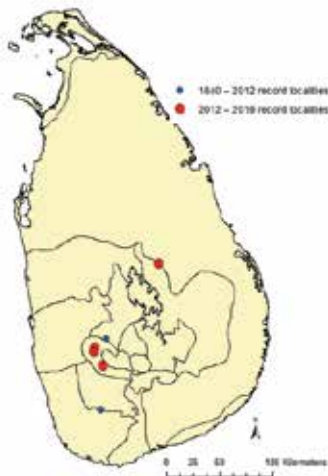
Flowering October to November

Habitat:

Along streams in lowland rain forest, 200-800 m

Localities:

Ambagamuwa, Kokool Korale, Sripadaya, Deraniyagala, Kukule ganga

***Strobilanthes* sp.**

Shrub, 1- 2 m.

Young stem rounded becoming quadrangular when old, much branched, branches hirsute. Leaves broadly elliptic, apex bluntly acuminate, bullate, base attenuate, margin dentate, decurrent on the petiole, hispid-pilose on upper surface. Flowers in oval-elongated heads. Bracts are arranged in well-spaced. Bracts broadly ovate, obtuse, concave, margin crenate with dotted glands densely covered with glandular-pilose, bracteoles absent. Corolla pale purple. Corolla tube gradually widened from the base. Stamens 4, included. 2-longer and 2-shorter. Pollen ellipsoid, ribbed.

Habitat:

Among rocks along streams, restricted to eastern slope of Knuckles Mountain, 230-240 m.

Localities:

Rambukoluwa



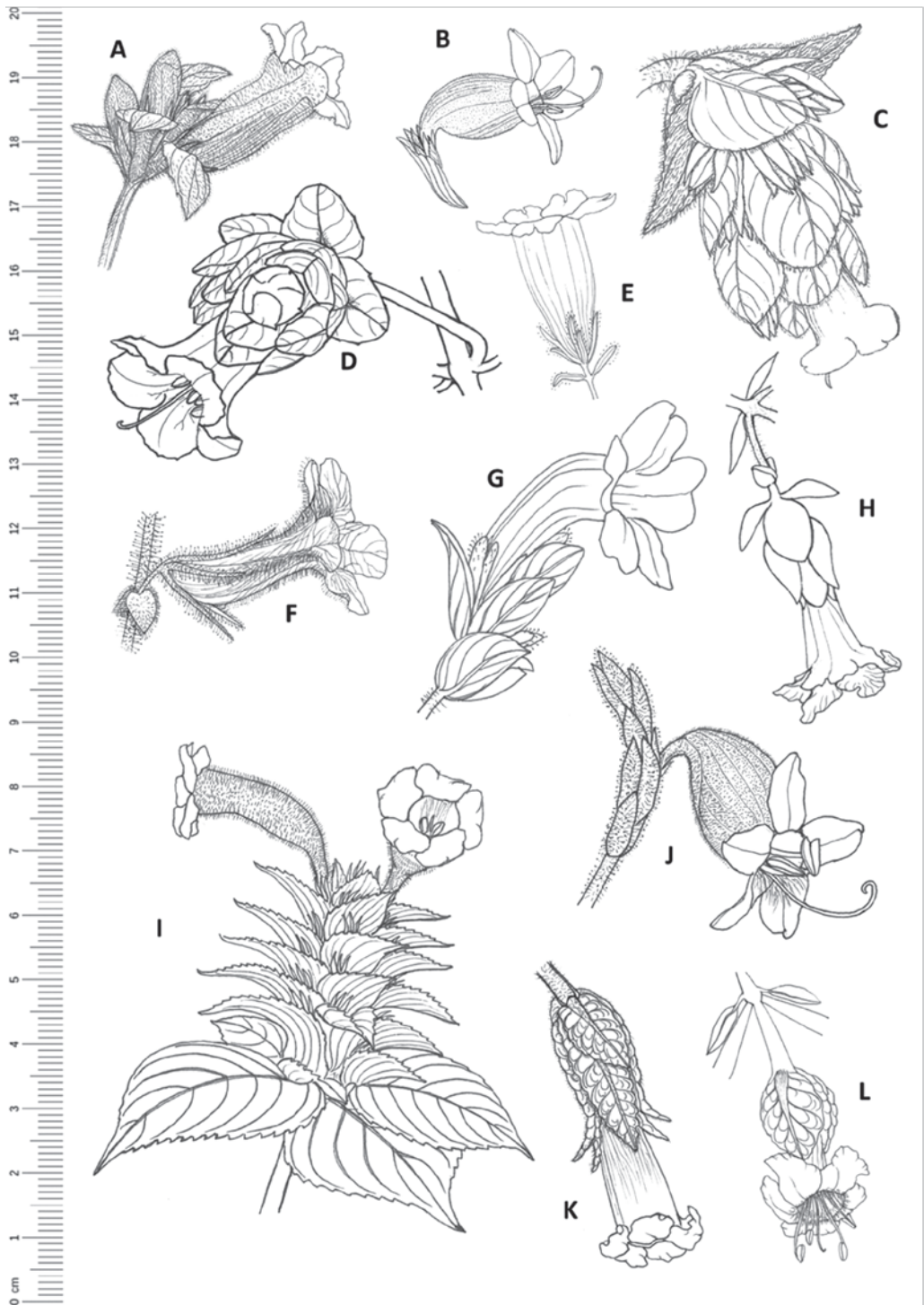


FIGURE 3 : Comparison of *Strobilanthes* Flowers - **A** - *S. anceps* var. *anceps*, **B** - *S. adenophora*, **C** - *S. calycina*, **D** - *S. hookeri*, **E** - *S. helicoides*, **F** - *S. pulcherrima*, **G** - *S. sexennis* var. *cerinthoides*, **H** - *S. lupulina* **I** - *S. zeylanica*, **J** - *S. viscosa* var. *viscosa*, **K** - *S. thwaitesii*, **L** - *S. walkeri*



FIGURE 4 : Comparison of *Strobilanthes* Flowers. **A** - *S. schomburgkii*, **B** - *S. arnottiana*, **C** - *S. cordifolia*, **D** - *S. diandra* var. *diandra*, **E** - *S. exserta*, **F** - *laxa*, **G** - *S. gossypina*, **H** - *S. habracanthoides*, **I** - *S. punctata*, **J** - *S. hamiltoniana*, **K** - *S. deflexa*, **L** - *S. nigrescens*, **M** - *S. stenodon*, **N** - *S. rhamnifolia*.



FIGURE 5 : Comparison of *Strobilanthes* Leaves - **A** - *S. arnottiana*, **B** - *S. anceps*, **C** - *S. gossypina*, **D** - *S. cordifolia*, **E** - *S. deflexa*, **F** - *S. diandra* var. *diandra*, **G** - *S. calycina*, **H** - *S. habracanthoides*, **I** - *S. exserta*, **J** - *S. adenophora*, **K** - *S. diandra* var. *densa*.

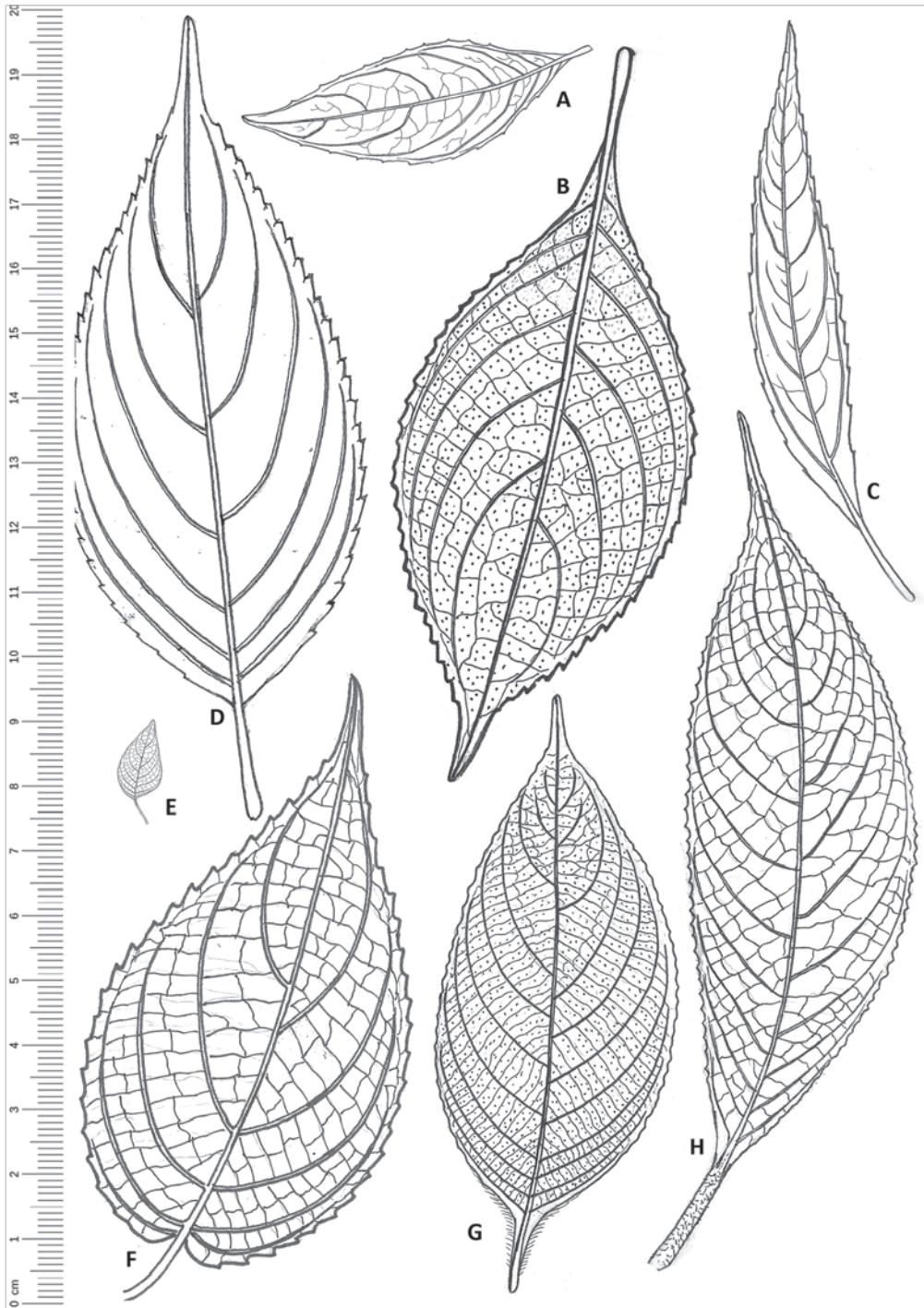


FIGURE 6 : Comparison of *Strobilanthes* Leaves. **A** - *S. helicoides*, **B** - *S. hookeri*, **C** - *S. laxa*, **D** - *S. hamiltoniana*, **E** - *S. punctata*, **F** - *S. laxa*, **G** - *S. lupulina*, **H** - *S. pulcherrima*.

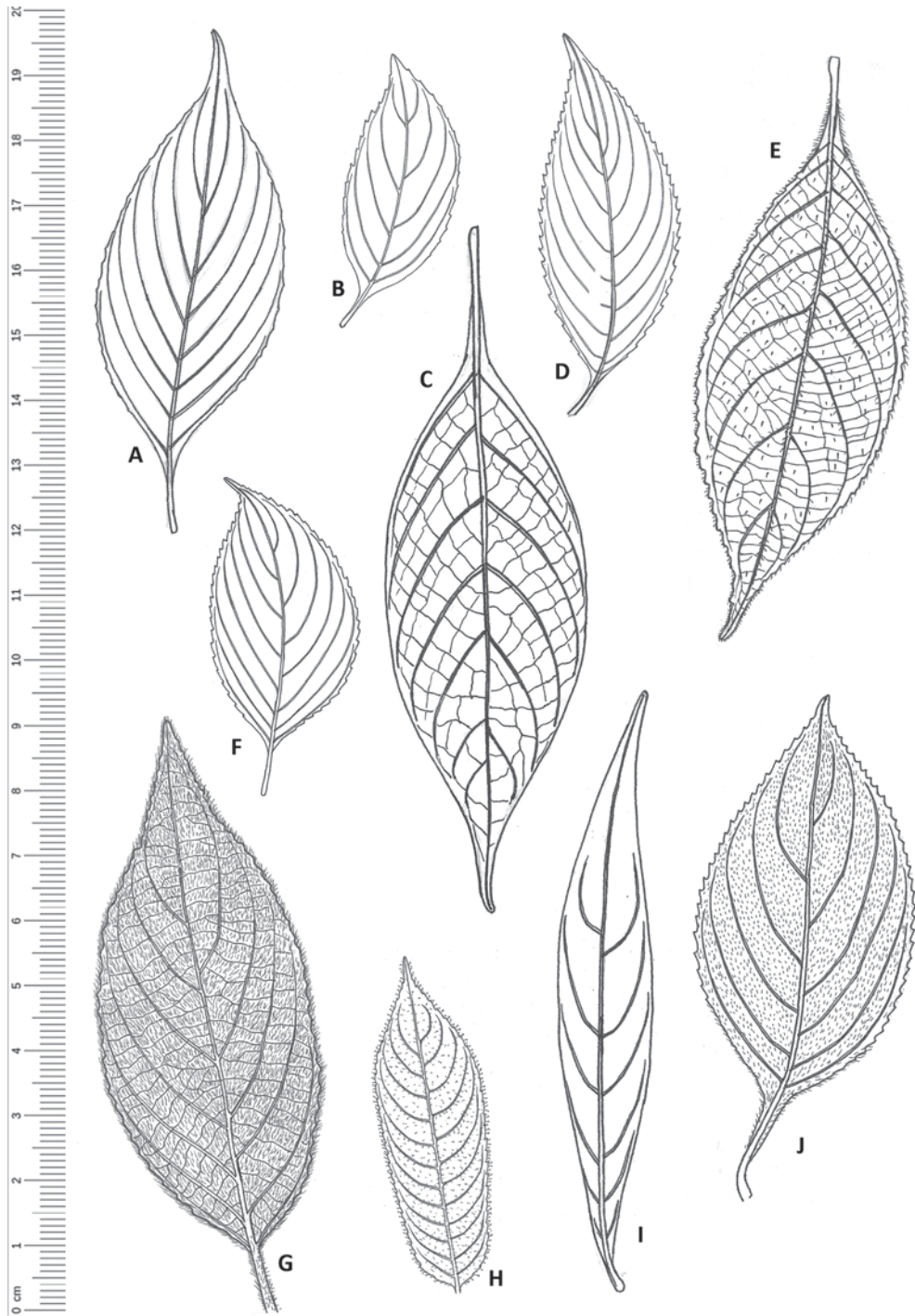


FIGURE 7 : Comparison of *Strobilanthes* Leaves. **A** - *S. stenodon*, **B** - *S. rhamnifolia*, **C** - *S. walkeri* var. *macroserma*, **D** - *S. sexennis* var. *sexennis*, **E** - *S. thwaitesii*, **F** - *rhamnifolia*, **G** - *S. vestita*, **H** - *S. sexennis* var. *hirsutissima*, **I** - *S. schomburgkii*, **J** - *S. viscosa* var. *viscosa*.

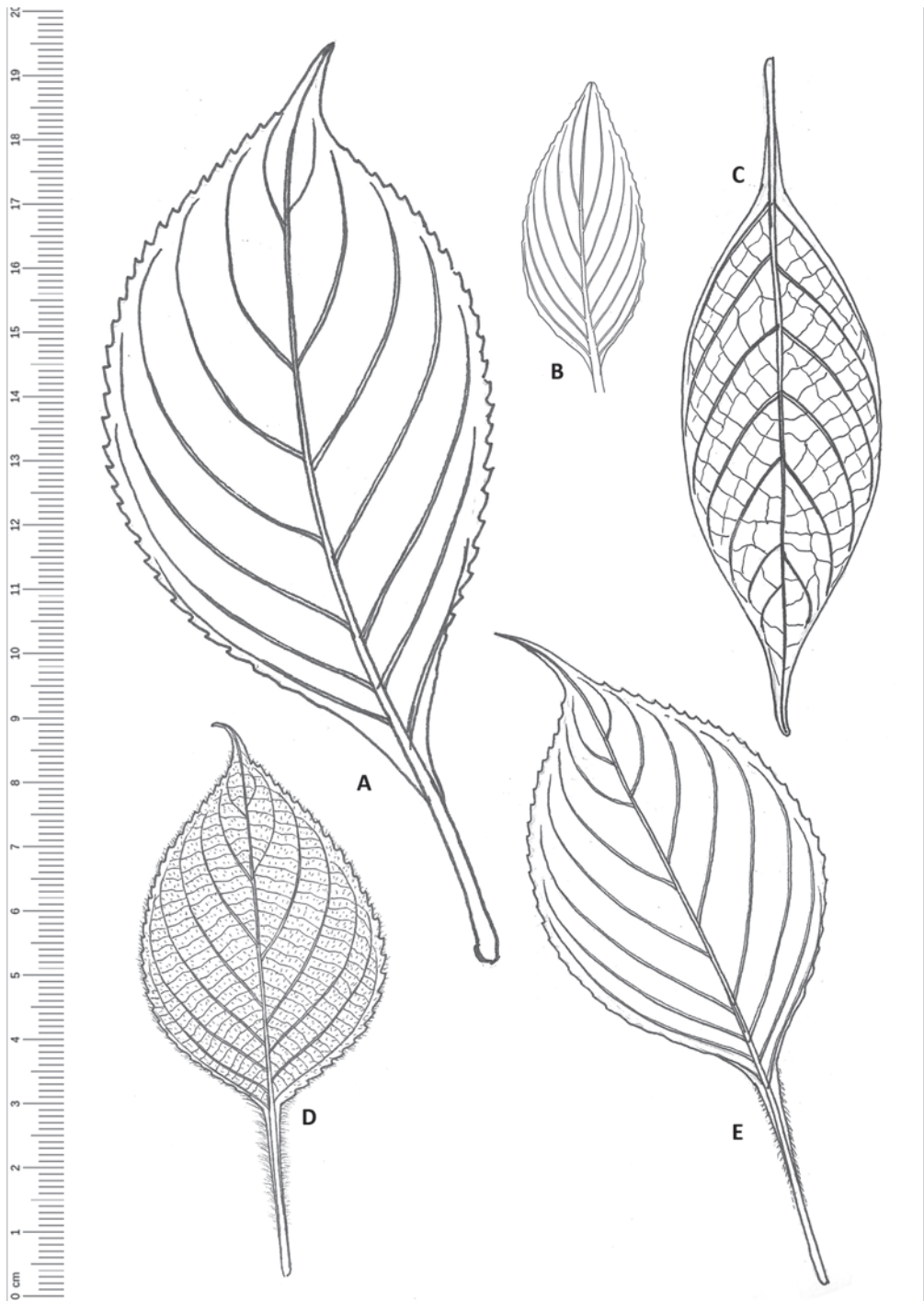


FIGURE 8 : Comparison of *Strobilanthes* Leaves. **A** - *S. zeylanica*, **B** - *S. willisii*, **C** - *S. walkeri* var. *macrosperma*, **D** - *Strobilanthes* sp. (Rambukoluwa), **E** - *S. walkeri* var. *walkeri*.

It was impossible to take photographs for seven species. *Strobilanthes caudata* has been already extinct and some species (*S. gardneriana*, *S. nockii*, *S. rhytisperma*) have not been recollected during many years. *S. willisii* was observed and collected flowering at last in 1995 and after that no one could be found flowering. *S. hypericoides* and *S. pentandra* are known only from the type collections made many years ago and they may have become already extinct as a result of their habitats being lost by a combination of factors; unsustainable agriculture and forestry practices, urbanization, pollution, land use changes, and the spread of invasive alien species and climate change. However, the species delimitation remains problematic, essentially because many species are poorly known and rarely collected, mainly because of their seasonal flowering pattern. Nevertheless, new species still remain to be discovered.

All *Strobilanthes* species have a rather restricted distribution in undisturbed montane and sub-montane forests and lowland rain forests of the island. *S. adenophora*, *S. habracanthoides*, *S. habracanthoides*, *S. nigrescens* and *S. zeylanica* are recorded only in lowland rain forests. *S. cordifolia* and *S. exserta* are recorded only on dry zones while *S. anceps*, *S. arnotiana*, *S. calycina*, *S. diandra*, *S. helicoides*, *S. hookary*, *S. laxa*, *S. nockii*, *S. pulcherrima*, *S. punctata*, *S. rhamnifolia*, *S. sexennis* and *S. stenodon* can be find in either montane or sub-montane forests or both. *Strobilanthes lupulina* can be find all forest types of Sri Lanka. When recorded locations of all species were mapped on floristic zones in Sri Lanka (Figure 2); foothills of Adam's Peak and Ambagamuwa has the highest species richness, whereas dry zone is the lowest compared to *Strobilanthes* recorded zones. Furthermore diversity and distribution of plants were affected by altitude. About 66% of *Strobilanthes* species from Sri Lanka belong to a threatened category, mainly because of the continued loss and fragmentation of natural habitats. Therefore special conservation plans should be implanted. This will help reduce the pressure on the forest and thus conserving the

natural environment. More research should be geared towards effects of climate and land use changes factors on vegetation establishment in this area as this will help in the management of landslide activities in these ecosystems.

RECCOMENDATIONS

Strobilanthes habitats are being lost by a combination of factors and 22 *Strobilanthes* species are under threatened according to the Red List of 2012. Therefore special conservation plans should be implanted. This will help reduce the pressure on the forest and thus conserving the natural.

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