RESULTS AND DISCUSSION

(a) Systematic Treatment


A shrub, up to 3 m high. Stem terete, quadrangular at the younger part, branches and upper petioles ciliate with simple long hairs and short glandular hairs. Leaves opposite, sessile to petiolate; petiole up to 4 cm long; lamina oblong, up to 13 x 6 cm, attenuate at base and decurrent into the petiole, undulate - crenate along the margins, acuminate at apex, lineolate-scabrous on both sides. Inflorescence slender, often bent; spike ovate, c. 2 x 1 cm, erect, sub-corymbose, very viscid. Bracts broadly ovate, 1.5 - 2 cm long, abundantly ciliate with simple long hairs and short glandular hairs, shortly and obtusely acuminate, herbaceous; bracteoles linear-spathulate, c. 7 mm long, pubescent all over, abundantly ciliate with simple long hairs and short glandular hairs. Calyx divided almost to the base, segments c. 1 cm long, unequal, narrow, linear-lanceolate, ciliate with many long hairs and glandular hairs, sparsely pubescent all over. Corolla c. 2 cm long, strongly dilated on the upper side of the tubular part; tube white, lobes with unequal segments. Stamens 4, didynamous; filaments included, ciliate, white; anthers blunt; pollen grains globose, acute angled. Ovary glabrous, provided with a few short glandular hair at the upper part; style and stigma filiform, white, glabrous, ovules 4 (2 in each cell). Capsules ovoid, tetragonal, 2 seeds aborted; seeds obovoid, broadly winged, glabrous.

Fl. & Fr.: February.
**Habitat:** In the forest area near Jog falls in Talguppa.

**Distribution:** Restricted to Central Western Ghats of Karnataka (Uttara Kannada) and is a narrow endemic. (Map 2a)

**Threat Status:** Critically Endangered [CR B2ab(iii)].

The taxon has been assigned 'Critically Endangered' category since area of occupancy is estimated to be less than 10 km², known to exist at only a single locality. It is known from a single collection.

**Pollen:** Spheroidal echinulate pollen.

**Note:** This species has not been collected after the type collection. The description is based on the protologue. When Sharma et al. (1984) and Ahmedullah & Nayar (1986) prepared the checklist for Karnataka and Endemic plants of the Indian Region (Peninsular Region) respectively, they included *Acanthopale jogensis* as well as the synonym *Strobilanthes jogensis* as separate entities. Although Ahmedullah & Nayar (1986) give the distribution of *A. jogensis* as Shimoga and Kanara, there is no evidence or collections to show the presence of the species in Shimoga. The protologue mentions its presence only at Jog falls in Uttara Kannada. *Type* material could not be traced or the photograph of *type* could not be traced.

*Acanthopale jogensis* is similar to *Strobilanthes ixiocephalus* in the shape and viscid nature of the spikes as well as in their spheroidal echinate pollen. However they differ from one another as *S. ixiocephalus* has robust branches, lilac coloured corolla and hairy seeds whereas *A. jogensis* has thinner branches, especially the flowering shoots which are scandant, white coloured corolla and glabrous seeds. Hence the two species are distinct.

An undershrub up to 1.5 m high. Stem sharply quadrangular, obscurely winged, stiff, almost glabrous, light green, nodes swollen, jointed and slightly hairy, internodal regions above the nodes pigmented. Leaves opposite, petiolate; petiole 2 - 5 cm long, shorter near apex; lamina elliptic-lanceolate, 7 - 16 x 3.2 - 7 cm, rounded to attenuate at base, strigosely ciliate along margins, acuminate at apex, coriaceous, glabrous above, sparsely hairy below, dark green above, glaucous below, cystoliths scattered on adaxial side; main veins in 4 - 6 pairs, depressed and white above, prominent below. Inflorescence 5 - 14 cm long, terminal spikes, often panicked and also often solitary. Bracts foliaceous, the lowest 2 or 3 pairs resembling the leaves, up to 12.5 x 6.5 cm, smaller above, ultimately becoming smaller than the calyx lobes; bracteoles linear-lanceolate, cucullate, 1.7 - 2.5 x 0.2 - 0.9 cm, acute at apex, ciliate along margins, with prominent midrib, almost glabrous. Flowers shortly peduncled; peduncle up to 1.2 cm long or sub-sessile. Sepals 4, outer sepals foliaceous, 3.7 - 4.7 x 2.2 - 2.8 cm, ovate-oblong, acute at apex; anterior one slightly smaller, sub-acute, glabrous and glaucous outside, slightly pubescent and pale green inside, midrib prominent, c. 4 pairs of main veins converging from base upwards; inner sepals linear.
- lanceolate, 1 - 1.6 x 0.2 cm, acuminate, glabrous outside at base and glandular hairy at apex, sparsely pubescent on inside, ciliate along margins. Corolla pink-mauve, c. 5.5 cm long, infundibuliform, tubular base c. 2.5 cm long, broadening upwards, lobes 2 - 3 cm long, glandular hairy on the outside, glabrous inside, lobes obovate with acute apex, veins visible, 2 upper lobes having elongated purple blotches extending from base of lobe, sometimes absent or present on all the 5 lobes. Stamens fertile 2, inserted on the corolla tube, slightly exserted; filaments c. 2.5 cm long, glandular hairy at base, glabrous above; anther lobes c. 2 mm long, oblong, parallel; staminodes 3, without anther lobes. Disc white, c. 1 mm thick. Ovary ovoid; style c. 4.6 cm long, glabrous; stigma subentire. Capsules ovoid to elliptic, 2 - 2.5 x 0.4 - 0.7 cm, acuminate at apex, glabrous, grey, 4-seeded; seeds suborbicular, 5 - 6 x 4 - 5 mm, dark brown to black, glabrous, subacute to obtuse at apex. (Plate la-e; Fig. 1a-i)

Fl. & Fr.: October - November.

Habitat: Found mostly growing on open hill tops or along slopes.

Distribution: Restricted to the Northern Western Ghats of Maharashtra (Satara, Pune) and is a narrow endemic. (Map 2a)

Threat Status: Endangered [EN B2ab(iii)].

The taxon has been assigned ‘Endangered’ category since area of occupancy is estimated to be less than 500 km², known to exist at no more than five localities. Two of the present localities, viz. Katraj Ghat and Saswad on Narayanpur road are projected as fragile. Road-widening activity at Saswad will threaten its habitat and further endanger its existence. It is therefore considered to be facing a very high risk of extinction in the wild.

It was earlier assigned the status of “Rare” by Sharma & Kulkarni (1988) and “Possibly Extinct” by Nayar (1996) and Mishra & Singh (2001).
Plate 1: *Barleria gibsonioides* Blatter — a. habit; b, c. flower, with purple blotches and without purple blotches, d, e. pollen, equatorial and polar view; *B. grandiflora* Dalzell — f. flowering twig; g, h. pollen, polar and equatorial view; *B. sepalosa* C. B. Clarke — i. fruiting twig
Fig. 1: *Barleria gibsonioides* Blatter – a. flowering twig; b, c. bracteole, dorsal, ventral view; d. calyx with bracteole; e, f. inner sepals, dorsal, ventral view; g. flower; h. capsule; i. seed

a) ● *Acanthopale jogensis*, ● *Barleria gibsonioides*; b) ● *B. grandiflora*; c) ● *B. involucrata* var. *elata*; d) ● *B. terminalis*
**Pollen**: Spheroidal in equatorial and sub-triangular in ambitus; large, variable, 100 - 107 x 89 - 108 μm; 3-zonocolporate, equidistant, brevi-colporate, broad, gradually tapering, furrow margin well defined, furrow membrane smooth; pores 3, central, equatorial, circular-lalongate, well defined, not protruding beyond the general surface, pore membrane smooth; exine very thick, 14 - 20 μm thick, open reticulate; reticulum homo-brochate; muri straight, simplibaculate; lumina polygonal (Chaubal, 1966; pers. obs.).

**Note**: *Barleria gibsonioides* is endemic to the state of Maharashtra. *B. gibsoni* Dalzell is the closest species and share a lot of characters with it. Therefore, these two species were compared. The type specimen of *Barleria gibsonioides* was studied at BLAT and the collections of *B. gibsoni* were studied at BLAT, BSI and MH. The protologues of both were also compared. The corolla in *B. gibsoni* has elongated dark purple blotches at the base on two corolla lobes, whereas there may or may not be purple blotches on the two corolla lobes in *B. gibsonioides*. The other differences between the two are in the inflorescence, bracts, sepals and seed colour. Critical observation of the collected specimens from Katraj Ghat and Saswad on the Narayanpur road, *type* and general collections of *B. gibsonioides* and *B. gibsoni*, showed that the smaller anterior sepal in *B. gibsoni* is obtuse at apex whereas in *B. gibsonioides* it is acute or sub-acute or slightly emarginated at apex. The collections made during the present study showed a greater resemblance to *B. gibsonioides* in the size and glaucous colour of the leaves, inflorescence size, flower colour and seed colour, but differed from it, in the inner sepals being glabrous at base, glandular hairs at the apex on the outside and sparsely pubescent on the inside instead of being glabrous. As for the purple blotches on the corolla lobes, the occurrence of the spots varied. In the same population or even on the same plant at Katraj Ghat, there were
flowers with and without the purple blotches. Whereas the population at Saswad on Narayanpur road showed some flowers with five purple blotches. When this same site was visited again the second time, the flowers observed had only two purple blotches. *B. gibsoni* was not collected and only herbarium collections were studied, since it has a wider distribution beyond Maharashtra and is nonendemic.

**Specimens examined:** **MAHARASHTRA:** **Pune:** Katraj Ghat, 01.01.1945, *H. Santapau* 5777 (BLAT); Katraj Ghat, November 1956, *R. M. M.* 9286 (BSI); Katraj Ghat, 02.10.1959, *Y. A. Merchant* 1354 (BLAT); Katraj Ghat, 06.10.2006, *M. E. Mascarenhas* 262 (GUH); Katraj Ghat, 03.11.2006, *M. E. Mascarenhas* 288, 289 (GUH); Narayanpur road before Saswad, 03.11.2006, *M. E. Mascarenhas* 294 (GUH); Katraj Ghat, 25.11.2007, *M. E. Mascarenhas* 447 (GUH); Narayanpur road before Saswad, 25.11.2007, *M. E. Mascarenhas* 449 (GUH). **Satara:** Godowli, near Panchgani, October 1927, *E. Blatter*, 2, 3, 5 & 7 (isotype); 4 & 6 (paratype) (BLAT!).

An undershrub, up to 1.5 m high. Stem obscurely quadrangular to terete, almost glabrous, except for a few small hairs at the nodes. Leaves opposite, short petioled; petiole up to 1.2 cm long, obscure due to decurrent leaf base; lamina elliptic-lanceolate, 14 - 18 x 5.5 - 6 cm, attenuate at base, entire, ciliate along margins, acuminate at apex, glabrous; main veins in 6 - 8 pairs, impressed on adaxial side, raised on abaxial side. Flowers solitary, axillary, opposite, sub-sessile; bracts foliaceous, the lower ones resembling the leaves, smaller above, ultimately smaller than the calyx lobes; bracteoles linear, 1.3 - 2.5 cm long, ciliate along margins, prominent midrib. Sepals 4; outer pair, herbaceous, ovate-broadly elliptic, 4.5 - 5 x 2.2 - 2.7 cm, unequal, the abaxial sepal smaller often emarginated, the larger one adaxial, acute at apex, ciliate along margins, glabrous, light green; prominently veined, c. 10 pairs of main veins divergent. Corolla white, c. 13.5 cm long, infundibuliform, minutely glandular hairy on the outside; tube c. 8 cm long, cylindric below, dilated in upper part; lobes 5, sub-equal, lobes obovate, obtuse, one lobe larger, forming a sort of lower lip, c. 4 x 2 cm; the remaining four lobes forming sort of an upper lip, the two central lobes smallest c. 3.5 x 1.5 cm, the peripheral lobes slightly broader c. 3.5 x 1.7 cm. Stamens 2 fertile, usually 2 staminodes and a 5th rudimentary staminode; filaments c. 5.5 cm long, filaments of staminodes c. 2.3 cm long, rudimentary filament c. 2 mm long, filaments almost glabrous; anther lobes bithecous, c. 1 cm long, oblong, parallel, staminodes without anthers. Disc present. Ovary oblong, glandular-pubescent, style c. 5 cm long, almost glabrous, stigma subentire, c. 2 mm long. Capsule shorter than the calyx, oblong, acuminate at apex, glandular pubescent, 4-seeded; seeds slightly compressed, orbicular, glabrous. (Plate 1 f-h; Fig. 2a-e)

Local Name: Safed Itari (Hindi).
Fig. 2: *Barleria grandiflora* Dalzell— a. habit; b, c. outer sepals, adaxial, abaxial (smaller); d. flower; e. corolla spread out showing stamens
Fl. & Fr.: October - February.

Habitat: An undershrub found mostly near dwellings, in the gardens or as a hedge. Also found in the wild, but could not be collected.

Distribution: From the Northern Western Ghats of Maharashtra to the Central Western Ghats of Karnataka. (Map 2b)

Threat Status: Vulnerable [VU B2ab (iii, iv)].

The taxon has been assigned ‘Vulnerable’ category since area of occupancy is estimated to be less than 2000 km², known to exist at not more than 10 localities. It was earlier evaluated as Critically Endangered for the Maharashtra region (Mishra & Singh, 2001). Both Ahmedulla & Nayar (1986) as well as Nayar (1996) have not listed it among the endemic species. During the present study it is evaluated as vulnerable. The present localities project a decline of the species in the wild and a shift to being found more in cultivation. It is therefore considered to be facing a high risk of extinction in the wild.

Pollen: Spheroidal in equatorial and sub-triangular in ambitus; large, variable, 86 - 157 x 96 - 152 µm; 3-zonicolporate, equidistant, brevi-colporate, broad, gradually tapering, furrow margin well defined, furrow membrane smooth; pores 3, central, equatorial, circular-lalongate, well defined, not protruding beyond the general surface, pore membrane smooth; exine very thick, 17 - 19 µm thick, open reticulate; reticulum homo-brochate; muri straight, simplibaculate; lumina polygonal (Chaubal, 1966; pers. obs.).

Note: According to the comment written by Raghavan on his herbarium (coll. no. 83244) at BSI, the plant is very rare and seen only near dwellings. The collections made during the present study were also mostly from cultivation and near dwellings, which shows that this species is found mostly in cultivation than in the wild. However
one collection during the study was made from the wild at Varand ghat. It was also
seen growing near a dwelling at Azra in Kolhapur district.

It is very similar to *Barleria lawii* Anderson, but can easily be distinguished
by its large corolla (c. 13.5 cm long) and acute or subacute corolla lobes. *B. lawii* on
the other hand has corolla c. 10 cm long, corolla lobes obtuse at apex and shows
prominent bluish-black coloured veins on drying.

*Barleria grandis* Hochst is used as a synonym for *B. grandiflora* Dalzell by
Almeida (2003). *B. grandis* has a glandular-pubescent stem; oblong-elliptic leaves;
nerves setulose abaxially and flowers triflorus below and uniflorus above. On the
other hand *B. grandiflora* has a glabrous stem; elliptic-lanceolate, glabrous leaves and
solitary flowers. Hence these two are treated as distinct.

**Specimens examined:** Goa: South Goa: Sanguem, Verlem, 28.10.2007, M. E.
Mascarenhas 428 (GUH); Karnataka: Shimoga: Agumbe, Kunddagudda,
15.10.1962, R. S. Raghavan 83244 (BSI). Uttara Kannada: Yellapur, 29.10.1884, W.
A. Talbot 1085 (BSI, MH); Karwar, Gooddhalli Peak, alt. 575 m, December 1920, Bell
152.17 (BLAT); Dandeli, 25.04.1950, s.l. s.n. (BLAT); Dandeli, banks of Kali nadi,
29.05.1954, s.l. s.n. (BLAT); Railway track on Anmode-Ramnagar road, 09.11.2005,
M. E. Mascarenhas 87 (GUH); Castle Rock, 11.02.2007, M. E. Mascarenhas & M. K.
Shendage 2508 (SUK). Raigad: Matheran, s. d., E. Blatter 23849 (BLAT); Matheran,
s. d., s. c. s. n. (MH).

*Barleria involucrata* Nees var. *elata* (Dalzell) C. B. Clarke in Hook. f. Fl. Brit. India

A shrub, up to 2 m high. Stem obtusely quadrangular to terete, swollen at nodes, prominent, hair strigose at older branches, appressed at younger. Leaves opposite, unequal; petiole 1.5 - 5 cm long, obscure due to decurrent leaf base, pubescent; lamina broadly elliptic-lanceolate, 10.5 - 12.5 x 4.2 - 7.2 cm, acuminate at both ends, entire, ciliate along margins, lineolate, more so on abaxial side, appressed hairy, more so on beneath, mainly on nerves; main veins 7 - 10 pairs. Inflorescence in unilateral racemose cymes (secund), sometimes a large terminal panicle; Flowers subsessile; bracts linear-lanceolate, c. 5 x 0.7 cm long, acuminate, prominent midrib, appressed hairy, more so on nerves beneath, longer than the calyx; bracteoles linear-lanceolate, 3.0 - 3.5 cm long, similar to bracts. Calyx divided almost to the base, appressed densely tomentose hairy; outer sepals unequal, elliptic-lanceolate, c. 4.5 x 1.2 cm, the longer one acuminate at apex, the shorter one often emarginate at apex, many nerved, diverging towards the apex; inner sepals nearly 2 cm long, narrowly linear - lanceolate, very acute, pubescent on the outside and with membranous ciliate
Corolla infundibuliform, purple with a reddish-puple tube, 6.5 cm long; tube reaching 3.5 cm long, cylindric below, dilated in the upper part, lobes 5, sub-equal, obovate, obtuse, one lobe larger, forming sort of a lower lip, almost oblong, 2 x 1.5 cm, other four lobes forming sort of an upper lip, each lobe 1.7 x 1.0 cm, glandular hairy on outer surface, hairy on inside at junction of stamens. Stamens 2 fertile, usually 2 staminodes, occasionally containing a little pollen, often a a 5th rudimentary staminode; filaments c. 3.5 cm long, filaments of staminodes c. 5 mm long, hairy at base; anthers oblong, c. 7 mm long. Disc large, cupular, half embracing the ovary, often with a toothed margin. Ovary c. 0.5 cm long, ovoid, two - celled; ovules 2 in each cell; style long; stigma sub-entire. Capsule elliptic, tapering at both ends, 2.6 - 3.1 x 0.9 - 1.2 cm, acute at apex, pubescent, above the upper half; seeds 4, ovate to sub-orbicular, 8 - 10 x 8 - 10 mm, obtuse to sub-acute at apex, black in colour, densely covered with long hairs. (Plate 2a-c; Fig. 3a-b)

Fl. & Fr.: October - April.

Habitat: A shrub, along outskirts of moist deciduous to semi-evergreen forests in thickets in Ghats in open places, sometimes under shade at high altitudes.

Distribution: Distributed throughout the Western Ghats, from the Northern Western Ghats of Maharashtra to the Southern Western Ghats of Kerala and Tamil Nadu. (Map 2c)

Threat Status: Near Threatened [NT].

The taxon has been assigned ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than 10 localities.

Pollen: Spheroidal in equatorial and sub-triangular in ambitus; large, variable, 108 - 167 x 101 - 152 μm; 3-zonicolporate, equidistant, brevi-colporate, broad, gradually tapering, furrow margin well defined, furrow membrane smooth; pores 3, central,
Plate 2: *Barleria involucrata* var. *elata* (Dalzell) C. B. Clarke – a. flowering twig; b. flower; c. pollen, equatorial view; *B. terminalis* Nees – d. habit; e. inflorescence; f. pollen, polar view; *Calacanthus grandiflorus* (Dalzell) Radlk. – g. habit; h. inflorescence; i, j. pollen, polar and equatorial view
Fig. 3: Barleria involucrata var. elata (Dalzell) C. B. Clarke – a. flowering twig; b. flower
equatorial, circular-lalongate, well defined, not protruding beyond the general surface, pore membrane smooth; exine very thick, 20 - 25 μm thick, open reticulate; reticulum homo-brochate; muri straight, simplibaculate; lumina polygonal (Chaubal, 1966; pers. obs.).

Note: Barleria involucrata var. elata differs from the typical variety as shown in the Table 3. Critical observation of the collections at MH reveals that the collections from Dakshina Kannada and Kodagu in Karnataka; Cannanore, Palghat, Trissur and Wyanad in Kerala; Nilgiris and Periyar in Tamil Nadu are B. involucrata var. elata whereas collection from Kollam, Thirunavanthapurum and Pathanamthitta in Kerala and Tirunelveli in Tamil Nadu show characteristics of the typical variety and hence are B. involucrata Nees var. involucrata.

Table 3: Differences in characters of Barleria involucrata var. involucrata and B. involucrata var. elata

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Character</th>
<th>B. involucrata var. involucrata</th>
<th>B. involucrata var. elata</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leaves</td>
<td>narrow elliptic</td>
<td>broadly elliptic-lanceolate</td>
</tr>
<tr>
<td>2</td>
<td>Hairs on nerves beneath</td>
<td>yellow strigose</td>
<td>appressed hairy</td>
</tr>
<tr>
<td>3</td>
<td>Racemes</td>
<td>few flowered</td>
<td>many flowered, secund</td>
</tr>
<tr>
<td>4</td>
<td>Bracts</td>
<td>shorter than calyx</td>
<td>longer than calyx</td>
</tr>
</tbody>
</table>

Specimens examined: Karnataka: Chikmagalur: Ballalarayanadurga, 08.02.1963, A. S. Rao 85317 (BSI); Ballalarayanadurga, 26.02.1963, R. S. Raghavan 86915 (BSI); Near Shankar falls, 10.10.1978, C. J. Saldanha & K. R. Keshava Murthy KFP-3344 (JCB); Charmadi Ghat, 13.11.1978, C. J. Saldanha & P. Prakash KFP4178 (JCB); on way to Dattatreya Petha, in open, 18.11.1978, A. L. Takhtajan, C. J. Saldanha & K. R. Keshava Murthy KFP-4640 (JCB). Dakshina Kannada: S. Canara ghats, 1866, R. H. Beddome Acc. no. 38485 (MH); S. Canara & Coorg, s. loc., s. d., s. c. Acc. no. 38611 (MH); Sampakatta, 13.01.1978, R. S. Raghavan 151604 (BSI); Shiradi Ghat, along
Keshava Murthy KFP6070 (JCB); 7 km after Jog Falls, 01.02.2006, **M. E. Mascarenhas** 175 (GUH). Castle Rock, 11.02.2007, **M. E. Mascarenhas & M. K. Janarthanam** 360 (GUH). **Kerala: Kannur**: Chandanathode, ± 790 m, 15.02.1978, **S. Ramachandran** 53976 (MH); way to Panoth, ± 550m, 13.11.1980, **V. S. Ramachandran** 58712 (MH); Kottiyoor, 220 m, 23.05.1995; 20.12.2003, **Biju & Joy** 10235 (FRLH). **Palghat**: Shola near Shribuck’s clearing, November 1883, s. c. 88492 (MH); Silent valley R F, 950 m, 10.10.1965, **E. Vajravelu** 26070 (MH); Shola below Ayyapan Kovil area, 800 m, 27.10.1976, **E. Vajravelu** 48728 (MH); Aruvampara R F, 06.12.1980, **N. C. Nair** 69144 (MH); Chemmanthimalai, Walayar, 680m, 18.12.1997, **Benjamin & A. Radha Krishnan** 21515 (FRLH). **Thrissur**: Poringalhuttu-Sholaiyai forest, 400 m, 25.11.1982, **K. Ramamurthy** 75526 (MH); **Wyanad**: Manantoddy, January 1884, s. c. Acc.no. 38494 (MH); s. loc., s. d., **R. D. Anstead** 83430 (MH); Chandanathode, Mananthavady, 06.12.1994, **E. S. Santhosh Kumar & C.M. Unnithan** 23212 (FRLH); Chandanathode, 28.11.2001, **Betty** 10593 (FRLH); Chandanathode, Mananthavady, 780 m, 20.12.2003, **Biju & Joy** 10076 (FRLH). **Maharashtra: Pune**: Bimashankar, s.d., **W. A. Talbot** 5032 (BSI). **Satara**: Mahabaleshwar to Pratapgad, 21.11.1902, **R. K. Bhide**, s.n. (BSI). **Sindhudurg**: Amboli ghat, 01.12.1982, **M. S. Kumbhojkar** 27490 (AHMA); Amboli, 05.11.2004, **M. E. Mascarenhas** 7 (GUH); Amboli, 21.01.2006, **M. E. Mascarenhas & M. K. Janarthanam** 140 (GUH); Amboli, Chaugol Rd., 07.10.2007, **M. E. Mascarenhas** 416 (GUH); Amboli, Chougol Rd., 21.01.2008, **M. E. Mascarenhas** 462 (GUH). **Thane**: Haligarh, Kedarnath slope, 17.11.1968, **K. V. Billore** 76242 (BSI). **Tamil Nadu: Nilgiri**: slopes of Neilgherries, s. d., s. c. Acc. no. 38494 (MH); Neilgherries, s. d., **G. Thomson** Acc. no. 38499 (MH); Coonoor ghat, September 1883, **J. S. Gamble** Acc. no. 38493 (MH); Coonoor


A shrub. Stem and branches densely villous, subtomentose upwards. Leaves only upper ones are present on the specimens; petioles 5 - 9 mm long, densely fulvous-hairy; lamina elliptic-lanceolate, c. 9 x 3 cm, shortly narrowed at base, acute, mucronulate at apex, covered with short yellow hairs on both surfaces, strigose above and fulvous below; main veins 6 - 8 pairs, prominent and strongly reticulate beneath. Flowers in 2 - 3 flowered axillary cymes or solitary, subsessile; peduncle almost 0; bracteoles lanceolate, 1.9 - 2.2 x 0.4 - 0.6 cm, ciliate along margins, acute at apex, hairy, rigid. Sepals 4, enlarged in fruit, yellow-villous, subtomentose; outer sepals ovate-elliptic, 3.8 - 4.4 x 0.4 - 1.9 cm, rounded at base, acute, apiculate at apex,
subscarious, with numerous prominent nerves showing reticulate venation, the shorter of the outer pair of segments sometimes 2-toothed at the apex; inner pair of sepals linear, c. 1.25 x 0.25 cm, acute at apex, densely hairy. Corolla not seen. Capsule oblong, 1.9 - 2.5 cm long, narrowed at both ends, glabrous. Seeds 6 x 6 mm long, broadly ellipsoid, flattened, obtuse, densely silky hairy. (Plate 1i)

**Fl. & Fr.**: September - February.

**Distribution**: Restricted to the Northern Western Ghats, ‘Konkan’ and is a narrow endemic.

**Threat Status**: Critically Endangered [CR B2ab (iii, iv)].

The taxon has been assigned ‘Critically Endangered’ category since area of occupancy is estimated to be less than 10 km², known to exist at only a single locality. It is known from a single collection. No threat status was assigned earlier to this species.

**Note**: This description is based on Clarke (1884) and Cooke (1905) as it could not be collected. It has not been collected after the type and there were no herbarium specimens in any of the local herbaria. Both Clarke and Cooke based their description on Gibson’s collection at Kew from ‘Konkan’. The photograph of the *Type* from Kew shows two flowering branches are pasted on the single sheet with bracteoles, calyx and capsules, but no flowers. Santapau (1952) states that it is similar to *B. gibsoni* Dalzell, but differs from it in the leaves, bracts and sepals.

This species shows a lot of similarity with *B. lawii* T. Anderson, but it is difficult to take taxonomic decision of merging them just by observing the scan of the type specimen.

**Specimens examined**: As in *type*.

A shrub, up to 1 m high. Stem obtusely quadrangular, sparsely strigose, nodes prominent. Leaves opposite, unequal in a pair. Petioles 0.8 - 8 cm long, obscure due to decurrent leaf base, strigose hairy; lamina broadly elliptic to elliptic - lanceolate to ovate-elliptic, 6.5 - 20 x 3.2 - 9 cm, attenuate at base, entire, strigose ciliate along margins, acuminate at apex, dark green above, paler below, lineolate and strigose hairy on both surfaces, mainly on nerves beneath, with long, often bulbous based hairs, cystoliths short, clearly visible; main nerves in 6 - 8 pairs. Inflorescences in terminal strigose hairy spikes, c. 6.5 cm long, often crowded at apex of branches; bracts and bracteoles similar, bracts elliptic-lanceolate, 2.6 - 2.9 x c. 0.65 cm, entire, ciliate along margins, acuminate at apex, strigose hairy, more so on dorsal side, not so prominently nerved; bracteoles lanceolate, 1.8 - 2.3 x c. 0.5 cm, entire, ciliate along
margins, short acuminate at apex, strigose hairy, more so on the dorsal side. Sepals 4; outer sepals herbaceous, ovate-elliptic, sub-equal, 2.9 - 3.6 x 1.2 - 1.8 cm, entire, ciliate along margins, densely strigose hairy, pubescent on ventral side, faintly many veined; anterior one slightly shorter and often emarginate at apex; posterior one slightly longer, sub-acute at apex; inner sepals ovate-lanceolate, c. 1.6 x 0.3 cm, ciliate along margins, acuminate at apex, thick, densely pubescent with appressed white silky hairs on both sides, glandular hairs on dorsal side towards the apex. Corolla bluish-purple, infundibuliform, 4.5 - 6 cm long, tube cylindrical at base, c. 2 cm long, paler than limb, widens above, 2.5 - 3 cm across, glandular hairy on outside; lobes glabrous, sub-equal, obovate-oblong, obtuse at apex; one lobe forming sort of lower lip, c. 1.8 x 1.6 cm and 4 lobes forming sort of upper lip, each lobe c. 1.8 x 1.3 cm. Stamens 2 fertile, staminodes usually 2, sometimes with a little pollen, often a fifth rudimentary stamen present; filaments c. 4.2 cm long, hairy at base, sparsely hairy to almost half the length; staminodes c. 8 mm long and of rudimentary stamen c. 6 mm long, filaments of staminodes and rudimentary stamen hairy all over; anthers lobes purple in colour, bithecous, oblong, parallel, 7 mm long. Disc large, cupular, half embracing the ovary, often with a toothed margin. Ovary c. 5 x 2 mm, hairy at apex; style long, filiform, c. 6.7 cm long, glabrous; stigma sub-entire, one aborted at apex; ovules 4. Capsule elliptic, 1.8 - 2.4 x 0.7 - 0.9 cm, acuminate at apex, glabrous, sparsely glandular hairy at apex, 4 seeded. Seeds broadly ovate, shining brown, 7 - 9 x 5 - 6 mm, with long hairs. (Plate 2d-f; Fig. 4a-q)

**Local name:** Kala Koranta (Marathi)

**Fl. & Fr.:** October - March.

**Habitat:** On road side or among lateritic stones or slopes above cut edges of roads. Frequent in open situations, sometimes in shade. Also found along stream banks.
Fig. 4: *Barleria terminalis* Nees – a. habit; b, c. bract, dorsal, ventral view; d, e. bracteole, dorsal, ventral view; f, g. adaxial sepal dorsal, ventral view; h, i. abaxial sepal dorsal, ventral view; j, k. inner sepal dorsal, ventral view; l. corolla; m. opened corolla showing stamens; n. fertile stamens; o. staminode; p. rudimentary stamen; q. gynoecium
**Distribution:** From the Northern Western Ghats of Maharashtra to Central Western Ghats of Karnataka. (Map 2d)

**Threat Status:** Near Threatened [NT]

The taxon has been assigned to 'Near Threatened' category since area of occupancy is estimated to be more than 20,000 km$^2$, known to exist at more than 10 localities.

**Pollen:** Spheroidal in equatorial and sub-triangular in ambitus; large, variable, 81 - 139 x 94 - 144 μm; 3-zonicolporate, equidistant, brevi-colporate, broad, gradually tapering, furrow margin well defined, furrow membrane smooth; pores 3, central, equatorial, circular-lalongate, well defined, not protruding beyond the general surface, pore membrane smooth; exine very thick, 10 - 20 μm thick, open reticulate; reticulum homo-brochate; muri straight, simplibaculate; lumina polygonal (Chaubal, 1966; pers. obs.).

**Note:** Although Nees (1847) as well as Dalzell & Gibson (1861) were the first to identify this species as *Barleria terminalis*, later authors treated it as a variety of *B. strigosa* Willd. until Malhotra & Moorthy (1981) reinstated it to the species level. It differs from *B. strigosa* in having the stem more strigose; spikes mostly terminal; bracts not reflexed and endemic to the Western Ghats. *B. strigosa* on the other hand, has stem less strigose; spikes axillary, often secund; bracts patently reflexed; ebracteolate; outer sepals broadly ovate-lanceolate, subcordate, sparsely hairy, distinctly reticulately veined and distributed in India and extending to Java and Malaya. In the present study, observations of collected specimens and available herbarium specimens of both species, confirm that *B. strigosa* and *B. terminalis* are indeed two separate entities and have to be treated as such.

**Specimens examined:** Goa: North Goa: Bardez, Camarcasana, 20.10.1972, K. Madathil 595 (JPH); Bardez, Cunchelim, 01.11.1972, K. Madathil 1005 (JPH);
Bardez, Corlim, 10.12.1972, *K. Madathil* 1247 (JPH); Bardez, Cunchelim, 02.12.1973, *K. Madathil* 2283 (JPH); Bardez, Duler, 10.02.1974, *K. Madathil* 2372 (JPH); Satari, Vageri fort, 19.11.2005, *M. E. Mascarenhas* 102 (GUH); Ponda, Bondla Sanctuary, 27.12.2005, *M. E. Mascarenhas* 116 (GUH); Ponda, Bondla, 28.01.2007, *M. E. Mascarenhas* 329 (GUH); Valpoi, Nagargao, 06.01.2008, *M. E. Mascarenhas* 502 (GUH). **South Goa:** Sanguem, Molem-Anmode, 19.10.1997, *M. K. Janarthanam*, V. C. Joshi & S. Rajkumar 1137 (GUH); Sanguem, 8 km before Molem, 09.11.2005, *M. E. Mascarenhas* 84, 85, 86 (GUH); Canacona, Amebghat, 15.11.2005, *M. E. Mascarenhas* 93, 95 (GUH); Sanguem, Verlem, 15.11.2005, *M. E. Mascarenhas* 99 (GUH); Sanguem, Verlem-Salgini, 24.01.2006, *M. E. Mascarenhas* 153 (GUH); Sanguem, Molem-Anmode road, 11.02.2007, *M. E. Mascarenhas* & *M. K. Janarthanam* 351 (GUH); Canacona, Tudal, 28.10.2007, *M. E. Mascarenhas* 419 (GUH); Sanguem, Verlem, 28.10.2007, *M. E. Mascarenhas* 427 (GUH); Canacona, Tudal, 26.01.2008, *M. E. Mascarenhas* 475 (GUH). **Karnataka:** Uttara Kannada: N. Kanara, s. loc., 1887, W. A. Talbot 7274 (BSI); Anmode, 22.04.1966, V. D. Vartak 23233 (AHMA). **Maharashtra:** Kolhapur: Shelap, s. d., *M. M. Sardesai* mmS-1016 (SUJ); s. loc., s. d., *M. M. Sardesai* mmS-1491 (SUJ); Dajipur, 26.11.1996, *M. M. Sardesai* mmS-670 (SUJ); Dajipur, 29.11.1996, *M. M. Sardesai* mmS-299 (SUJ); s. loc., s. d., *M. M. Sardesai* mmS-994 (SUJ); s. loc., s. d., *M. M. Sardesai* mmS-1211 (SUJ). **Pune:** Lonavala, 09.11.1907, G. A. Gammie 10807 (BSI); Raigad, s. d., V. D. Vartak 5863 (MACS); Khandala, St. Xavier's Ravine, October 1918, s. loc. 28096 (BLAT); Khandala, November 1926, R. D. Acland ACK 941 (BLAT); Khandala, alt 600m, 01.11.1941, *H. Santapau* 159.40° (BLAT); Khandala, Echo Pt.-Sausages, 20.10.1942, *H. Santapau* 1156 (BLAT); Khandala, St. X. V.-foot of Behran's Plat., 01.10.1943, *H. Santapau* 2786 (BLAT); Khandala-Saddle, 02.10.1943, *H. Santapau*.
2850 (BLAT); Khandala, Behran’s Plat., 03.10.1944, *H. Santapau* 5047 (BLAT); Khandala, C. H.-Forbay-Bhoma Top, 20.11.1948, *H. Santapau* 9511 (BLAT); Khandala, Monkey hill Plat., 29.10.1949, *H. Santapau* 10488 (BLAT); Khandala, St. Xavier’s Villa-Echo Pt., 06.11.1951, *H. Santapau* 13862 (BLAT); Khandala, 31.10.1954, Z. J. Kapadia ZK808 (BLAT); Khandala, St. Xavier’s Villa-Echo Pt. Ravine, 25.01.1957, *J. A. Merchant* 860 (BLAT); Khandala (old ry. Line), 22.10.1958, S. C. Tavakari T1985 (BLAT); Khandala, Monkey Pt.-Hart Pt., 21.10.1959, N. A. Irani NI4701 (BLAT); Khandala, St. Xavier’s Ravine near pipes, 31.03.2007, *M. E. Mascarenhas* 373 (GUH). **Raigad:** Matheran, s.d., T. Cooke, s. n. (BSI); Matheran, 03.11.1907, *H. P. Paranjape* s. n. (BSI); Matheran, Waterpipe-Matheran (railway line), 20.10.1959, *N. A. Irani* NI 4742 (BLAT). **Satara:** Mahabaleshwar, s. d., T. Cooke 55451 (BLAT); Mahabaleshwar to Pratapgad, 07.11.1902, R. K. Bhide s.n. (BSI); Mahabaleshwar, Fitzgerald Ghat, October 1924, R. D. Acland ACK943 (BLAT); Mahabaleshwar, beyond Dhobi’s Falls, 21.10.1951, P. V. Bole Bole364 (BLAT); Mahabaleshwar, Fitzgerald Ghat, 22.12.1954, P. V. Bole Bole1274 (BLAT); Mahabaleshwar, Fitzgerald Ghat, 06.01.1959, P. V. Bole 1882 (BLAT); Mahabaleshwar, on way to Lodwick Pyt, 07.11.1959, P. V. Bole 2286 (BLAT); Mahabaleshwar, Mahad Rd., 31.12.1960, P. V. Bole 2428 (BLAT); Vasota, January 1994, M. P. Bachulkar-Cholekar 5835 (SUK); Pali, March 1995, M. P. Bachulkar-Cholekar 20374 (SUK). **Sindhudurg:** Amboli Ghat, October 1885, G. M. Woodrow s. n. (BSI); Danoli, Belgaum to Vengurla Rd., 30.12.1907, R. K. Bhinde s. n. (BSI); Amboli ghat, 01.12.1982, M. S. Kumbhojkar 27486 (AHMA); Amboli, 05.11.2004, *M. E. Mascarenhas & M. K. Janarthanam* 8 (GUH); Amboli, 21.01.2007, *M. E. Mascarenhas* 304 (GUH); Amboli, 06.10.2007, *M. E. Mascarenhas & M. K. Janarthanam* 413 (GUH).

An erect shrub. Stem quadrangular, sulcate, glabrous, swollen and bent above node. Leaves opposite, unequal, upper sub-sessile, lower petiolate; petioles 1 - 4.5 cm long, obscure due to decurrent leaf base, glabrous; lamina elliptic, 8 - 16 x 3 - 6.5 cm, acute at base, entire along margin, ciliate, acuminate at apex, sparsely scabrous adaxially, glabrous abaxially, strongly lineolate on both surfaces; main nerves in 9 - 14 pairs, prominent and raised, curved upwards. Flowers in axillary and terminal
spikes, peduncle 1.5 - 8 cm long glabrous, with one or two nodes with bracts; spikes 1.5 - 8 cm long; bracts c. 2 x 0.75 cm, elliptic-lanceolate, penninerved; bracteoles c. 1.5 x 0.3 cm, oblong-lanceolate, bracts and bracteoles densely ciliate with long white hairs on inner side. Calyx c. 1.2 cm long, divided nearly to the base, the longest segment c. 3.0 mm wide, lanceolate, five-nerved, the two ventral segments narrower, lanceolate, three-nerved, the two lateral segments linear-subulate, shorter than the others, segments densely ciliate with long white hairs on inner side. Corolla bluish-purple, c. 4 cm long, hairy outside, bi-lipped; upper lip two-lobed; lower lip three-lobed, palate convex, transversely plicate and with two rows of bright yellow hairs along centre; narrow portion of tube short. Stamens four, didynamous; inserted above the middle of the tube; filaments glabrous, connate at the base, in pairs connected by a transverse line; anthers two celled, subequal, sagittate, ciliate. Disc c. 2 mm broad, white, not prominent. Ovary hairy, two-celled; ovules two in each cell; style long, filiform, hairy; stigma simple, linear. Capsules 1.9 - 2.2 x 0.8 cm, obovoid, compressed, narrowed at base, acute at apex, pubescent. Seeds c. 8 mm across, hairy.

(Plate 2g-j; Fig. 5a-i)

**Local name:** Pandhra Karva (Marathi)

**Fl. & Fr.:** October - April.

**Habitat:** Found on hill slopes or near small streams of the hill slopes at high altitudes. Not so gregariously found as those of genus *Strobilanthes*.

**Distribution:** From the Northern Western Ghats of Maharashtra to the Central Western Ghats of Karnataka. (Map 3a)

**Threat Status:** Near Threatened [NT]

The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than 10 localities.
Fig. 5: *Calacanthus grandiflorus* (Dalzell) Radlk. – a. habit; b, c. bract, dorsal, ventral view; d, e. bracteole, dorsal, ventral view; f. calyx; g. corolla; h. androecium; i. gynoecium

a) • *Calacanthus grandiflorus*; b) • *Dicliptera ghatica*, • *D. nasikensis*; c) • *Eranthemum capense* var. *concanensis*; d) • *Gymnostachyum febrifugum*
Pollen: Shape in equatorial view prolate, ambitus subtriangular, medium in size, 48 - 71 x 35 - 53 µm, porate, central, circular, conspicuous pore, membrane smooth, exine differentiated into pseudocolpi and ridges; ridges broad at one end and tapering towards the other, converging together in circumpolar region, ridges punctuate, thick band in circumpolar region (Pers. obs.).

Note: This monotypic genus is an elegant shrubby plant, with distinct leaves and flowers, in solitary small patches. Plants at Ambolim were observed at two locations on the side of the hill slope at a higher altitude near the sides where water flows. At Wageri too, there were a few plants at one spot under similar conditions. The stem, leaves and flowers turning black on drying.


A herb, up to 60 cm high, erect, branched, rooting at lower nodes. Stem obtusely tetragonal, densely woolly tomentose when mature. Leaves opposite; petiole up to 2.5 cm long, densely woolly tomentose, with a groove on adaxial side, obscure due to decurrent leaf base; lamina ovate to ovate-elliptic, 3.5 - 10 x 1.8 - 5.5 cm, attenuate at base, entire, ciliate along margins, acuminate at apex, pale green, sparsely pubescent below, more so on nerves, sparsely hairy above, mainly on midrib, younger leaves more pubescent, cystoliths visible in dry leaves; main veins in 5 - 6 pairs, curved upwards, prominent on both sides. Inflorescence axillary and terminal umbels or panicked umbels, often 2 from the axil, sometimes clustered at later stage. Inflorescence axis usually distinct, up to 2.3 cm long, woolly tomentose; bracts at the apex of inflorescence axis linear, 3 - 8 mm long, spreading outwards, with long spreading hairs, yellowish; each umbel has 3 - 5 inflorescence units; each inflorescence unit borne on a peduncle; peduncle 2 - 25 mm long, woolly tomentose; floral bracts in pairs, each enclosing c. 4 flowers, bracts unequal; abaxial floral bract suborbicular, obovate to elliptic, 11 - 11.5 x 9 - 11 mm, apiculate at apex; adaxial bract ovate to elliptic to obovate, c. 14.5 x 8 - 9 mm, acute or acuminate at apex, both bracts tomentose, ciliate with long hairs, strongly many nerved, nerves convergent; bracteoles linear-lanceolate, 4 - 4.5 mm long, ciliate with long hairs along margins, acuminate at apex; secondary bracteoles similar to primary, c. 2 mm long. Calyx c.
5.5 mm long, 5 lobed, divided to about two-third the length; segments unequal, subulate, hairy, ciliate. Corolla light pink, resupinate, 17 - 20 mm long, hairy outside; tube *c.* 7 mm long, cylindric, glabrous, upper part slightly enlarged, *c.* 4 mm long, sparsely hairy; bilipped, *c.* 6 mm long, nervèd; upper lip *c.* 6 mm long, entire to notched; lower lip *c.* 9 mm long, three-lobed; each lobe *c.* 2 mm long, obtuse. Stamens 2, slightly shorter than the upper lip, inserted at the throat; filaments *c.* 7 mm long, hairy all over; anther lobes oblong, *c.* 1 mm long, superimposed. Disc copular, *c.* 0.75 mm broad, prominent, obliquely truncate, dentate. Ovary *c.* 2 mm long; style *c.* 14 mm long, sparsely hairy; stigma bifid. Capsule orbicular to obovate, 5.5 - 6.5 x 4 - 4.5 mm, woolly tomentose, with non-glandular hairs all over, stipitate, stalk *c.* 1 mm long; placentas separating elastically from the base of the capsule on dehiscence, to disperse the seeds. Seeds 4, orbicular-ovate, 2 - 3.5 x 2 - 3.5 mm, thinly tuberculate mainly along margin. (Plate 3a-d; Fig. 6a-o)

**Fl. & Fr.**: December - April.

**Habitat**: In a forest clearing at Meroli plateau, Khandala and along dried nullah in ravines near St. Xavier’s Villa. In the nullah, the associated species are *Barleria prionitis* L., *B. terminalis* Nees, *Strobilanthes callosus* Nees, *Celosia argentea* L., *Haplanthodes verticillata* (Roxb.) Majumdar, *Lepidagathis cuspidata* (Wall.) Nees, *Rhinacanthus nasutus* Kuntze and grasses.

**Distribution**: Restricted to the Northern Western Ghats of Maharashtra and is a narrow endemic. (Map 3b)

**Threat Status**: Endangered [EN B2ab(iii)].

The taxon has been assigned ‘Endangered’ category since area of occupancy is estimated to be less than 500 km², known to exist at not more than five localities. Populations in the type locality could not be located thus indicating decline in area
Plate 3: *Dicliptera ghatica* Santapau – a. habit; b. flowering twig; c, d. pollen, polar and equatorial view; *D. nasikensis* Lakshmin. & Sharma – e. flowering twig; f, g. pollen, polar and equatorial view; *Eranthemum capense* L. var. *concanensis* (C. B. Clarke) Santapau – h. habit; i. flowering twig; j, k. pollen, equatorial and polar view
Fig. 6: *Dicliptera ghatica* Santapau – a. habit; b. common bract at base of inflorescence; c, d. adaxial bract, dorsal, ventral view; e, f. abaxial bract, dorsal, ventral view; g. primary bracteole; h. secondary bracteole; i. calyx; j. corolla; k. corolla spread out showing stamens; l. stamen; m. gynoecium; n. capsule; o. seed
and number of locations. The present locality is projected as very fragile as any landslide will threaten its habitat and further endanger its existence. It is therefore considered to be facing a very high risk of extinction in the wild.

It was considered endemic to Khandala in the Pune District (Maharashtra) and was evaluated as Critically Endangered (Mishra & Singh, 2001). The present collection has helped to change its threat status to Endangered.

**Pollen:** Ellipsoidal, prolate in equatorial view, subtriangular in ambitus. Medium in size. 46 - 51 x 25 - 33 μm in size; Colpi 3-zonicolporate, equidistant, broad in the middle, gradually tapering towards the poles, acute at ends, margins well defined, furrow membrane smooth. Pores 3, central, equidistant, conspicuous, protruding beyond the general surface, pore membrane smooth. Exine differentiated into pseudocolpi and ridges; pseudocolpi 6, 2 in each mesocolpium alternating with ridges, pseudocolpar extension polar, acute at ends, margins well defined, membrane smooth; ridges areolate, extending and converging at the poles (Chaubal 1966; pers. obs.).

**Note:** The *Type* specimen was collected from Khandala, Meroli Plateau on 20.04.1943 by Santapau. He later collected it again from Khandala, at the nullah near pipes at St. Xavier's Ravine on 29.03.1951 and once more from the type locality on 17.02.1957. Subsequently, no fresh collections have been made. During the present study, fresh collections were made from the same locality, i.e., Khandala, nullah near pipes at St. Xavier's Ravine on 31.03.2007, after a gap of 50 years. It was found on both the sides of this dried up nullah. As the flowering season proceeds the large lower leaves are shed and only the smaller ones at the apex of stem are seen. Live specimens were collected (the same population as that of collection no. 372) and grown at Goa for observations. There are no differences between cultivated and wild specimen.
Three collections (coll. nos. 21802, 22836 and 1459) at Blatter Herbarium initially identified as *Dicliptera zeylanica* Nees, were later identified as *D. ghatica* by Almeida. These collections on critical analysis in the present study are found to belong to *D. foetida* Blatter. These wrong identifications might have made Almeida (2003) to reduce *D. ghatica* to a variety of *D. foetida* as they were shown to differ only in their degree of hairiness.

Critical morphological, palynological and seed micromorphological studies of *D. ghatica* and *D. foetida* reveal that both are distinct entities and hence *D. ghatica* has been reinstated as a distinct species (Table 4).

Table 4: A comparison of the characters of *Dicliptera ghatica* and *D. foetida*.

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Plant part</th>
<th><em>Dicliptera ghatica</em></th>
<th><em>Dicliptera foetida</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stem</td>
<td>erect, branched, densely woolly tomentose</td>
<td>prostrate or sub-scandant, glabrous or hairy or sometimes densely woolly</td>
</tr>
<tr>
<td>2</td>
<td>Peduncle</td>
<td>2 - 25 mm long</td>
<td>2 - 7 mm long</td>
</tr>
<tr>
<td>3</td>
<td>Flower colour</td>
<td>light pink</td>
<td>pink or rose-coloured</td>
</tr>
<tr>
<td>4</td>
<td>Hair on calyx</td>
<td>non-glandular</td>
<td>glandular</td>
</tr>
<tr>
<td>5</td>
<td>Hair on capsule</td>
<td>non-glandular</td>
<td>glandular and non-glandular</td>
</tr>
<tr>
<td>6</td>
<td>Seeds</td>
<td>non glochidiate</td>
<td>glochidiate</td>
</tr>
<tr>
<td>7</td>
<td>Short rods on seed surface</td>
<td>absent</td>
<td>present</td>
</tr>
</tbody>
</table>

Specimens examined: Maharashtra: Pune: Khandala, March 1917, *E. Blatter* 22836 (BLAT); Khandala (nullah near pipes), 29.03.1951, *H. Santapau* 12358 (BLAT); Khandala, Meroli Plat., 17.02.1957, *H. Santapau* 21856 (BLAT); Khandala (nullah near pipes at St. Xavier’s Ravine), 31.03.2007, *M. E. Mascarenhas* 372 (GUH); Khandala (nullah near pipes at St. Xavier’s Ravine), 24.11.2007, *M. E. Mascarenhas* 432 (GUH); Grown in Goa, 05.12.2007, *M. E. Mascarenhas* 454 (GUH).

A small, much branched, woody herb. Stem 4 - 6 angled, grooved, green, shortly hispid hairy. Leaves opposite; petioles 0.5 - 1.0 cm. long, obscure due to decurrent leaf base; lamina ovate-elliptic, 1.5 - 3.5 x 1.0 - 2.5 cm, tapering at base, ciliate along margins, acute-subacute at apex, sparsely hairy, mainly on nerves beneath, cystoliths visible in dry leaves. Inflorescence axillary as well as terminal umbels, often lax, panicked umbels, generally one, sometimes two in the axils of the leaves; inflorescence axis up to 2.5 cm long, hispid hairy; bracts at the apex of the inflorescence axis ovate, 3.5 - 5 mm long, ciliate along margins, acuminate at apex; each umbel has c. 3 inflorescence units; each inflorescence with a short peduncle, almost sub-sessile; peduncle 2 - 3 mm long; floral bracts in pairs, each enclosing c. 5 flowers; bracts unequal, adaxial bract slightly bigger, elliptic to oblanceolate, c. 10 x 4 mm, ciliate with long hairs and few short glandular hairs along margins, mucronate at apex, sparsely hairy on dorsal side, mostly on the midrib, more so on the ventral side with short glandular hairs as well as short hairs; abaxial bract smaller c. 8 x 2.5 mm, elliptic, similar to adaxial bract; bracteoles c. 6 mm long, linear-lanceolate, ciliate along margins, acuminate at apex, glandular hairy on both sides; secondary bracteoles c. 5 mm long, similar to the primary bracteoles. Calyx c. 6 mm long, divided almost to the base, hairy; segments 5, unequal, c. 5 mm long, linear-lanceolate, ciliate with long and short hairs, acuminate at apex. Corolla bright pink or rose coloured, resupinate, c. 22 mm long, hairy on the outside, with 2 rows of hairs inside on the tube to guide the style; tube c. 5 mm long, cylindric, upper part slightly enlarged, c. 3 mm; limb bi-lipped, c. 11 mm long; upper lip ovate to broadly elliptic,
slightly knotched to form a two-lobed lip; lower lip broad, spreading, shortly three-lobed, prominently veined; each lobe oblong, c. 1 mm long, middle one slightly broad. Stamens 2, shorter than the upper lip, inserted at the throat; filaments pink, c. 7 mm long, flattened and hairy all over; anther lobes dark pink, c. 1 mm long, superimposed, oval. Disc cupular, c. 1 mm broad, prominent, obliquely truncate, dentate. Ovary c. 2 mm long, style pink, c. 15 mm long, sparsely hairy; Stigma bifid. Capsule obovate, c. 7 x 3 mm, truncate, apiculate at apex, glandular hairy all over, stipitate, stalk c. 2 mm long; placentas separating elastically from the base of the capsule on dehiscence, to disperse the seeds. Seeds 4, almost orbicular with a slight notch, c. 1.5 x 1.5 mm, reticulate surface, tuberculate, tubercules glochidiate, brown in colour. (Plate 3e-g; Fig. 7a-r)

Fl. & Fr.: January - May.

Habitat: A woody herb in a fallow land in shade of *Madhuca* trees at Nasik (Dang Saundra) whereas at Kolhapur (Arboretum at Panhala), it is found growing in the open lateritic ground under dry conditions. (Map 3b)

Distribution: Restricted to the Northern Western Ghats of Maharashtra.

Threat Status: Endangered [EN B2ab (iii)].

The taxon has been assigned 'Endangered' category since area of occupancy is estimated to be less than 500 km², known to exist at not more than five localities and populations in the type locality could not be located thus indicating decline in area and number of locations. Constant weeding of the present locality at the Panhala arboretum presents a threat to the existence of the species. It is therefore considered to be facing a very high risk of extinction in the wild.

Pollen: Ellipsoidal, prolate in equatorial view, subtriangular in ambitus. Medium in size. 38 - 51 x 25 - 33 µm in size; Colpi 3-zonicolporate, equidistant, broad in the
Fig. 7: Dicliptera nasikensis Lakshmin. & Sharma – a. habit; b, c. common bract at base of inflorescence dorsal, ventral view; d, e. adaxial bract, dorsal, ventral view; f, g. abaxial bract, dorsal, ventral view; h, i. primary bracteole, dorsal, ventral view; j, k. secondary bracteole; l. corolla; m. corolla spread out showing stamens; n. stamen; o. gynoecium; p. capsule; q. seed; r. glochidate tubercle
middle, gradually tapering towards the poles, acute at ends, margins well defined, furrow membrane smooth. Pores 3, central, equidistant, conspicuous, protruding beyond the general surface, pore membrane smooth. Exine differentiated into pseudocolpi and ridges; pseudocolpi 6, 2 in each mesocolpium alternating with ridges, pseudocolpar extension polar, acute at ends, margins well defined, membrane smooth; ridges areolate, extending and converging at the poles (Chaubal 1966; pers. obs.).

**Note:** The species is endemic to Maharashtra and is categorised as “Critically Endangered” (Mishra & Singh, 2001). The species is represented by only the type collections (holo, iso- and paratypes) from Dung Saundane of Nasik district. The present collection is from the second locality i.e. Panhala of Kolhapur District. *D. nasikensis* is similar to *D. cuneata* Nees but differs as shown in Table 5.

**Specimens examined:** Maharashtra: Nasik: Dang Saundane, Satara Range, 20.05.1983, *P. L. Narasimhan* 163977B-E (isotype BSI!); Dung Saundane, Satara Range, alt. 675 m, 17.05.1985, *P. L. Narasimhan* 167696A-D (paratype BSI!).

**Kolhapur:** Panhala, 26.01.2007, *M. E. Mascarenhas* 316 (GUH).

Table 5: A comparison of the characters of *Dicliptera cuneata* and *D. nasikensis*.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Character</th>
<th><em>D. cuneata</em></th>
<th><em>D. nasikensis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stem</td>
<td>herbaceous, glabrous</td>
<td>woody herb, shortly hispid hairy</td>
</tr>
<tr>
<td>2</td>
<td>Leaves</td>
<td>3.75 - 7.5 x 1.9 - 3.75 cm</td>
<td>1.5 - 3.5 x 1.0 - 2.5 cm</td>
</tr>
<tr>
<td>3</td>
<td>Leaf apex</td>
<td>acuminate</td>
<td>acute to sub-acute</td>
</tr>
<tr>
<td>4</td>
<td>Petioles</td>
<td>1.25 - 3.75 cm long</td>
<td>0.5 - 1.0 cm long</td>
</tr>
<tr>
<td>5</td>
<td>Each umbel</td>
<td>3 - 8 inflorescence units</td>
<td>3 inflorescence units only</td>
</tr>
<tr>
<td>6</td>
<td>Corolla</td>
<td>c. 1.25 cm long</td>
<td>c. 2.2 cm long</td>
</tr>
<tr>
<td>7</td>
<td>Ovary</td>
<td>glandular hairy</td>
<td>non glandular, sparsely hairy</td>
</tr>
<tr>
<td>8</td>
<td>Capsule</td>
<td>densely pubescent at apex with short glandular hairs, less densely so on the sides &amp; scarious faced</td>
<td>glandular hairy all over</td>
</tr>
<tr>
<td>9</td>
<td>Seeds</td>
<td>not glochidiate</td>
<td>glochidiate</td>
</tr>
</tbody>
</table>

A suffruticose herb up to 60 cm high, quadrangular at younger branches. Shortly scabrous at lower parts, sometimes white hairy above. Leaves opposite, unequal, petiolate; petiole 1 - 6 cm long, obscure due to decurrent leaf base, glabrous; lamina 5 - 11.5 x 1.5 - 4 cm, elliptic-lanceolate, attenuate, sometimes rounded at base, entire to sub-entire along margins, acuminate at apex, dark green above, paler below, scattered cystoliths visible on both sides, more so on adaxial side; main veins in 5 - 6 pairs, curving upwards, prominent on both sides, slightly impressed above, raised below, lineolate on both sides. Inflorescence 4 - 13.5 cm long interrupted spikes, forming compound terminal panicles; rachis quadrangular, glandular-hairy; flowers opposite on the rachis in monochasial cymes; bracts opposite, unequal, 6 - 15 x 2 mm, ovate-lanceolate, ciliate, glandular-hairy, as well as few long hairs along margins, obtusely acuminate, short and glandular hairs on the outside, glabrous on the inside, with prominent midrib; bracteoles linear-subulate, 5 - 6 x 1 mm, similar to bracts.
Calyx c. 6 mm long, divided to 2/3rd its length into 5 unequal segments; segments c. 4 mm long, lanceolate, ciliate with glandular-hairy, as well as few long hairs along margins, acuminate at apex, glandular-hairy on the outside, glabrous on the inside, prominent midrib on adaxial surface. Corolla rotate, coppery-blue, shortly pubescent on the outside, corolla drying white; tube bluish white, narrow, cylindric, c. 3.7 x 1 mm, slightly broader above; limbs at right angles to tube, c. 11 x 7 mm, oblong-ovovate, rounded or obtuse at apex, gentian violet at throat, nerves visible at throat and lobes. Stamens 2, inserted on the tube just below the throat, filaments c. 4 mm long, glabrous; anthers orange, slightly exserted, bithecous, c. 3 mm long, oblong, parallel, apiculate at base, connective prominent between the anther lobes, slightly protruding at apex; staminodes 2 between the fertile stamens, c. 1.5 mm long. Disc c. 1 mm thick, prominent. Ovary c. 2 mm long, shortly hairy at upper half, style c. 4.2 cm long, hairy all over; stigma one lobe linear, c. 1 mm long, the other obsolete. Capsule c. 14 mm long, clavate, with a narrow solid base, apiculate at apex, slightly notched about the middle, short hairy mainly at upper half, few glandular hairs at apex, 4-seeded; seeds brown, orbicular, c. 3 x 2.5 mm, with hygroscopic hairs along periphery, glabrous at centre on both faces. (Plate 3h-k; Fig. 8a-b)

Fl. & Fr.: December - April.

Habitat: On edges of forests, along banks of streams or in partial shade amongst undergrowths of evergreen, semi-evergreen and deciduous forests.

Distribution: Restricted to the Central Western Ghats of Karnataka. (Map 3c)

Threat Status: Near Threatened [NT]

The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than ten localities.
Fig. 8: *Eranthemum capense* L. var. *concanensis* (C. B. Clarke) Santapau – a. habit; b. flower
Pollen: Speroidal in equatorial view, sub-triangular in ambitus; large in size, 71 - 83 x 73 - 83 μm; colpi 3-sonicolporate, equidistant, broad in the centre, gradually tapering, ending acute, margin defined, furrow membrane smooth; pores 3-central, equatorial, circular, conspicuous, not-protruding; exine thick, reticulate, reticulum homobrochate, muri simplibaculate, lumina polygonal to round, with a single bacula (spine) in the centre of the lumina (Chaubal 1966; pers. obs.).

Note: This variety has a slender spike and small ovate-lanceolate bracts as compared to other species; flowers dry white.


An acaulescent scapigerous herb, with a woody rootstock, stem c. 5 cm long. Leaves sub-radicle, unequal; petiole 1.5 - 14 cm long, winged due to decurrent leaf base, surface similar to lamina; lamina ovate to sub-orbicular, 5.5 - 16.5 x 3.5 - 15 cm, rounded to cordate, slightly decurrent at base, sub-entire or undulate-crenulate, minutely ciliate along margins, obtuse to acute at apex, minutely punctuate, minutely papillose and setulose on adaxial side, glabrous beneath, pubescent on the nerves on abaxial side, dark green above, pale below; main veins in 4 - 6 pairs, lineolate, prominent and raised below, curved upwards, intramarginal venation prominent. Inflorescence scapigerous spikes or panicles, 19.5 - 34.5 cm long, with opposite to sub-opposite, few flowered cymes; axis sharply quadrangular, purplish, puberulous; bracts at base of inflorescence branch c. 3.5 x 2 mm, oblong to foliaceous, minutely
scabrous; floral bracts subulate, 2 - 3 mm long, minutely scabrous, ciliate along margins, acute at apex; bracteoles 0. Flower sub-sessile, pedicel c. 1 mm long. Calyx 0.3 - 0.4 mm long, divided almost to the base; segments c. 3 mm long, linear, subulate, minutely scabrous, ciliate along margins, acuminate at apex. Corolla 3.3 - 3.5 cm long, white tinged with purple, lower lip yellow, minutely puberulous without; limb large, tubular at base, ventricose above; tube 8 - 10.5 mm long; ventricose portion 13 - 15 x 10 mm, upper half inflated; shortly bi-lipped above, upper and lower lips almost equal; upper lip 7 - 9 mm long, hooded, emarginate, lobes obtuse, apiculate at apex, 1.5 - 2 x 1.5 - 2 mm; lower lip 6 - 9 mm long, three-lobed, recurved on opening, lobes oblong, acute at apex, 3.5 - 4 x 1.5 - 2 mm. Stamens two, included within hooded upper lip; filaments c. 15 mm long, glabrous, adnate at the base of ventricose portion; anthers bithecoeus, anther lobes transversely placed, c. 2.5 mm long, oblong, apiculate at both ends, adjoiniing at distal end, hastate, divaricate and scarious at proximal end, glandular hairy at back and densely ciliate. Disc 1 mm broad, fleshy. Ovary c. 2.5 mm long; style up to 23 mm long, pubescent all over; stigma c. 3 mm long, sub-entire, one lobe aborted. Capsule purplish, 2.5 mm long, linear, sub-cylindrical, c. 2 cm long. (Plate 4a-b; Fig. 9a-c)

Local name: Nelamuchala (Kannada)

Fl. & Fr.: July-December.

Habitat: It is a common herb, found in shade in a semi-evergreen forest.

Distribution: It is distributed from Central Western Ghats in Karnataka to Southern Western Ghats in Kerala. (Map 3d)

Threat Status: Near Threatened [NT]

The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than 10 localities.
Plate 4: Gymnostachyum febrifugum Benth. – a. habit; b. inflorescence; G. glabrum (Dalzell) T. Anderson – c. habit; d. inflorescence; e, f. pollen, polar and equatorial view; g, h. SEM, seed and portion enlarged
Fig. 9: Gymnostachyum febrifugum Benth. – a. habit; b. flower; c. capsule
**Pollen:** Prolate in equitorial view, in ambitus subtriangular; medium size, 47 - 53 x 28 - 31 μm; colpi 3-zeonicolporate, broad in the centre, gradually tapering towards the poles, extension circumcircular, ending acute, margin defined, multigranulose, furrow membrane with granules scattered in groups; pores 3, central, equatorial, circular, not conspicuous, faintly defined, not protruding beyond the surface; exine reticulate, reticulum homobrochate (Chaubal, 1966; pers. obs.).

**Note:** This species could not be collected from the study area, but was collected from Malappuram (Kerala) and therefore the description is based on this specimen and the herbarium material observed at JCB. A decoction of the root is used as a febrifuge.

**Specimens examined:** *Karnataka: Dakshina Kannada:* Sampaje, 07.08.1900, C. A. Barber 2229 (MH); Sullia, October 1900, C. A. Barber 2131 (MH); Sampaje, 07.11.1900, C. A. Barber 2229 (MH); Shiradi, November 1908, A. Meebold 6637 (CAL); Shiradi Ghat, 15.12.1918, s. c. 15617 (MH); Parappa, 250 ft, 19.11.1920, C. E. C. Fisher 4521 (CAL); Gundia, alt. 600 m, 26.11.1927, S. R. Raje & Naganathan 18215 (MH); Sullia, 28.10.1960, C. J. Saldanha CS 6314 (BLAT; JCB); Sullia, 29.10.1960, C. J. Saldanha CS 6363 (BLATT); Belthangady, 02.11.1960, C. J. Saldanha CS6441 (JCB); Keelar, 29.09.1961, A. S. Rao 74776 (BSI); Between Shiradi village and Uppinangadi 100 m, 22.09.1971, C. J. Saldanha HFP2201 (JCB); in bushes in an evergreen forest, 21.07.1978, S. R. Ramesh KFP1886 (JCB); Kodlimallai in a secondary forest, 28.07.1978, C. J. Saldanha, S. R. Ramesh & N. S. Ravindra KFP1966 (CAL; JCB); Suratkal, near sea shore in open, 18.10.1978, C. J. Saldanha & K. R. Keshavamurthy KFP 3395 (CAL); Mangalore-Konaje road, 07.12.1978, C. J. Saldanha & K. P. Sreenath KFP4946 (JCB); Gururayankere-Naravi, 03.08.1979, C. J. Saldanha, S. R. Ramesh & K. P. Sreenath KFP8817 (JCB); Coorg & S. Canara plains, s. d., s. c. 38211 (MH); Kudupu-Gurpur alt. 20 m, 23.08.1980, C. J.
An undershrub. Stem nearly glabrous, hairy at nodes, obtusely quadrangular. Leaves opposite, unequal; petioles 6 - 7 cm long, obscure due to decurrent leaf base; lamina elliptic-lanceolate, 13.5 - 19.5 x 7.5 - 9.5 cm, attenuate at base, undulate crenate, sparsely ciliate along margins, acuminate at apex, green above, pale below, lineolate, minutely punctuate on adaxial side, glabrous or nearly so, sparsely scabrous on the nerves on abaxial side; main nerves 10 - 12 pairs, prominent, raised beneath, intramarginal venation. Inflorescence terminal glandular-pubescent panicles of cymose racemes; 15 - 37 cm long, axis glandular hairy; flowers sub-sessile, opposite; bracts and bracteoles similar, minute, linear-lanceolate, acute at apex, glandular hairy on the outside, ciliate along margins; bracts 3 - 4 mm long; bracteoles c. 2 mm long. Calyx divided to almost the base, c. 5 mm long, glandular hairy on the outside; segments 5, linear-lanceolate, c. 4 mm long, ciliate with glandular hairs along margins, acute at apex. Corolla white with purple spots on inside, c. 1.7 cm long, glandular-pubescent without; lower portion of tube c. 5.5 mm long, cylindrical, bent, widens above into ventricose portion; ventricose portion c. 4.3 x 3 mm; deeply bilipped above, upper lip slightly shorter than lower lip; upper lip 3.1 mm long, shortly 2-lobed; lobes c. 2.5 x 1.6 mm long; lower lip 4.4 mm long, deeply 3-lobed; lobes c. 4 x 2.3 mm long, lobes oblong, obtuse at apex, spread out on opening; Stamens 2, not exserted, along lower lip; filaments 8.5 mm long, hairy at the point of insertion in the corolla tube, glabrous above, adnate at base of ventricose portion; anthers bithecous, oblong-lanceolate, parallel, c. 2 mm long, acute at both ends and scarious at proximal end, glandular hairy at back. Disc fleshy, white, c. 0.8 mm broad. Ovary c. 2.5 mm long, minutely hairy; style c. 12.6 mm long, slightly pubescent; stigma sub-entire, c 0.5 mm long. Capsules c. 17 mm long, sub-cylindric, apiculate, glandular - pubescent.
Seeds c. 1 x 0.9 mm, ovate, compressed, surface wrinkled with short soft hairs arranged in groups on the ridges and along margins. (Plate 4c-h; Fig. 10a-n)

Fl. & Fr.: January - March.

Habitat: Mostly along the road sides and stream banks as an undergrowth, often under slightly exposed conditions.

Distribution: From the Northern Western Ghats of Maharashtra (Kolhapur) to the Central Western Ghats of Karnataka (N. Kanara). (Map 4a)

Threat Status: Near Threatened [NT]

The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than ten localities.

Pollen: Prolate in equatorial view, in ambitus subtriangular; medium size, 33 - 43 x 25 - 33 μm; colpi 3-zonicolporate, broad in the centre, gradually tapering towards the poles, ending acute, margin defined, multigranulose, furrow membrane with granules scattered in groups; pores 3, central, equatorial, circular, not conspicuous, faintly defined, not protruding beyond the surface; exine reticulate, reticulum homobrochate (Pers. obs.)

SEM of seeds: Ovate, covered with soft hairs all over; seed surface rugose, papillae arranged in rows, very prominent; hairs arranged in rows on ridges of surface.

Note: An undershrub in ghat area, grows as an undergrowth, endemic to Northern Western Ghats. The pollen grains are smaller than those of Gymnostachyum latifolium (Dalzell) T. Anderson var. latifolium and G. latifolium var. decurrens Gamble, but similar in size to those of G. polyanthum Wight. Micromorphology of seed reveals that the papillae on the seed surface are more prominent as compared with those of the two varieties of G. latifolium.
Fig. 10: *Gymnostachyum glabrum* (Dalzell) T. Anderson - a. habit; b, c. bract at base of inflorescence, dorsal, ventral view; d, e. floral bract, dorsal, ventral view; f, g. bracteole, dorsal, ventral view; h, calyx; i. flower; j. corolla spread out showing stamens; k. stamen; l. gynoecium; m. capsule; n. seed

a) Gymnostachyum glabrum, G. polyanthum; b) G. latifolium var. latifolium; c) G. latifolium var. decurrens; d) Haplanthodes plumosus
Specimens examined: Goa: ‘Goa Journey’, January 1886, T. Cooke s. n. (BSI); North Goa: Chorla Ghat, s. d., s. c. Acc. no. 69614 (MH); Chorla Ghat, 16.03.1997, M. K. Janarthanam, V. C. Joshi & S. Rajkumar 627 (GUH); Chorla Ghat, 10.03.2005, M. E. Mascarenhas & M. K. Janarthanam 45 (GUH); Chorla Ghat, 12.03.2006, M. E. Mascarenhas 217, 222 (GUH). South Goa: Sanguem, Badsare-Tudal 2 miles from Tudal, April 1963, S. R. Rao s.n. (BSI); Badsare-Wagal hill after Tudal, 17.03.1964, K. C. Kanodia Acc. no. 96337 (BSI; CAL); Caranzol, April 1966, s. c., s. n. (BSI); Dudhsagar, 15.01.1997, V. C. Joshi & S. Rajkumar 493 (GUH); Verlem to Salgini, 24.01.2006, M. E. Mascarenhas 152 (GUH). Karnataka: Uttara Kannada: Supa, 12.01.1886, W. A. Talbot 1362 (CAL); Castle Rock, Duski river, 25.02.1981, M. R. Almeida MRA1168 (BLAT); Castle Rock, January 1991, P. S. K. 23863 (BLAT). Maharashtra: s. loc., s. d., M. Law Acc. no. 341497 (CAL); s. loc., s. d., s. c. Acc. no. 341498 (CAL); s. loc., s. d., M. Law Acc. no. 341501 (CAL); Malabar, Concan, s. loc., s. d., Stocks & Law Acc. no. 341500 (CAL); Western India, s. loc., s. d., Gibson Acc. no. 341502 (CAL). Kolhapur: Vasota, Pali, January 1994, M. P. Bachulkar-Cholekar 6047 (SUK); Karanjphen, s. d., M. M. Sardesai mmS-897 (SUK); s. loc., s. d., M. M. Sardesai mmS-12 (SUK); Tambyachi wadi, s. d., M. M. Sardesai mmS-1-816 (SUK); Udegiri, s. d., M. M. Sardesai mmS-987 (SUK); s. loc., s. d., M. M. Sardesai, mmS. 1026 (SUK). Sindhudurg: Amboli, 24.03.1980, M. R. Almeida MRA/471 (BLAT); Amboli, 21.01.2006, M. E. Mascarenhas 138 (GUH); Amboli, 21.01.2007, M. E. Mascarenhas & M. K. Janarthanam 305 (GUH).
**Gymnostachyum latifolium** (Dalzell) T. Anderson

Key to the varieties:

1a. Lamina broadly ovate to slightly cordate, rounded or truncate at base; stamens and style exserted .......................... var. *latifolium*

b. Lamina broadly elliptic, decurrent at base; stamens and style included ......................................................... var. *decurrens*


*Type:* India, s. loc.; s. d.; s. c. Acc. no. K000438731 (K photograph!).


An undershrub up to 1 m high. Stem obscurely quadrangular when young, almost terete when old, nodes prominent, swollen, sparsely lenticular. Leaves opposite, unequal; petiole 2 - 14 cm long, quadrangular, minutely scabrous; lamina broadly ovate to slightly cordate, 5 - 16.5 x 3 - 13 cm, rounded or truncate, sometimes
very slightly acute at base, entire to obscurely dentate along margins, acuminate at apex, dark green above, pale below, minutely punctate, minutely scabrous and cystoliths present on adaxial side; main veins in 10 - 11 pairs, lineolate, parallel nerved, curving upwards, lower nerves close together, prominent on both sides, raised and dark in colour beneath. Inflorescence axillary, often on older leafless part of the stem, spikes trifid, secund, cymes few flowered, 1.5 - 9.5 cm long; axis quadrangular, minutely scabrous; bracts at base of inflorescence branch ovate-lanceolate, c. 5 mm long; floral bracts and bracteoles similar, minute, linear, subulate, acuminate at apex, minutely scabrous, more so on dorsal side, ciliate along margins; floral bracts c. 3 mm long; bracteoles 2 - 2.5 mm long. Flowers alternate, sub-sessile, pedicel c. 1 mm long. Calyx c. 5 mm long, divided almost to the base; segments c. 4.8 mm long, subulate, unequal, acuminate at apex, minutely scabrous, more so on dorsal side, ciliate along margins. Corolla greenish yellow, 2.7 - 2.8 cm long, sparsely minutely hairy without; tubular at base, lower portion of tube 4 - 6 mm long, bent above and widens gradually into ventricose portion; ventricose part narrow, c. 8 x 4 - 4.5 mm; deeply bi-lipped above, upper and lower lips almost equal, 6.5 - 9.5 mm long; upper lip c. 9.5 mm long, emarginate, lobes c. 1 x 1 mm, ovate, sub-acute, mucronulate at apex, shallowly hooded; lower lip c. 9 mm long, deeply 3-lobed; lobes c. 7.5 x 2 mm, oblong-lanceolate, sub-acute, mucronulate at apex, lobes recurved to base on opening. Stamens 2, exserted, along upper lip; filaments c. 15 mm long, adnate at base of bent part of tube, minutely hairy all over; anthers bithecous; anther lobes oblong, c. 2.5 mm long, parallel, apiculate at both ends, glandular hairy at back and sparsely ciliate. Disc c. 1 mm long, fleshy. Ovary c. 1.5 mm long, glabrous; style 2.1 - 3 cm long, sparsely hairy all over; stigma c. 1.5 mm long, sub-entire, one lobe aborted. Capsule sub-cylindrical, 1.7- 2.2 cm long, glabrous, striate, acute at apex, stalk c.
1 mm long, 6 - 13 pairs of seeds from base; seeds 0.8 x 0.6 mm, sub-orbicular, flattened, surface wrinkled, with dense hygroscopic hairs all over. (Plate 5a-e; Fig. 11a-n)

**Local name:** Sanjeevini moola (Marathi).

**Fl. & Fr.:** November - May.

**Habitat:** An undergrowth in thick forests at high altitude and in moist soil along road sides and along slopes.

**Distribution:** In the Northern and Central Western Ghats of Maharashtra and Karnataka. (Map 4b)

**Threat Status:** Near Threatened [NT]

The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than ten localities.

**Pollen:** Prolate in equatorial view, in ambitus subtriangular; medium size, 33 - 46 x 23 - 30 μm; colpi 3-azonicolporate, broad in the centre, gradually tapering towards the poles, ending acute, margin defined, multigranulate, furrow membrane with granules scattered in groups; pores 3, central, equatorial, circular, not conspicuous, faintly defined, not protruding beyond the surface; exine reticulate, reticulum homobrochate (Chaubal, 1966; pers. obs.).

**SEM of seeds:** Sub-orbicular, covered with soft hairs all over; seed surface rugose, papillae arranged in rows, not so prominent; hairs arranged in rows on ridges of surface.

**Note:** Field collections and data collected from various local herbaria reveals that the species is widely distributed in the Central Western Ghats of Karnataka, however it has been collected from one locality in Northern Western Ghats of Maharashtra, Kolhapur. Although literature shows that it is widely distributed from Maharashtra to
Plate 5: Gymnostachyum latifolium (Dalzell) T. Anderson var. latifolium – a. habit; b. inflorescence; c. pollen; d, e. SEM, seed and portion enlarged; G. latifolium (Dalzell) T. Anderson var. decurrens Gamble – f. habit; g. inflorescence; h. pollen, equatorial view; i, j. SEM, seed and portion enlarged
Fig. 11: Gymnostachyum latifolium (Dalzell) T. Anderson var. latifolium – a. habit; b, c. bract at base of inflorescence, dorsal, ventral view; d, e. floral bract, dorsal, ventral view; f, g. bracteole, dorsal, ventral view; h. calyx; i. corolla; j. corolla spread out showing stamens; k. stamen; l. gynoecium; m. capsule; n. seed
Nilgiris (Tamil Nadu) and Silent Valley (Kerala), no collections were found from the other districts of Maharashtra, Goa, Tamil Nadu and Kerala.

Anderson (1867) has treated *G. latifolium* T. Anderson from Malabar and Concan and *P. latifolius* Wight from Coorg as two different species. On analysis it is observed that *G. latifolium* is *G. latifolium* var. *decurrens* and *P. latifolium* Wight is *G. latifolium* var. *latifolium*. The two type collections at Kew can be co-related to the two taxa of Anderson as follows: the type from Manantoddy (Wyanad), Lawson Acc. no. K000438730 is *G. latifolium* which is now identified as *G. latifolium* var. *decurrens* and the type Acc. no. K000438731 is identified as *G. latifolium* var. *latifolium* during the present study.

**Specimens examined: Karnataka:** Chikmagalur: Kulhutty, Bababudan hills, 5000 ft, October 1908, A. Meebold 10187 (MH); Bababoodan hills, Malabar coast, s. d., M. Law Acc. no. 341520 (CAL); Nalur, Agumbe, February 1961, s. c. s. n. (BSI); Ballalarayanadurga top, February 1963, A. S. Rao 85343 (BSI); Samse-Kudremukh road, 03.04.1964, R. S. Raghavan 97409 (BSI); Bababudangiri range, 18.11.1978, A. L. Takhtajan, C. J. Saldanha, K. R. Keshavamurthy KFP 4650 (CAL); Bababudangiri range, 01.12.1978, S. R. Ramesh, K. R. Keshavamurthy KFP 4738 (JCB); Bababudangiri range, 01.12.1978, S. R. Ramesh, K. R. Keshavamurthy KFP 4738 (CAL); Nagundi-Balehole, s. d., S. R. Ramesh, P. Prakash KFP6543 (JCB); Along mountain stream, 26.04.1980, C. J. Saldanha, S. R. Ramesh KFP11262 (JCB); Bababudangiri range, s.d., A. L. Takhtajan, C. J. Saldanha, K. R. Keshava Murthy KFP4650 (JCB); Kemmanagundi alt. 1300 ft, 05.04.1997, K. Ravikumar & P. S. Udayan 09607 (FRLH); 25 km before Kemmanugundi, 20.02.2006, M. E. Mascarenhas, M. K. Janarthanam 193 (GUH). Dakshina Kannada: S. Canara, s. loc., s. d., s. c. Acc. no. 341524 (CAL); S. Canara, s. loc., 1866, R. H. Beddome Acc.
no. 30248 (MH); Kodrachadri, 14.01.1978, R. S. Raghavan 151625 (BSI); Mallur ghats, 15.04.1978, C. J. Saldanha, S. R. Ramesh, Syed Maqsood Ahmed KFP721 (JCB); Mallur ghats, 15.04.1978, C. J. Saldanha, S. R. Ramesh, Syed Maqsood Ahmed KFP721 (CAL). Hassan: Shiradi ghat (upper section), 15.01.1969, C. J. Saldanha 12264 (JCB); Bisle ghat, middle section, 24.01.1969, C. J. Saldanha 12134 (JCB); Shiradi ghat, 30.01.1969, C. J. Saldanha 12609 (JCB); Shiradi ghat, 26.02.1969, C. J. Saldanha 12823 (JCB); Kenchankumri, 12.11.1971, S. S. Hooper & K. N. Gandhi HFP 2465 (JCB); Stream in undergrowth of forest, 22.12.1980, C. J. Saldanha & S. R. Ramesh KFP 12458 (JCB). Kodagu: Talacauvery, s. d., R. H. Beddome Acc. no. 38247 (MH); Coorg, s. loc., 1873, R. H. Beddome Acc. no. 38250 (MH); Bagamandala, 10.03.1960, R. K. Arora 61554 (BSI); Baghamandala, 04.02.1976, B. C. Banarjee 11567 (CAL); Gauremore estate, 30.10.1981, C. J. Saldanha, B. G. Singh & Shivaprabash, KFP13961 (JCB); Talacauvery, 960 m, 20.04.1998, P. S. Udayan & S. P. Subramani 11272 (FRLH). Shimoga: Kodachadri range, 06.03.1979, C. J. Saldanha KFP6143 (JCB). Uttara Kannada: Western India, s. loc., s. d., Gibson Acc. no. 341522 (CAL); s. loc., s. d., s. c. Acc. no. 341526 (CAL); Canara & Mysore, s. loc., s. d., M. Law Acc. no. 341530 (CAL); Gersoppa falls, 1881, W. A. Talbot Acc. no. 7352 (BSI); N. Kanara, s. loc., W. A. Talbot 49 (CAL); Nilkund ghat forest, 04.12.1885, W. A. Talbot 785 (CAL); Ainsi, 29.04.1885, W. A. Talbot 1199 (BSI); Ainsi ghat, 01.05.1885, W. A. Talbot s. n. (CAL); Castle Rock, January 1891, P. S. K. Acc. no. 341523 (BSI); Castle Rock, December 1910, s. c., s. n. (BLAT); Castle Rock, March 1919, Sedgwick 5583 (BLAT); Ainsi Ghat, alt. 1000 ft, Oct. 1920, Bell 152.13 (BLAT); Anmod jungles, 09.02.1950, J. Fernandez JF985 (BLAT); Castle Rock, 22.12.1953, C. J. Saldanha CS1072 (JCB); Castle Rock, westward along railway line, s.d., H. Santapau 17839

An undershrub up to 1 m high. Stem obtusely quadrangular to almost terete, glabrous, slightly lenticellate. Leaves opposite, unequal; petiole 3 - 17 cm long, slender, quadrangular, minutely scabrous; lamina broadly elliptic, 8 - 21.5 x 5 - 10 cm, acuminate at both ends, base decurrent into petiole, entire, faintly undulate, sparsely ciliate along margins, dark green above, pale below, minutely punctate and sparsely minutely scabrous on both sides, more so on nerves below, cystoliths on adaxial side mainly on nerves; main veins in 8 - 12 pairs, strongly lineolate on both sides, parallel nerved, curved upwards, lower nerves equally spaced, prominent on
both sides, raised and dark in colour on the abaxial side. Inflorescence axillary, trifid spikes, secund, few flowered cymes, c. 7.5 cm long; axis quadrangular, minutely scabrous; bracts at base of inflorescence branches c. 3 mm long, foliaceous; floral bracts and bracteoles similar, minute, linear, subulate, acuminate at apex, minutely scabrous, more so on dorsal side, ciliate along margins; floral bracts c. 4 mm long; bracteoles smaller, c. 2 mm long. Flowers sub-sessile, alternate; calyx c. 6 mm long, divided to almost the base; segments unequal c. 4.5 mm long, subulate, acuminate at apex, minutely scabrous, more so on dorsal side, ciliate along margins. Corolla c. 2.5 cm long, greenish-yellow, pubescent, glandular hairy without; lower portion of tube c. 6 mm long, cylindrical, slightly bent, widens above into ventricose portion; ventricose portion c. 10 x 8 mm, inflated at upper half; deeply bi-lipped above, upper and lower lip almost equal, 8 - 9 mm long; upper lip c. 8 mm long, hooded, emarginate, lobes c. 0.5 x 0.5 mm, sub-acute, mucronulate; lower lip c. 9 mm long, shortly 3-lobed, each lobe c. 3.5 x 2.5 mm, ovate, sub-acute, mucronulate, lobes recurved at apex on opening. Stamens 2, included within hooded upper lip; filaments c. 16 mm long, adnate at base of ventricose portion, hairy all over, bent above at the connective; anthers bithecous; anther lobes c. 2 mm long, oblong, apiculate at both ends, contiguous at distal end, hastate, divaricate and scarious at proximal end, minute glandular hairs at back, ciliate, transversely placed. Disc c.1 mm broad, fleshy. Ovary conical, laterally flattened, c. 2 mm long, glabrous; style c. 16 mm long, glabrous to sparsely hairy at the middle; stigma sub-entire, c. 3 mm long, one lobe aborted. Capsule 2 - 2.4 cm long, linear, sub-cylindrical, striate, glabrous, apiculate, 6 - 7 pairs of seeds; seeds oblong to ovate, flattened, c. 1 x 1 mm, surface wrinkled, with soft hairs all over. (Plate 5f-j; Fig. 12a-n)

Fl. & Fr.: October - February.
Fig. 12: *Gynostachyum latifolium* (Dalzell) T. Anderson var. *decurrens* Gamble – a. habit; b, c. bract at base of inflorescence, dorsal, ventral view; d, e. floral bract, dorsal, ventral view; f, g. bracteole, dorsal, ventral view; h. calyx; i. flower; j. corolla spread out showing stamens; k. stamen; l. gynoecium; m. capsule; n. seed
**Habitat:** Found growing among laterite rocky slopes near streams in a moist deciduous forest.

**Distribution:** In the Western Ghats of Kerala (Wyanad, evergreen forests of Cannanore above 800 m) and now in Central Western Ghats of Goa and Karnataka. (Map 4c)

**Threat status:** Vulnerable [VU B2ab (iii)].

The taxon has been assigned to 'Vulnerable' category as the area of occupancy is estimated to be less than 2000 km² and is known to exist at no more than 10 localities.

**Pollen:** Prolate in Equatorial view, in ambitus subtriangular; medium size, 41 - 46 x 28 - 30 μm; colpi 3-azonicolporate, broad in the centre, gradually tapering towards the poles, ending acute, margin defined, multigranulose, furrow membrane with granules scattered in groups; pores 3, central, equatorial, circular, not conspicuous, faintly defined, not protruding beyond the surface; exine reticulate, reticulum homobrochate (Pers. obs.).

**SEM of seeds:** Oblong to ovate, with soft hairs all over; seed surface rugose; papillae arranged in rows, prominent; hairs arranged in rows on ridges of surface.

**Note:** The present collection from Verlem, Sanguem (Goa) was confirmed by comparing the collection with authentic specimens at MH (syntypes) and the photograph of syntype at Kew. Gamble (1924) described this variety based on Lawson’s (1884) collection from the Western Ghats at Manantoddy (Mananthawadi), Wyanad, Kerala. The same collection is deposited at Kew. After critical analysis of the syntypes, the collection at MH, Coimbatore (MH 38251) is selected here as the lectotype. Subsequent collections are all from the adjacent areas that are mostly in Kannur (earlier Cannanore) district. Ramachandran & Nair (1988); Nayar et al. (2006) state that it is restricted to the state of Kerala. A few earlier collections of this
taxon from Goa and Karnataka wrongly identified and thus escaped the attention of earlier workers have been brought out during the present study. Another small population was located at Verlem, Goa during the present study. This showed an extended distribution of the taxon from Kerala up to the Northern Western Ghats. The type sheet \( G. \text{ latifolium} \) var. \( \text{decurrens} \) at Kew has a segment of the inflorescence and the diagram of \( G. \text{ serratum} \) pasted on it.

Beddome (1874) while identifying the species as \( G. \text{ latifolium} \) (Dalzell) from Dakshina Kannada, has pointed out that leaves of this species and those of \( \text{Phlogacanthus latifolius} \) Wight from the Coorg jungles were similar. His diagram point out that \( G. \text{ latifolium} \) has a few flowered inflorescence, shortly 3-lobed lower lip of corolla, included stamens and style whereas the diagram of \( P. \text{ latifolius} \) shows a numerous flowered inflorescence, deeply 3-lobed lower lip of corolla, exserted stamens and styles. Although he describes the leaves of \( G. \text{ latifolium} \) as ovate to sub-orbicular, his illustration shows that the leaves are elliptic with decurrent leaf base; thus the taxon identified by Beddome as \( G. \text{ latifolium} \) matches with characters for \( G. \text{ latifolium} \) var. \( \text{decurrens} \) and the characters of \( P. \text{ latifolius} \) matches with \( G. \text{ latifolium} \) var. \( \text{latifolium} \). Thus this two taxa identified by Beddome and Wight are two varieties of the same species.

**Specimens examined:** Goa: South Goa: Canacona, Yed forests on way to Nadquem, 13.03.1964, K. C. Kanodia 96239 (BSI, CAL); Canacona, Yed forest on way to Nadquem, 27.03.1964, J. Cherian 109082 (BSI); Sanguem, Verlem, 15°02’30.8” N and 074°14’ 33.6” E, 530 m, 28.10.2007, M. E. Mascarenhas 426 (GUH); Sanguem, Verlem, 24.02.2008, M. E. Mascarenhas 488 (GUH); Sanguem, Verlem, 03.04.2008, M. E. Mascarenhas 499 (GUH). Karnataka: Kodagu: Kerti block, (Waterolly Makut), 25.02.1963, A. S. Rao 86704 (BSI). Shimoga: Agumbe, Nalur, 07.02.1961,
R. S. Raghavan 69437 (BSI, CAL). Uttara Kannada: N. & S. Canara, 1873, R. H. Beddome Acc. no. 39535 (MH); s. loc., 1880, R. H. Beddome Acc. no. 39566 (MH). Coompta, December 1882, W. A. Talbot Acc. no. 7351 (BSI). Kerala: Kannur: Chandanathode-on way to Kannoth, 700 m, 04.11.1961, J. L. Ellis 26422 (MH); Chandanathode, 600 m, 19.04. 1966, J. L. Ellis 27143 (MH); Chandanathode, 650 m, 03.12.1967, J. L. Ellis 24931 (MH); Chandanathode, ± 800 m, 14.02.1978, V. S. Ramachandran 53953 (MH); Theerthundamalai-Chandanathode, ± 800 m, 14.02.1978, V. S. Ramachandran 53953 (CAL); Theerthundamalai, Chandanathode, ± 875 m, 09.11.1978, V. S. Ramachandran 58632 (MH); Theerthundamalai, Chandanathode, ± 875 m, 09.11.1978, V. S. Ramachandran 58632 (CAL); Ambayathode, ± 525 m, 22.01.1979, V. S. Ramachandran 59095 (CAL); Kottiyur, 550 m, 22.01.1979, V. J. Nair 59782 (MH); Kottiyur, 550 m, 22.01.1979, V. J. Nair 59782 (CAL); Chandanathode, ± 840 m, 22.02.1979, V. S. Ramachandran 60098 (MH); Chandanathode, ± 840 m, 22.02.1979, V. S. Ramachandran 60098 (CAL); Tirunelli Range Forest, ± 725 m, 04.03.1979, V. S. Ramachandran 52057 (MH); Tirunelli Range Forest, ± 725 m, 04.03.1979, V. S. Ramachandran 52057 (CAL); Taliparamba, 100 m, 06.10.1979, R. Ansari 64769 (MH); Taliparamba, 100m, 06.10.1979, R. Ansari 64768 (MH); Ambayathode, ± 550 m, 15.12.1979, V. S. Ramachandran 65217 (MH). Wyanad: s. loc. 1200 m, 1880, s. c. Acc.no. 341529 (CAL); Manantoddy, January 1884, M. A. Lawson Acc. no: MH 38252 (syntype MH!); Manantoddy (Wyanad), January 1884, M. A. Lawson Acc. No: K000438730 (syntype K photograph!).

Gymnostachyum polyanthum Wight Icon. t. 1494. 1850; C. B. Clarke in Hook. f. Fl. Brit. India 4: 508. 1884; Gamble 2: 1053. 1924; Raghavan & Singh in J. Econ.
Acaulescent, scapigerous herb, stem c. 4 cm long, with a vertical rootstock and adventitious roots from the base. Leaves sub-radicle, opposite, unequal; petioles 1 - 11.7 cm long, dark green in colour, quadrangular, glabrous; lamina ovate to broadly ovate, sub-orbicular, 5 - 11.5 x 4 - 10.5 cm, rounded to cordate at base, almost entire, slightly repend, obscurely sub serrate along margins, acute at apex, dark green above, glaucous, minutely punctuate, glabrous below; main veins in 3 - 6 pairs, veins prominent, raised and dark beneath, curving upwards forming prominent intramarginal venation. Inflorescence scapose, bearing opposite to sub-opposite fascicles in racemose terminal panicles, up to 39.5 cm long; axis glabrous, quadrangular, grooved. Flowers sub-sessile, peduncle 1 - 2 mm long, minutely scabrous; bracts and bracteoles similar, minute, linear, subulate, sub-acute at apex, minutely scabrous, more so on dorsal side, ciliate along margins; bract c. 1.5 mm long; bracteoles two at base of pedicel, c. 0.75 mm long. Calyx pinkish, 2 - 3 mm long, 5-lobed, divided almost to the base, segments c 1.5 mm long, subulate, acuminate at apex, minutely scabrous to almost glabrous, more so on dorsal side, ciliate along margins. Corolla pinkish-purple, 2 - 2.3 cm long, minutely glandular hairy on outside, glabrous within, tubular at lower end, ventricose above; tube 7 - 8 mm long, bent; ventricose portion 8 - 10 x 4.8 - 5.6 mm long; shortly bi-lipped, lips c. 5 - 6 mm long, upper lip shorter than lower; upper lip 2-lobed, 2.3 - 2.8 mm long, cmarginated, lobes 1.7 - 2 x 1.8 - 2.3 mm; lower lip 3-lobed, 3.8 - 4.5 mm long; lobes ovate, 2.0 - 2.0 x 2.2 - 2.3 mm, subacute, mucronulate at apex, recurved at apex on
opening. Stamens two, included, bent along lower lip; filaments c. 14 mm long, arising from base of ventricose portion of the corolla, glabrous; anthers bithecous, oblong-lanceolate, c. 2 mm long, acute at both ends, adjoining at distal end, hastate, divergent and scarious at proximal end, glandular hairy at back and sparsely minutely ciliate. Disc c. 0.5 mm broad, cupular. Ovary elongated, c. 1.5 mm long, with minute sparse glandular hairs; style c. 13 mm long, pubescent all over; stigma c. 3 mm long, sub-entire, one lobe aborted. Capsule linear to sub-cylindrical, striate, c. 15 mm long, acute at apex, minutely hairy, with c. 24 seeds arranged in two rows, 12 in one row in each cell; seeds 0.9 - 1 x 0.75 - 0.9 mm, oblong, obtuse at apex, surface wrinkled, with soft, hygroscopic hairs all over. (Plate 6a-d; Fig. 13a-l)

Fl. & Fr.: October - February.

Habitat: In the semi-evergreen forests at Agumbe MPCA at 620 m, on the cut edge of the road almost in the ditch on moist soil under shade.

Distribution: Coorg, Shimoga (Agumbe) and Dakshina Kannada in Karnataka. (Map 4a)

Threat Status: Endangered [EN B2ab(iii, iv)].

The taxon has been assigned 'Endangered' category since area of occupancy is estimated to be less than 500 km², known to exist at no more than five localities.

Pollen: Prolate in Equitorial view, in ambitus subtriangular; medium size, 32.89 - 43.01 x 25.3 - 32.89 µm; colpi 3-zonicolporate, broad in the centre, gradually tapering towards the poles, ending acute, margin defined, multigranulose, furrow membrane with granules scattered in groups; pores 3, central, equatorial, circular, not conspicus, faintly defined, not protruding beyond the surface; exine reticulate, reticulum homobrochate (Pers. obs.).
Plate 6: Gymnostachyum polyanthum Wight - a. habit; b. inflorescence; c, d. pollen, equatorial and polar view; Haplanthodes plumosus (T. Anderson) Panigrahi et G. C. Das - e. habit; f. inflorescence; g, h. pollen, equatorial and polar view; Hypoestes lanata Dalzell - i. habit
Fig. 13: Gymnostachyum polyanthum Wight - a. habit; b, c. floral bracts, dorsal, ventral view; d, e. bracteole, dorsal, ventral view; f. calyx; g. corolla; h. corolla spread out showing stamens; i. stamen; j. gynoecium; k. capsule; l. seed
Note: Wight described this species from Jerdan’s collection in Wight Herb. Gamble also refers to this same collection. This collection was not available for examination during the present study. Even though the distribution is given as Coorg, Shimoga (Agumbe) and Dakshina Kannada, it is restricted only to Shimoga, mainly Agumbe, as can be seen from collections and data from various local herbaria. Earlier herbarium collections, show its presence at Agumbe, Someshwar Ghat road, Hulical and Barkana. But during the present study it could be collected only from Agumbe, near forest check post. The species is represented by very few collections at the moment and was said to be rare by Nayar (1996). It can be said to be a narrow endemic.

The flowers are small and with stamens along the lower lip as in of *G. glabrum* and arranged in sub-opposite fascicles on the inflorescence axis and each flower has two bracteoles.

S. P. Subramani 11990 (FRLH); Agumbe Forest check post, MCPA, 15.12.2007, K. Ravikumar & R. V. Sankar 105921 (FRLH, GUH); Agumbe Forest check post, MCPA, 10.02.2008, M. K. Janarthanam & M. E. Mascarenhas 484 (GUH).


An erect, unbranched herb, 50 - 60 cm high, woolly-tomentose, terete and leafless at lower end, hirsute, glandular hairy, quadrangular, obscurely grooved above bearing axillary branches. Leaves opposite, petiolate, isophyllous, petiole 1.5 - 5.5 cm long, winged, obscure due to decurrent leaf base, glandular-pubescent; lamina ovate-elliptic, 3.5 - 10.5 x 2 - 6.5 cm, attenuate at base, entire, ciliate along margins, acuminate at apex, sparsely strigose hairy, mainly on nerves below, glandular hairy on lower side at base; main veins in 9 - 10 pairs, curving upwards, prominent and raised on both sides, lineolate on both sides, short cystoliths visible. Inflorescence in false whorls, scattered at nodal regions of main axis and axillary branches, cladodes in axil
of minute leaves similar to foliage leaves, ciliate with glandular and simple hairs; cladodes 7 - 25 mm long, recurved densely sub-plumose at base, hispid-glandular hairy above, with 2 inconspicuous spines, sometimes bearing an apical bud at apex; bracts 1 - 5 mm long, bracteoles c. 2 mm long, similar to bracts, elliptic-subulate, glandular-hairy, shorter than calyx. Calyx c. 5.5 mm long, divided nearly to the base, densely sub-plumose, with long hairy, glandular hairs; segments linear-subulate, aristate. Corolla small, tubular-ventricose, c. 12 mm long, light violet-whitish, violet nerves visible on ventricose part, nerves visible on the lobes, hairy on the outside up to apex of lobes; tubular-ventricose part c. 6 mm long, tubular part c. 3 mm long, slightly enlarged and curved above; limb obscurely bi-lipped, upper lip 2-lobed, lower lip 3-lobed; lobes c. 3 x 1.5 mm, ovate, obtuse at apex. Stamens 2, short, inserted below the throat, filament c. 3 mm long, flattened, glabrous; anthers c. 1.5 mm long, connivent, sub-coherent, 2-celled, dorsifixed, cells oblong, unequal, one usually muticous and bearded on the back, other cell usually sterile. Disc present, small. Ovary c. 1.5 mm long, glandular-hairy at apex; style c. 7 mm long, hairy in the middle; stigma linear, c. 1 mm long, one lobe aborted. Capsule c. 7.5 x 2 mm, narrowly oblong-conical, acute-apiculate at apex, glandular-hairy from apex to 1/3rd its length, compressed at right angles to septum, c. 8 seeded; seeds c. 1.5 x 1 mm, oblong, obtuse at apex, slightly compressed laterally, rugose, densely hairy when wetted. (Plate 6e-h; Fig. 14a-l)

Fl. & Fr.: November - April.

Habitat: Mostly found along the edge of the forest, along the forest paths or roadsides, under shade in deciduous forests. It was also found in almost pure strands in clearings.

Distribution: Restricted to the Northern Western Ghats of Maharashtra. (Map 4d)
Fig. 14: *Haplanthodes plumosus* (T. Anderson) Panigrahi et G. C. Das – a. flowering twig; b, c. cladodes; d, e. bracts, dorsal ventral view; f. bracteole; g. calyx; h. corolla; i. androecium; j. gynoecium; k. capsule; l. seed
Threat Status: Vulnerable [VU B2ab (iii)].

The taxon has been assigned to 'Vulnerable' category since the area of occupancy is estimated to be less than 2000 km² and is known to exist at not more than 10 localities.

Pollen: Sub-oblate in equatorial view, triangular in ambitus; medium in size, uniform, 25 - 31 x 24 - 28 µm; colpi 3-zonicolporate, equidistant, broad in the centre, gradually tapering towards the poles, endings rounded; margins thick, well defined, like a collar, furrow membrane granulose; pores 3, central, equatorial, circular, conspicuous; exine reticulate, heterobronchate; bronchi of smaller size in the circumpolar area around the colpar collar and the bronchi of bigger size in the inter-colpar area; muri straight, lumina polygonal to circular, psilate (Chaubal, 1966; pers. obs.).

SEM of seed: Seeds ovate-oblong, obtuse at apex, with a U-shaped groove on the surface, rugose and densely hairy and a depression at the base of the seed.

Note: Nees (1832) described the anthers of Haplanthus as monothecous, the other locule aborted, tomentose whereas Anderson (1867) described the anthers bithecous and bearded at back. During the present study, critical analysis of the stamens shows that the anthers are bithecous but the anterior locule is abortive and posterior muticous and bearded on the back.

Since there was no holotype found in any of the herbaria referred, a lectotype was selected during the present study. From the two type collections deposited at CAL, Stocks, Acc. no. 341461 was selected as the lectotype.

Specimens examined: Maharashtra: Type: North & South Concan, s. loc., s. d., M. Law Acc. no. 341462 (syntype CAL!). Concan, s. loc., s. d., Stocks Acc. no. 38205 (MH). Mumbai: Mumbra, 10.12.1953, K. V. Shenoy KVS1651 (BLAT); Mumbra,
17.12.1953, K. V. Shenoy KVS1676 (BLAT); Mumbra, 05.01.1954, K. V. Shenoy KVS1905 (BLAT); Mumbra, 19.01.1954, K. V. Shenoy KVS2026 (BLAT); Mumbra, 09.02.1954, K. V. Shenoy KVS2119 (BLAT); Mumbra, 25.02.1954, K. V. Shenoy KVS2240 (BLAT); Mumbra, 10.06.1954, K. V. Shenoy KVS3420 (BLAT); Mumbra, 28.08.1954, K. V. Shenoy KVS4179 (BLAT); Nasik: Igatpuri, 26.12.1958, Y. A. Merchant 800 (BLAT). Pune: Khandala, 28.12.1890, G. M. A. s. n. (BSI); Khandala, Dukes’s Nose Ravine, 08.11.1942, H. Santapau & C. McCann 1304 (BLAT); Khandala, St. Mary’s Ravine by Agent bungalow, 30.12.1942, H. Santapau 1460 (BLAT); Khandala, St. Xavier’s Ravine, 21.03.1943, H. Santapau 1750 (BLAT); Khandala, St. Mary’s Ravine descend behind St. Mary’s, 23.12.1943, H. Santapau 3409 (BLAT); Khandala, Meroli Plateau, 15.01.1944, H. Santapau 3533 (BLAT); Khandala slopes under Elphinston point, 05.03.1944, H. Santapau 3687 (BLAT); Khandala, Echo point Ravine, 12.04.1946, H. Santapau 8779 (BLAT); Khandala slopes below Elphinston point, 13.04.1946, H. Santapau 8806 (BLAT); Khandala, St. Xavier’s Ravine, 28.12.1948, H. Santapau 9708 (BLAT); Khandala below elephant point, 20.12.1949, H. Santapau 10593 (BLAT); Khandala, Echo Pt. Ravine, 21.12.1952, H. Santapau 15361 (BLAT); Khandala, Meroli Plateau, 30.01.1954, H. Santapau 17489 (BLAT); Khandala, Battery hills, 07.03.1962, S. R. R. 69754 (BSI); Ambavne Kate Pani forest on way to Kolaba district, February 1964, s. c. s. n. (BSI); Khandala, St. Mary’s Villa descend of slope, 24.11.2007, M. E. Mascarenhas 436 (GUH); Khandala, St. Mary’s Villa descend of slope, December 2007, M. E. Mascarenhas 457 (GUH). Raigad: Matheran, 1212 m, April 1906, A. Meebold 4845 (CAL); Matheran, 03.11.1907, H. P. Paranjape s. n. (BSI); Matheran, Konkan, March 1918, H. Santapau 23184 (BLAT); Water pipe, 27.11.1958, N. A. Irani NI2886 (BLAT); Matheran - Water pipe (railway line), 13.12.1958, N. A. Irani NI2668


A prostrate herb. Stem rooting at lower nodes, sharply quadrangular, hirsute. Leaves opposite, sub-sessile to short petioled; petioles unequal in a pair, 0.2 - 1.3 cm long, obscure due to decurrent base, strigously hairy; lamina ovate-broadly elliptic, 1.2 - 2.0 x 0.6 - 1.7 cm, acute at both ends, attenuate at base, crenate, prominently
ciliate along margins, acute at apex, strigously hairy on both sides, upper leaves elliptic, becoming smaller, ultimately serving as bracts; bracteoles 2, lanceolate, same length as calyx, prominently ciliate along margins, densely hairy on both surfaces. Flowers solitary axillary. Calyx c. 1 cm long, 5-lobed, divided to about half its length, segments linear-lanceolate, 5 - 7 mm long, acute at apex, very hairy. Corolla 5 mm long, purple, bi-lipped, lips equal in length; upper lip shallowly 2-lobed, lower lip deeply 3-lobed; lobes rounded, twisted to the left in bud, pubescent on the outside for 1/3rd of the length of the portion above tube and on the upper somewhat compressed part of the tube. Stamens 2, one fertile, the other sterile, included, base of filament of fertile stamen and staminode joined to form a sheath with long hairs; filament adnate to entire length of tube, at the point of separation of staminode a hooked tip present; anther cells 2, parallel, oblong, erect, muticous, separate, yellow. Ovary many-ovuled, pubescent; Style longer than calyx, with upward directed hairs; stigma bifid, with short unequal stigmatic lobes. Capsules linear-oblong, 7 x 1.2 mm, subtetragonal, with 2 grooves, minute pubescence at apex. Seeds 10 - 12 in two rows, one row in each cell on a slightly upcurved retinacula, light brown, more or less tetragonal, with hygroscopic hairs along margins, sometimes also on surface, sparsely arranged. (Plate 7a; Fig. 15a-b)

Fl. & Fr.: November.

Habitat: From the description of the herbarium specimen it appears that it is found by the road side or on the edge of Vehar lake in Salsette island on damp soil.

Distribution: Restricted to the Northern Western Ghats of Maharashtra. Endemic to Maharashtra and is a very narrow endemic. (Map 5a)

Threat Status: Critically Endangered [CR B2ab(iii)].
Plate 7: *Hygrophila anomala* (Blatter) Almeida – a. habit; *H. pinnatifida* (Dalzell) Sreem. – b. habit, submerged; c. habit, arial with inflorescence; *Justicia santapau* Bennet – d. habit; e. inflorescence; f. pollen, equatorial view
Fig. 15: *Hygrophila anomala* (Blatter) Almeida – a. habit; b. stem apex enlarged showing calyx
The taxon has been assigned to ‘Critically Endangered’ category as the area of occupancy is estimated to be less than 10 km$^2$ and known to exist at only a single location. It is known from a single collection.

**Pollen:** The pollen grains of this genus are homogenous, prolate spheroidal in equatorial view and spheroidal in ambitus, of medium size, with 4-zonicolporate, 4 pores central, equatorial, exine differentiated into pseudocolpi and ridges converging at the poles, pseudocolpi alternating with ridges, ridges reticulate, homobrochate (Chaubal, 1966).

**Note:** Blatter (1930) was not fully convinced to place this species under *Cardanthera anomalala*, but since Clarke had already placed another anomalous species under *Cardanthera*, he placed this one also and as Santapau (1952) had not seen the type of this species, he did not want to change its nomenclature. The name *Cardanthera Voigt*, 1845) was an invalid name, since Voigt had not described the genus. A description of *Cardanthera* was published by Nees (1847) while *Synnema* Benth. was published in 1846. Thus *Cardanthera* becomes a synonym and a superfluous name and *Synnema* is to be considered as the valid name for the genus. Therefore Santapau (1967) changed the name to *Synnema anomalum* (Blatter) Santapau.

The one character that helps to differentiate *Cardanthera* and *Hygrophila* is a papilliform retinacula in *Cardanthera* and hook-shaped one in *Hygrophila* (Heine, 1962), a view shared also by Sreemadhavan (1968). Blatter (1930) in the protologue of *Cardanthera anomalala*, describes the seeds to be supported on a slightly upcurved retinacula, hence its placement in *Hygrophila* is justified. Therefore Almeida (2003) changed *Synnema anomalum* (Blatt.) Santapau (1967) into *Hygrophila anomalala* (Blatter) Almeida which is accepted during the present study.
Hallberg collection no.9766 type from Vehar lake, Salsette and Hallberg
collection no. 9767 cotype from Tardeo, Bombay island and Khandala (s. n.) are not
available, however the only collection available is the one selected as the neotype at
BLAT.

Specimens examined: As in neotype.

Kulkarni, Fl. Sindhudurg 327. 1988; Almeida, Fl. Sawantwadi 322. 1990; Kothari &

**Nohila pinnatifida** Dalzell in Hook. Kew J. Bot. 3: 38. 1851; Dalzell & Gibson,
Bombay Fl. 184. 1861. **Adenosma pinnatifidum** (Dalzell) T. Anderson in J. Linn. Soc.
9: 455. 1867; Bedd. Icon. Pl. Ind. Or. t. 246. 1874. *Type*: India, South Concan, s. loc.,
s. d., Law Acc. no. 335602 (CAL!) (lectotype selected here). **Cardanthera pinnatifida**
(Dalzell) Benth. ex. C. B. Clarke in Hook. f. Fl. Brit. India 4: 455. 1884; Woodrow in

**Synnema pinnatifidum** Kuntze, Revis. Gen. Pl. 2: 500. 1891; Lindau in Pfam. 4(3B):
295. 1895.

A slender, prostrate herb; stem branched, rooting at lower nodes,
quadragangular, grooved, hispid, glandular hairy. Leaves opposite, heterophyllous, short
petioled; petioles 2 - 9 mm in aerial leaves, 1.2 - 3.5 cm in under-water leaves,
obscure due to decurrent leaf base, pubescent, glandular hairy; lamina of aerial leaves
elliptic-obovate, 1.3 - 3.8 x 0.5 - 1.7 cm, acute, attenuate at base, crenate-serrate,
ciliate along margins, obtuse at apex, pubescent, glandular hairy on both sides, mainly
on nerves on abaxial surface, lamina of under-water leaves lanceolate-strap shaped, 7 - 13 x 1 - 1.7 cm long, leathery, acute, attenuate at base, pinnatifid, ciliate along margins, acute to acuminate at apex, glabrous above, cystoliths present, sparsely hairy on nerves beneath, reddish-brown on abaxial surface, dark green on adaxial surface; midrib prominent on both sides, raised on abaxial side, main veins in 4 - 8 pairs, prominent, reticulate venation seen beneath. Flowers in axillary cymes; peduncle c. 1 mm long, glandular pubescent; bract elliptic-lanceolate, c. 11 x 3 mm, trifid at apex, midrib prominent, glandular hairy on both sides; bracteoles elliptic-lanceolate, c. 5 x 1 mm, acute at both ends, glandular pubescent, with prominent midrib. Calyx 5-fid; segments linear-lanceolate, divided almost to the base, glandular hairy on outside; segments c. 7 mm long, unequal, hairy on inside. Corolla c. 15 mm long, hairy without, tubular at base, c. 4 mm long, ventricose above; upper lip c. 8 mm long, 2-lobed, lobes oblong-obtuse; lower lip c. 6 mm long, with transverse ridges on floor, shortly 3-lobed, middle lobe larger than lateral lobes, obtuse. Stamens 4, didynamous; filament of longer pair c. 5 mm long, of shorter pair c. 2 mm long; anther lobes of longer stamen c. 2 mm long, of shorter pair c. 1.5 mm long, anther lobes oblong, cells equal, divaricate or connate at apex. Disc present, c. 0.5 mm broad. Ovary c. 2.5 mm long, ovate-oblong, pubescent; style c. 9 mm long, pubescent; stigma simple. Capsule narrowly oblong, glabrous; Seeds more than 10 in each locule, small, supported on minute conical, soft curved, retinacula. (Plate 7b-c; Fig. 16a-b)

Fl. & Fr.: January - May.

Habitat: Submerged herb on the river beds and on rocks in nullahs, in flowing waters, in dry nullahs and sides of streams.

Distribution: From the Northern Western Ghats of Maharashtra to the Central Western Ghats of Karnataka. (Map 5a)
Fig. 16: *Hygrophila pinnatifida* (Dalzell) Sreem. – a, b. habit, submerged, arial showing flowers

a) • *Hygrophila anomala*, • *H. pinnatifida*; b) • *Hypoestes lanata*; c) • *Justicia santapaui*; d) • *J. wynaadensis*
Threat status: Near Threatened [NT]

The taxon has been assigned to 'Near Threatened' category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than ten localities.

**Pollen:** Prolate spheroidal in equatorial view and spheroidal in ambitus, of medium size, 30 - 51 x 23 - 51 μm in size; with 4-azonicolporate, equidistant, broad in the centre and gradually tapering towards the poles, 4 central, equatorial pores, exine differentiated into pseudocolpi and ridges converging at the poles, pseudocolpi alternating with ridges, ridges reticulate, homobrochate (Chaubal, 1966; pers. obs.).

**Note:** A delicate slender submerged herb with two types of leaves (heterophyllous); the submerged leaves are strap shaped, pinnately lobed, leathery, abaxial surface of leaves reddish-brown, dark green on adaxial side, whereas the aerial floating leaves are shorter, crenate-serrate along margins.

From among the two type collections at CAL, Law Acc. no. 335602 has been selected as the *lectotype* during the present study.

**Specimens examined:** **Goa:** North Goa: Pernem, Querim, 16.03.1997, *M. K. Janarthanam & S. Rajkumar* 621 (GUH); Bicholim, Dodamarg, 12.04.1998, *M. K. Janarthanam & S. Rajkumar* 1506 (GUH); Satari, Tulsimala, Poryem, 12.03.2006, *M. E. Mascarenhas* 218 (GUH). **Karnataka:** Belgaum: Davalli-Londa, 540 m, 25.10.1978, *C. J. Saldanha & P. Prakash* KFP 3492 (JCB); Londa-Anmod road, 22.05.1979, *C. J. Saldanha* KFP 7822 (CAL; JCB). **Shimoga:** Kilangur to Hulical road, 21.03.1964, *R. S. Raghavan* 97055 (CAL). **Uttara Kannada:** *s. loc., s. d., s. c. Acc. no. 37204 (MH); near Soongsal, 18.01.1885, *W. A. Talbot* Acc. no. 37205 (MH); Soongsal bed of river, Deviman Ghat, 04.01.1885, *W. A. Talbot* 1131 (BSI); Mullund, 1889, *W. A. Talbot* 1868 (BSI); Deviman Ghat, February 1873, *s. c. s.n.* (BSI); Banks of Kali nadi, Londa, 21.04.1950, *H. Santapau* 10822 (BLAT); Katgal, 30.04.1956,
Pourí & Party 1359 (BSI). **Maharashtra**: Concan, *s. loc.*, *s. d.*, *Stocks*, Law Acc.no: 37203 (MH); Concan Vc., *s. loc.*, *s. d.*, *Stocks*, Law Acc.no: 335601 (Syntype CAL!).


Suffruticose undershrub; stem glabrous, geniculate, ascending. Leaves short petioled; petioles up to 1.9 cm long, sometimes winged; lamina elliptic-lanceolate, base acute, decurrent along the petiole, sometimes nearly to the base, entire, ciliate along margins, acuminatae apex, sparsely hispid on adaxial side, glabrous on abaxial side; main veins in 5 - 6 pairs, curved upwards, prominent on both sides. Inflorescence axillary as well as terminal, elongate, interrupted, leafy trichotomous, white woolly tomentose spikes, up to 15 cm long and more running into terminal panicles; heads of 1 to 3 flowers in the opposite axils of the primary bracts, each head with 1 fertile flower and the other 1 - 2 flowers always aborted; common involucre of 1 - 3, foliaceous floral bracts; floral bracts linear, 1.3 - 1.9 cm, unequal, sub-acute at apex, very hairy, partly connate at base, densely glandular pubescent, twice as long as calyx; bracteoles 2, foliaceous, subulate, acute at apex, glandular hairy. Calyx c. 5 mm long, nearly as long as the bracteoles, 5-fid (upper two segments partly fused or united as one) or 4-fid, divided to two-thirds its length; segments linear-subulate, one-nerved, hairy. Corolla light purple, c. 2.5 cm long or more, resupinate, tube pubescent outside, slender below, slightly enlarged above; upper lip c. 1.6 x 0.3 cm, ligulate, obtuse, shortly emarginate, parallel-nerved; lower lip as long as the upper, c. 0.8 cm broad, oblong, base purple-spotted, apex three-lobed, lobes short and equal. Stamens 2; filaments flat, pubescent, purple; anthers one-celled, muticose, deep yellow. Style filiform, glabrous; stigma bifid. Capsules nearly 1.3 - 1.9 cm long, stalked, narrowly clavate, pointed, pubescent, 2-seeded. Seeds c. 3 x 2 mm, oblong, rounded at the apex, verrucose. (Plate 6i)

Fl. & Fr.: October - February.

Habitat: In shaded forest as an undergrowth on low hills up to an elevation of 800 ft in the vicinity of Dapoli.
**Distribution:** Restricted to the Northern Western Ghats of Maharashtra (Mumbai, Raigad and Ratnagiri). (Map 5b)

**Threat Status:** Critically Endangered [CR B2ab(iii)].

The taxon has been assigned to 'Critically Endangered' category as the area of occupancy is estimated to be less than 10 km² and known to exist at only a single location. It is known from a single collection.

**Note:** The habit of this species is very different from other species of the genus in the area in being an undershrub and the leaves not being polka dotted. However the common involucral bracts, corolla and stamens are typical of *Hypoestes*. These views are also shared by earlier workers, Clarke (1885) and Santapau (1952). It resembles *Strobilanthes perfoliatus* in having an almost winged petiole.

Nayar and Sastry (1990) reported a collection of *Hypoestes lanata* (Acland 916) from Kherdi hill near Dapoli (1921) which is supposed to be housed in BLAT. Dalzell & Gibson (1861) gave its distribution as Roha of Raigad; Law (1851) gave its location as Rameshwar in N. Koncan. None of the collections mentioned above could be traced. Hence the description is based on Dalzell (1850), Clarke (1885) and Cooke (1905). The photograph of the *type* (Dalzell K5000357980) was obtained from Kew.

**Specimens examined:** As in *type*.


An undershrub, up to 1 m high. Stem obtusely quadrangular, glabrous, swollen at nodes. Leaves opposite; petiole 1.5 - 2.5 cm long, sparsely hairy; lamina elliptic to linear- lanceolate, 14.0 - 20.5 x 3.0 - 6.0 cm, acute at base, entire along margin; acute-acuminate at apex, glabrous, dark green above, pale below; main veins in 8-pairs, prominent on undersurface. Inflorescence terminal and often cymosely branched, c. 20 cm long, axis pubescent. Flowers sub-sessile; bracts ovate-oblong, 0.35 x 0.2 cm, ciliate, acute at apex, sparsely pubescent on both sides, midrib prominent; bracteoles linear-lanceolate, 0.4 x 0.15 cm, ciliate, acute at apex, sparsely pubescent. Calyx c. 0.7 cm long, 5-partite, divided almost to the base; segments unequal, subulate, acuminate, glandular hairy. Corolla c. 2.0 cm long, bilipped, white with slight pink tinge on back of upper lip and pink dots on lower lip, hairy without and at junction of throat within, with a groove on upper lip to hold the style in place; tube c. 0.7 cm long, terete; limb c. 1.5 cm; upper lip 0.9 cm long hooded, bi-lobed, lobes obtuse; lower lip 0.8 x 0.1 cm, three-lobed, lobes obtuse, middle lobe 1.0 x 0.5 cm, broadest;
lateral lobes 1.0 × 0.3 cm. Stamens 2; filaments hairy at point of attachment to corolla, exerted; anthers placed one above the other, lower lobe spurred. Disc c. 0.1 cm broad, fleshy, greenish. Ovary ovoid, 0.35 × 0.10 cm, pubescent all over; style slender, long, sparsely hairy up to middle; stigma obscurely bifid; ovules orbicular, glabrous. Capsules clavate, 2.0 - 2.8 × 0.6 - 0.8 cm, basal stalk 0.6 - 1.2 cm, apiculate, pubescent all over. Seeds 4, orbicular, labyrinthically rugose, glabrous. (Plate 7d-f; Fig. 17a-j)

**Local name:** Kadu gurkae (Kannada); Kathupukayile (Malayalam)

**Fl. & Fr.:** December - April.

**Habitat:** Mostly found as undergrowth by the road side, near the streams and in dense semi-evergreen forests.

**Distribution:** Throughout the Western Ghats from the Northern Western Ghats of Maharashtra (Matheran) to the Southern Western Ghats of Tamil Nadu (Anamalais). (Map 5c)

**Threat Status:** Near Threatened [NT]

The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than ten localities

**Pollen:** Ellipsoidal in shape, isopolar, equatorially constricted, prolate in equatorial view and spheroidal in ambitus. Medium in size; 48 - 63 × 23 - 30 μm in size; Colpi 3-zonicolporate, equidistant, circular around the pore, abruptly narrowing to a fine point on either sides of the colpus. Pores 3, central, conspicuous, granulose margins around the pore. Exine reticulate, heterobrochate; differentiated, circumpolar area uniformly finely reticulate; intercolpar area coarsely reticulate; demarcating line between the circumcolpar area and the intercolpar area is straight. Homologous with *Dicliptera* Juss. (Chaubal, 1966; pers. obs.).
Fig. 17: *Justicia santapau* Bennet – a. habit; b, c. bract, dorsal, ventral view; d. calyx; e. corolla; f. stamen; g. gynoecium; h. ovule; i. capsule; j. seed
Note: Bennet (1970) mentions that the specific epithet ‘montana’ cannot be used for this plant under Justicia as used by earlier authors, because the earlier name Justicia montana Roxb. (1805) is for an entirely different plant. Hence he proposed the name santapaui which is the first validly published name for this species. Ramamoorthy (1976) proposed a new name Justicia andersonii Ramam. for this same species. Yoganarasimhan et al. (1982) states that Justicia andersonii is a later name, hence superfluous and J. santapaui Bennet has to be maintained as the correct name.

During the present study, from among the type collections at CAL, Stocks, Law Acc.no. 342526 is selected as the lectotype.


A suffruticose herb. Stem elongate with distant nodes, slender, terete, striate, glabrous or nearly so. Leaves opposite, unequal; petioles 0.5 - 3.5 cm long, obscure due to decurrent leaf base, pubescent; lamina elliptic or elliptic-lanceolate, 6.0 - 12.5 x 1.5 - 4.5 cm, attenuate at base, sub-entire, ciliate along margins, acuminate apex, prominently lineolate, sparsely strigose above, pubescent on midrib, glabrous beneath, lineolate on both sides; main nerves in 6 - 8 pairs, slender, curved, prominent on both sides, raised beneath. Inflorescence axillary and terminal elongate, drooping, interrupted spikes, 6 - 10.5 cm long; inflorescence axis glandular-hairy. Flowers sub-sessile, opposite; bracts ovate, c. 2 x 1 mm, glandular hairy along margins, acute at apex, glandular-pubescent on dorsal side, glabrous on inner side; bracteoles linear-lanceolate, 3.5 - 4 mm long, glandular hairy along margins, acute at apex, glandular-pubescent on dorsal side, glabrous on inner. Calyx 4 - 5 mm long, divided almost to the base, segments unequal, linear-lanceolate, glandular hairy along margins, acute at apex, glandular hairy on outside, glabrous inside. Corolla c.10 mm long, pubescent outside, white to light pink in colour, bilipped; upper lip c. 4 mm long, obtuse, concave, slightly notched, nerved; lower lip very slightly longer, c. 4.5 mm long, with three-lobed; lobes obtuse the middle lobe the broadest, palate with transverse dark pink bands spreading on each side of the midnerve. Stamens two; filaments hairy below, glabrous above; anthers 2-celled, superimposed, the cell oblong or rounded,
the lower cell with a longer white basal appendage. Ovary hairy; style pubescent at lower half; stigma shortly two-fid. Capsule c. 1.4 x 0.4 cm, densely hairy, glandular hairy at base, gradually narrowed into a stalk 6 mm long, acutely mucronate, 4-seeded. Seeds c. 3 mm in diameter, rugose with small obtuse tubercles. (Plate 8a-d; Fig. 18a-l)

Fl. & Fr.: December - April.

Habitat: Diffuse herb in open, along road side, forest stream banks, along forest clearings in wet deciduous forests or as an undergrowth in semi evergreen forests.

Distribution: Distributed throught the Western Ghats from the Northern Western Ghats of Maharashtra (Ratnagiri) to the Southern Western Ghats of Kerala (Pathanamthitta) and occurs from low altitudes up to 660 m. (Map 5d)

Threat Status: Near Threatened [NT]

The taxon has been assigned to 'Near Threatened' cetegory since area of occupancy is estimated to be more than 20,000 km$^2$, known to exist at more than ten localities.

Pollen: Prolate in equatorial view, spheroidal or slightly oval in ambitus; medium in size, 33 - 46 x 25 - 33 μm; colpi 2-pororate, equidistant, opposite, circular around pores; pores 2, central, equatorial, opposite, circular, conspicuous, pore surface smooth; exine reticulate, reticulum heterobronchate; differentiated, circumpolar exine with a row of prominent groups, more or less circular, reticulate, on either side of the colpus and they coalesce at the poles; intercolpar exine uniformly inversely reticulate; exine much thicker at the equator than at the poles in side view (Chaubal, 1966; pers. obs.)

Note: This species has interrupted spikes with flowers in opposite pairs on a glandular- hairy rachis, which helps in the easy identification.
Plate 8: *Justicia wynaadensis* Heyne – a. flowering twig; b. flower; c, d. pollen, equatorial view; *Neuracanthus trinervius* Wight – e. habit; f. inflorescence; g, h. pollen, equatorial and polar view
Fig. 18: *Justicia wynaadensis* Heyne – a. flowering twig; b, c. bracts, dorsal ventral view; d, e. bracts, dorsal ventral view; f. calyx; g. corolla; h. corolla spread out with stamens; i. stamen; j. gynoecium; k. capsule; l. seed
Maharashtra: Kolhapur: Suleran, s. d., M. M. Sardesai mmS-1124 (SUK); s. loc. s. d., M. M. Sardesai NNS-109 (SUK). Ratnagiri: Gavate, 5 km from Bhedshi, February 1966, s. c. s. n. (BSI); Ramghat, Bhedshi, 27.04.1971, s. c. s. n. (BSI); Satara: Kumbharahli ghat, Koyna, February 1979, s. c. s. n. (BSI); Jungti, December 1995, M. P. Bachulkar-Cholekar 20293 (SUK). Tamil Nadu: Coimbatore: MPCA: Topslip, Valandy Range, 10°25’N 75°50’E, 12.02.1984, V. S. Ramachandran 1530 (FRLH).


An undershrub with branches up to 1 m high. Stem terete-obtusely quadrangular with long internodes up to 10.5 cm long. Leaves opposite, subsessile; lamina elliptic, 8 - 12 x 3 - 4 cm, tapering at both ends, decurrent at base strigously ciliate along margins, acuminate at apex, slightly lineolate on both surfaces, glabrous on both sides, paler below; main veins in 7 - 9 pairs, raised on the adaxial side. Inflorescence axillary as well as terminal. Spikes elongate, tetragonal, c. 3 cm long; bracts imbricately arranged, broadly elliptic tapering at both ends, coriaceous, densely ciliate with long and glandular hairs along margins, acute, mucronate at apex, densely pubescent with long simple and glandular hairy on outer side, glabrous inside, c. 7 nerved, converging towards apex; bracteoles 0. Peduncle c. 1 mm long to subsessile.
Calyx obscurely bi-lipped, divided almost to the base, c. 8 mm long; upper lip 3-lobed, divided to about the middle; lower lip 2-lobed, divided almost to the base; segments linear-subulate, densely ciliate with long and glandular hairs along margins, acuminate at apex, densely pubescent, as well as long simple and glandular hairs on outside, each long hair c. 2.5 mm long, sparsely simple hairy at apex on inside. Corolla blue; tubular-campanulate, 11 mm long; tube cylindrical at base, 5 mm long; at 3.5 mm tube constricted, slightly swollen above; campanulate part obscurely bi-lipped; upper lip c. 2 x 2 mm, bifid, lower lip 3-lobed, middle lobe c. 3 x 4 mm, lateral lobes c. 3 x 3 mm; lobes sub-similar, obtusely triangular, plicate in bud, hairy on outside, tufted at apex, hairy on inside from constricted part of tube upwards. Stamens 4, didynamous, included, attached at the constricted part in the middle of the tube; filaments hairy, longer filament c. 8 mm long, shorter c. 3.5 mm long; anther lobes c. 7.5 mm long, oblong, parallel, muticose at base, bithecous for longer stamen, monothecous for shorter stamen, other anther lobe aborted. Disc prominent, c. 1 mm broad, fleshy, cupular, with dense long hairs on two sides. Ovary, conical, elongated, c. 2 mm long, glabrous; style c. 1.5 mm long, glabrous; stigma one oblong, other aborted. Capsule, oblong-conical, glabrous; seeds 4. (Plate 8e-h; Fig. 19a-j)

**Fl. & Fr.:** November - April.

**Habitat:** Erect herb found as an undergrowth along slopes in deciduous forests in open situations.

**Distribution:** Restricted to the Northern Western Ghats of Maharashtra up to the Central Western Ghats of Karnataka (N. Kanara), with no occurrence in Goa. (Map 6a)

**Threat Status:** Near Threatened [NT]
Fig. 19: *Neuracanthus trinervius* Wight – a. flowering twig; b, c. bracts, dorsal ventral view; d. calyx; e. corolla; f. corolla spread out with stamens; g, h. stamens; i. gynoecium; j. capsule

a) • *Neuracanthus trinervius*; b) • *Rungia linifolia* var. *linifolia*,  
• *R. linifolia* var. *saldanhae*.; c) • *Strobilanthes anamallaica*;  
d) • *S. aurita*
The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than ten localities.

**Pollen:** Prolate spheroidal in equatorial view, subtriangular in ambitus; medium or large in size, 41 - 63 x 38 - 63 μm; colpi 3-zygotic, equidistant, broad in the centre, thick around the pore, oval, tapering towards poles, extension circumpolar, ends acute, margins straight, furrow membrane smooth; pores 3, central, equatorial, angul-aperturate, conspicuous, slightly depressed, margin granular with thick walls, pore surface smooth; exine uniform, granulose, very thick; intine depressed below the pores (Chaubal 1966; pers. obs.).

**Note:** Even though Clarke (1885) states that *N. tetragonostachyus* Nees hardly differs from *N. trinervius*, Santapau (1951) states that the two cannot be fused into one. Both are endemic to entirely far separated localities, while *N. tetragonostachyus* is endemic to Burma (present day Myanmar), *N. trinervius* to ‘Bombay’ (present day Maharashtra) with no intermediate or connective forms or localities. Therefore such a separation makes it difficult to consider them as conspecific. Anderson (1867) also treats the two separately and considers them to be endemic to the two localities mentioned earlier. The type of *N. tetragonostachyus* from Myanmar was observed during the present study at CAL and found to differ from *N. trinervius*.

**Specimens examined:** Karnataka: Uttara Kannada: *s. loc.*, 20.01.1884, W. A. Talbot 845 (BSI); Yellapore, 10.02.1884 W. A. Talbot 878 (BSI); *s. loc.*, 20.02.1903, W. A. Talbot 4416 (BSI). Maharashtra: Concan, *s. loc.*, *s. d.*, Stocks Acc. no. 69592 (MH). Mumbai: Mumbra, 30.11.1953, K. V. Shenoy KVS1442 (BLAT); Mumbra, 10.12.1953, K. V. Shenoy KVS1658 (BLAT); Mumbra, 17.12.1953, K. V. Shenoy KVS1729 (BLAT); Mumbra, 27.03.1954, K. V. Shenoy KVS52489 (BLAT); Mumbra, 28.08.1954, K. V. Shenoy KVS4184; Mumbra, 27.11.1954, K. V. Shenoy
KVS5506 (BLAT); Mumbra, 05.02.1955, P. V. Bole 1319 (BLAT). Nasik: Umberthan, 13.02.1982, P. L. Narasimhan 165448 (BSI); Pune: Khandala, 27.12.1890, T. Cooke s. n. (BLAT, BSI); Khandala, January 1892, s. c. s. n. (BSI, MH) Khandala Rama’s B.P., 24.01.1942, H. Santapau, 152.57 (BLAT); Khandala, 21.04.1942, H. Santapau 152.74 (BLAT); Khandala, St. Mary’s Ravine-Agent’s bungalow, 30.12.1942, H. Santapau 1457 (BLAT); Khandala, St. Mary’s Ravine descent behind St. Mary’s, 23.12.1943, H. Santapau 3413 (BLAT); Khandala, Echo pt. Ravine, 30.12.1943, H. Santapau 3520 (BLAT); Khandala, Slopes under Elphinston pt., 18.04.1944, H. Santapau, 4009 (BLAT); Khandala, St. Xavier’s Ravine, 20.01.1945, H. Santapau 5792 (BLAT); Khandala, St. X. Ravine, 16.02.1946, H. Santapau 8663 (BLAT); Khandala, Battery hill Plat., 28.12.1949, H. Santapau 10661 (BLAT); Khandala, Slopes below Elphinston pt., 27.01.1951, H. Santapau 12181 (BLAT); Khandala, Echo pt. Ravine, 21.12.1952, H. Santapau 15372 (BLAT); Khandala. 24.01.1959, H. Santapau 23028 (BLAT); Khandala (St. Xavier’s Villa - Monkey Hill Plateau), 24.01.1959, J. A. Merchant 840 (BLAT); Tungar, Shivansai, 05.12.1960 N. Y. Das NYD2821 (BLAT); Tungar, Usgaon, 28.02.1961, N. Y. Das NYD3207 (BLAT); Tungar, Mandvi, 08.12.1961, N. Y. Das NYD5160 (BLAT); Parol, 29.12.1961, N. Y. Das NYD5423 (BLAT); Tungar, Parol, 11.01.1962 N. Y. Das NYD6681 (BLAT); Khandala Tank, 09.03.1962, S. S. R. 78914 (BSI); Khandala Tank, 09.03.1962, S. S. R. 78926 (BSI); Ambavane forest on way to Kolaba, 14 miles of Lonavala, 02.02.1964, B. Venkata Reddi 95922 (MH); Sakar Pathan hill slopes facing Tiger Slip - Lonavala, 24.11.1964, B. Venkata Reddi 101165 (BSI); Tungar foot hill, Mandvi Range (Eastern Slope), 19.01.1968, K. V. Billore 113686 (BSI); Varandha ghat (grown in Kolhapur University garden), 18.11.2007, S. M. Shendege &
Rungia linifolia Nees

Key to the varieties:

la. Leaves coriaceous, acute at apex; bracts ovate-elliptic .......................................................... var. linifolia
lb. Leaves membranous, acuminate at apex; bracts elliptic-lanceolate ...................................................... var. saldanhae

A small erect to suberect, slender herb, 4 - 18 cm high; stem scabrously hairy, obtusely quadrangular, often rooting at the lower nodes, branches filiform. Leaves opposite; petioles 0.1 - 0.2 mm long, obscure due to decurrent leaf base, almost sub-sessile; lamina elliptic-lanceolate, 0.4 - 2.0 x 0.1 - 0.8 cm, acute at base, attenuate at base, margin entire, slightly revolute, ciliate along margins, acute at apex, coriaceous, glabrous or minutely scabrid, pubescent mainly on nerves on both surfaces, cystoliths on abaxial side; main veins prominent, raised on both sides, in 2 - 4 pairs. Inflorescence axillary and terminal spikes; peduncles 0.5 - 5.0 cm long, slender, filiform, curved inwards, pubescent hairy, with one or two nodes and a pair of bracts at the nodes; Spikes 0.5 - 5 cm long, secund, 4-ranked, with 2 bracts flowerless and 2 bracts with flowers; sterile bracts ovate-elliptic, *c.* 3.5 mm long, scarious, ciliate along margins, mucronate-cuspidate at apex, pubescent, glandular hairy on outer side, sparsely glandular hairy on inner side; floral bract similar to sterile bract, but apex not so mucronate-cuspidate; bracteoles lanceolate, *c.* 3.5 mm long, narrowly scarios.
ciliate along margins, acuminate at apex, pubescence similar to bracts. Calyx c. 3 mm long, divided almost to the base, segments unequal, linear-lanceolate, acuminate at apex, pubescent-glandular hairy on the outside. Corolla 5 - 7 mm long, distinctly 2-lipped, sparsely glandular outside, pubescent on inflated part of corolla within, tube c. 2.5 mm long, cylindric; upper part 2.5 -4.5 mm long, broader; upper lip c. 2 mm long, 2-lobed; lower lip c. 4.5 mm long, 3-lobed, lateral lobes obtuse, c. 2 x 2 mm, central one slightly more broader, retuse. Stamens 2; filaments flattened, c. 1 mm. long, glandular on outer side at upper half; anthers bithecous; anther lobes oblong, c. 1 mm long, superposed, lower one slightly spurred. Nectar secreting disc cupular, c. 1 mm. broad. Ovary oblong-elliptic, sparsely pubescent; style pubescent at base; stigma bifid; ovules orbicular, compressed; Capsule elliptic-ovovate, 2 - 3 x 1 mm, tetragonous, stipitate, mucronulate, hairy all over, 4-seeded; placentas separating elastically from the base of the capsule on dehiscence, to disperse the seeds. Seeds orbicular-oblong, 1x1 mm, light brown, test verrucose. (Plate 9a-d; Fig. 20a-o)

Fl. & Fr.: October - May.

Habitat: Erect small herbs growing in small clumps in crevices of rocks on dry river bed.

Distribution: Endemic to the Northern Western Ghats of Karnataka (North Kanara). (Map 6b)

Threat Status: Endangered [EN B2ab (iii, iv)].

The taxon has been assigned to ‘Endangered’ category since area of occupancy is estimated to be less than 500 km², known to exist at not more than five localities.

Pollen: Ellipsoidal in shape, prolate in equatorial view, ambitus oval. Minute in size. Colpi 2-colporate, broad in the centre, gradually tapering on either side, extension circumpolar, ends acute, margins well defined, furrow membrane smooth. Pores 2,
Plate 9: *Rungia linifolia* Nees var. *linifolia* - a. habit; b. inflorescence; c. pollen, equatorial view; d. SEM, seed; *R. linifolia* Nees var. *saldanhae* Mascar. et Janarth. - e. habit; f. inflorescence; g. pollen, equatorial view; h. SEM, seed; *Strobilanthes anamallaica* J. R. I. Wood - i. habit
Fig. 20: *Rungia linifolia* Nees var. *linifolia* – a, b, c. habit; d, e. flowerless bract, dorsal, ventral view; f, g. floral bract, dorsal, ventral view; h, i. bracteoles, dorsal, ventral view; j. calyx; k. corolla; l. stamen; m. gynoecium; n. capsule; o. seed
opposite, central, equatorial, conspicuous, slightly protruding, pore surface smooth. Exine reticulate, heterobrochate; differentiated into circumpolar area and interpolar area; circumpolar area finely reticulate, with a row of groups of prominent reticulate patches on either side of the colpus, extension subpolar; interpolar area uniformly, coarsely inversely reticulate. Holmologous to Justicia. Linn. (Chaubal, 1966; pers obs.).

**SEM of seeds:** SEM study on seed morphology reveals the testa to be verrucose.

**Note:** The specimen is an erect small herb, often rooting at the lower nodes, growing in small clumps in cracks of rocks on the dry river bed of Kala nadi between Ulvi & Dandeli in exposed conditions showing stunted growth. Some flowers were white with purple stripes whereas others were pink with purple stripes.

The two collections of Bachulkar-Cholekar’s from Vasota Flora at SUK and one from Rajasthan (Anandsagar Banswara), JAV 29238 at BSI on critical analysis showed that they were wrongly identified as R. linifolia and hence its distribution remains restricted to Uttara Kannada.

From the two types at CAL, Heyne Coll. no. 2447 was selected as the **lectotype.**

**Specimens examined:** **Karnataka:** Concan Vc., s. loc., s. d., Stock (CAL!). **Uttara Kannada:** Gersoppa falls, October 1919, Hall & McCann 34142 (BLAT); Jog falls, 17.05.1954, H. Santapau 18531 (BLAT.); Gund Range, Dandeli, 14.02.1979, K. R. Keshava Murthy, S. B. Mohanan & S. R. Ramesh KFP6043 (JCB); Gund Range, Dandeli, 14.02.1979, K. R. Keshava Murthy & S. B. Mohanan KFP6048 (JCB); Between Ulvi and Dandeli near Kaner, N 15°05.205’ E 074°30.985’ alt.: 1301 ft., 28.04.2007, M. E. Mascarenhas & M. K. Janarthanam 381 (GUH).

A herb. Stem slender, erect, c. 30 cm high, quadrangular, pubescent, branches dichotomous, filiform. Leaves opposite; petioles 5 - 7 mm long, obscure due to decurrent leaf base; lamina elliptic to linear-lanceolate, 2.5 - 4.5 x 0.5 - 1.0 cm, tapering at both ends entire, slightly revolute, ciliate along margins, acuminate at apex, membranous, pubescent, more so on nerves beneath, cystoliths on abaxial side; main veins prominent, raised on both sides, in 3 - 5 pairs. Inflorescence axillary or terminal spikes; peduncles, up to 4.5 cm long, filiform, curved inwards, glandular pubescent; bracts at the base of inflorescence axis small, similar to leaves; spike 1.5 - 2.5 cm long, secund, 4-ranked; bracts elliptic-lanceolate, c. 5 mm long, acuminate at apex, entire, scarious, ciliate along margins glandular hairy on outside, sparsely glandular hairy on the inside, midrib prominent, floral and sterile bracts similar; bracteoles 2, lanceolate, c. 3 mm long, acuminate at apex, scarious, ciliate along margins, glandular hairy on the outside, glabrous or nearly so on the inside, midrib prominent, pubescent. Calyx c. 3.5 mm long, divided almost to the base, unequal, segments linear-lanceolate, glandular pubescent on the outside. Corolla c. 9 mm long, pubescent on the outside sparsely hairy within; tube c. 4 mm long, cylindric; upper part c. 5 mm long, ventricose, distinctly bi-lipped; upper lip 2-lobed, lower lip 3-lobed, lobes obtuse, middle one bigger. Stamens 2; filaments flattened, c. 2.5 mm long, glandular on outer side at upper half; anthers bithecous; anther lobes c. 0.75 mm long, oblong, superposed, with a spur at the base of the lower anther lobe. Disc present, cupular; Ovary ovoid, glabrous; ovules 4; style sparsely hairy at base; stigma bifid. Capsule obovate, 3.5 - 4.5 mm long, stipitate, mucronulate at apex, pubescent.
Fig. 21: *Rungia linifolia* Nees var. *saldanhae* Mascar. et Janarth. – a. habit; b, c. flowerless bract, dorsal, ventral view; d, e. floral bract, dorsal, ventral view; f, g. bracteole, dorsal, ventral view; h. calyx; i. corolla; j. stamen; k. capsule; l. seed
all over; placentas separating elastically from the base of the capsule on dehiscence, to
disperse the seeds. Seeds 4, orbicular-oblong, c.1 x 1 mm, brown, testa compound
verrucose. (Plate 9e-h; Fig. 21a-l)

Fl. & Fr.: January - February.

Habitat: By the roadside as an undergrowth in moist conditions, between Kottigehara
to Jenukallu at the upper ghats.

Distribution: Karnataka: Found in the Central Western Ghats of Karnataka
(Chikmagalur and Hassan districts). (Map 6b)

Threat Status: Endangered [EN B2ab (iii, iv)].
The taxon has been assigned ‘Endangered’ category since area of occupancy is
estimated to be less than 500 km², known to exist at not more than five localities. The
present locality is projected as very fragile as any road-widening activity will threaten
its habitat and further endanger its existence.

Pollen: Prolate in equatorial view, ambitus oval. Minute in size. Colpi 2-colporate,
broad in the centre, gradually tapering on either side, acute at ends, margins well
defined, smooth furrow membrane. Pores 2, opposite, equatorial, central, prominent,
slightly bulging, smooth pore surface. Exine reticulate, heterobrochate; circumcolpar
area finely reticulate, with a row of groups of reticulate patches on both sides of the
colpus, subpolar extension; intercolpar area uniformly coarsely reticulate (Chaubal,
1966; pers obs.)

SEM of Seed: SEM study on seed morphology reveals the testa to be compound
verrucose.

Note: The four earlier collections, three at JCB and one at BSI from Hassan and
Chikmagalur respectively were identified as *R. linifolia* Nees. Fresh collection of the
specimen was made from Kottigehara (Chikmagalur). Critical analysis of the above
mentioned specimens, the present collection and comparison with the typical variety of *R. linifolia*, showed that they were distinct and the same was confirmed by SEM analysis of the seeds of the present collection and the seeds of the typical variety (Table 6). Hence in the present study it is designated as a new variety.

Table 6: Differences between *Rungia linifolia* var. *linifolia* and *R. linifolia* var. *saldanhae*

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Character</th>
<th><em>Rungia linifolia</em> var. <em>linifolia</em></th>
<th><em>R. linifolia</em> var. <em>saldanhae</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Habitat</td>
<td>dried river banks, among rock crevices, in exposed conditions</td>
<td>roadside, an undergrowth, in moist and shady conditions</td>
</tr>
<tr>
<td>2</td>
<td>Height</td>
<td>4 - 18 cm high</td>
<td>up to 30 cm high</td>
</tr>
<tr>
<td>3</td>
<td>Stem</td>
<td>Scabrous</td>
<td>pubescent</td>
</tr>
<tr>
<td>4</td>
<td>Leaves</td>
<td>4 - 20 x 1 - 8 mm</td>
<td>25 - 45 x 5 - 10 mm</td>
</tr>
<tr>
<td>5</td>
<td>Leaf surface</td>
<td>coriaceous</td>
<td>membranous</td>
</tr>
<tr>
<td>6</td>
<td>Leaf margin</td>
<td>sparsely ciliate</td>
<td>ciliate</td>
</tr>
<tr>
<td>7</td>
<td>Leaf apex</td>
<td>Acute</td>
<td>acuminate</td>
</tr>
<tr>
<td>8</td>
<td>Bracts</td>
<td>ovate-elliptic, mucronate-cuspidate at apex</td>
<td>elliptic-lanceolate, acuminate at apex</td>
</tr>
<tr>
<td>9</td>
<td>Verrucose seed testa</td>
<td>Simple</td>
<td>compound</td>
</tr>
</tbody>
</table>

**Etymology:** The epithet of the new variety is in honour of the late Fr. Cecil J. Saldanha S. J. who has contributed immensely to the taxonomy of this region.

**Specimens examined:** (paratypes) **Karnataka:** Chikmagalur: Ballalarayanadurga, 27.02.1963, *R. S. Raghavan* 86993 (BSI). **Hassan:** Devalkere, 28.01.1969, *C. J. Saldanha* 12436 (JCB); stream between Davalkere & Davarunde, 24.02.1970, *C. J. Saldanha* 16461, (JCB); stream before Daverunde, 28.01.1971, **T. P. Ramamoorthy** HFP 1369 (JCB).

A shrub, up to 1 m high. Leaves opposite, isophyllous or weakly anisophyllous; petioles 1 - 1.25 cm long, obscure due to decurrent leaf base; lamina narrowly elliptic or lanceolate, 10 - 15 x 2.5 - 4 cm, acuminate at base, entire along margins, acuminate at apex, thick, paler below, glabrous, strongly lineolate above, not so beneath; main veins in 4 - 6 pairs, faint, curved upwards. Inflorescence axillary and terminal solitary spikes, 2.5 - 5 cm long; peduncles thickened at apex, 2.5 - 4.4 cm long, invariably with 2 distinct but small leaves in middle of peduncle, often deflexed; bracts broadly obovate - orbicular, concave, 8 - 12.5 mm long, adhering to peduncle at base, entire along margins, obtuse or minutely apiculate at apex, thick, glabrous, lineolate; bracteoles linear-oblanceolate, c. 7 mm long, glabrous, lineolate. Calyx c. 1.2 cm long, divided to c. halfway downwards; segments 5, 2 segments more united than the other 3, acute or obtuse at apex, membranous, glabrous. Corolla tubular-campanulate, 2.5 - 3.1 cm long, glabrous outside, hairy inside, pale blue or lavender; tube cylindrical short, c. 5 mm long; campanulate part widening above, c. 1.5 cm long; lobes five, orbicular, obtuse. Stamens 4, didynamous; staminal sheath extending beyond cylindrical base; filaments and staminal sheath hairy throughout. Disc prominent. Ovary c. 2.5 mm long, glabrous; style slender, c. 1.8 cm long, glabrous. Capsules broadly elliptic, c. 1 cm long, glabrous; seeds orbicular, c. 5 mm, glabrous, areolate; areole minute. (Plate 9i)
Fl. & Fr.: September - December.

**Habitat:** In the undergrowth of evergreen forest.

**Distribution:** **Karnataka:** Restricted from Central Western Ghats in Dakshina Kannada (Karnataka) to Southern Western Ghats in Kollam (Kerala) and Tirunalveli (Tamil Nadu). (Map 6c)

**Threat Status:** Vulnerable [VU B2ab (iii)].

The taxon has been assigned to 'Vulnerable' category as the area of occupancy is estimated to be less than 2000 km\(^2\) and is known to exist at no more than 10 localities.

**Pollen:** Subprolate in equatorial view, circular in polar view; 3-zonicolporate; equidistant, long and narrow (fusiform), gradually tapering towards either poles, ends acute; pores 3 central, equatorial, circular; exine differentiated into pseudocolpi, alternating with ridges; each ridge with aggregates of exine along the middle more so continuous (Carine & Scotland, 1998).

**Note:** There is only one collection of Beddome from the study area (Dakshina Kannada) housed in MH. It could not be located in the study area during the present study. Clarke (1885) suggested an affinity with *S. ciliata* Nees, except that *S. ciliata* has a smaller corolla with a narrow tube and exserted stamens.

**Specimens Examined:** **Karnataka:** Dakshina Kannada: *s. loc.*, 1880, R. H. Beddome Acc. no. 39555 (MH). **Kerala:** Kollam: Pamba, 1075 m, 01.10.1976, K. Vivekananthan 48373 (MH); Palghat: Below Ayyappan Kovi area, 900 m, 26.10.1976, E. Vajravelu 48693 (MH). **Tamil Nadu:** Coimbatore: Attakatti to Valparai, 1200m, 14.12.1960, *N. P. Balakrishnan & J. L. Ellis* 11729 (MH); Sholaiyer submergible area, 1030 m, 25.12.1963, K. Ramamurthy 18099 (MH); Lower Nirar to Italier forest, ± 950 m, 06.09.1983, K. Ramamurthy 78410 (MH);
Tirunelveli: Tirunelveli, s. loc., 1880, R. H. Beddome Acc. no. 37791 (MH); S. Tirunelveli, s. loc., s. d. (1880), Beddome s. n. Acc. no. 337577 (syntype CAL !)


A small shrub. Stem branched, quadrangular, grooved, swollen at nodes, pubescent at older parts, hispid hairy at younger parts. Leaves opposite, unequal, shortly petioled; petiole c. 0.3 - 1.3 cm long, hirsute hairy; lamina elliptic-lanceolate, 6.5 - 14 x 1.8 - 3.5 cm, tapering at base, entire, ciliate along margins, acuminate or caudate at apex, pale green beneath, sparsely hairy, more so on nerves on both surfaces; main veins in 8 - 10 pairs. Inflorescence axillary as well as terminal heads; peduncles 3 - 5 cm long, hirsute hairy. Bracts spatulate, linear-oblong, c. 2 cm long, longer than the flowers, persistent, glandular-pubescent; bracteoles similar. Calyx c. 1 cm long, divided almost to the base, segments 5, unequal, unequal, 1 segment longer, remaining 4 in 2 pairs of equal length, slender, oblong, acute at apex, hispidulous hairy on both surfaces. Corolla tubular at base, ventricose above, c. 2 cm long and c. 1.2 cm wide; tube cylindrical, c. 5 mm long, pale yellow or white with a tinge of red; ventricose part, c. 1.5 cm long, hairy inside; lobes orbicular, with 2
yellow spots on lower lobes. Stamens 4; filaments joined below to form a sheath, more or less adherent to corolla tube except along margins; staminal sheath reaching up to half the length of the ventricose part, hairy along margins; longer filaments c. 4 mm long, shorter ones c. 3 mm long, included, glabrous. Disc present. Ovary c. 3 mm long, glandular hairy at apex; style c. 1.2 cm long, glabrous, persistent; stigma bilobed, one lobe suppressed. Capsules broadly elliptic, c. 1.2 cm long, acute at apex, glandular pubescent, 4-seeded; seeds ovoid, lenticular, c. 2 mm broad, brown, hairy, densely so on margins, areolate at base; areole small, semicircular or reniform, glabrous on both sides. (Plate 10a; Fig. 22a-i)

Fl. & Fr.: November - February.

Habitat: In partial or complete shade on loam and humus, mostly in wet deciduous forest, in study area between 500 m and 800 m. It is also recorded from evergreen forests at 1000 m (Venu 2006).

Distribution: Restricted from the Central Western Ghats of Karnataka (Hassan) to the Southern Western Ghats of Kerala (Idukki). (Map 6d)

Threat status: Endangered [EN B2ab (iii)].

The taxon has been assigned to 'Endangered' category since area of occupancy is estimated to be less than 500 km², known to exist at no more than five localities.

Pollen: Prolate in equatorial view, circular in polar view; 3-zonicolporate; equidistant, long and narrow, fusiform, pores 3 central, equatorial, circular; exine differentiated into pseudocolpi, alternating with ridges; each ridge with a coarse ladder-like reticulum, with perforate lumina (Carine & Scotland, 1998).

Note: The description of this species was based on the isotype (HFP1147) at JCB, Wood (1994) and Venu (2006). The south Indian species was considered to be the same as Strobilanthes caudata from Ceylon by Beddome and Clarke. After critically
Plate 10: Strobilanthes aurita J. R. I. Wood – a. habit; S. barbatus Nees – b. habit; c. spike; d. spike, fruiting; e. pollen, equatorial view; S. canaricus Bedd. – f. habit; S. gamblei Carine et al. – g. habit; h. flower
Fig. 22: Strobilanthes aurita J. R. I. Wood – a. habit; b, c. bract, dorsal, ventral view; d, e. bracteoles, dorsal, ventral view; f. calyx; g. corolla spread out showing stamens; h. dehisced capsule; i. seed
analysing the type material (Thwaites 364) at Kew and Peredeniya, Wood (1994) observed that the south Indian plant differed from the one from Ceylon in having a smaller, 4-seeded capsule, erect peduncles and bracts which are much longer, often spathulate, bigger than the flower heads. Hence, concluded that the two were distinct and treated the south Indian plant to be a new species and gave it the specific epithet ‘aurita’ because of the long bracts.

According to Carine & Scotland (1998), the pollen of *S. aurita* and *S. caudata* are placed in the same group (Type 3), but they still differ in their shape and in the coarse ladder-like reticulations on the longitudinal ribs. Hence they cannot be considered as synonyms.


A large shrub, subscandant. Stem obtusely quadrangular at older parts and lenticellate, sharply quadrangular and winged at younger parts, nodes prominent, bent above the nodes. Leaves opposite, unequal, petiolate; petiole 0.5 - 7 cm long, winged, obscure due to decurrent leaf base, often pigmented at the midrib, wings sometimes running into the wings of the stem or branch; Lamina elliptic-lanceolate,
tapering at both ends, leaf base extended into petiole as a wing, crenate, scabrous along margins, acuminate at apex, coriaceous, dark green above, pale below, glabrous above, sparsely scabrous hairy beneath, cystoliths densely arranged on abaxial side; main veins in 3 - 11 pairs, prominent, raised on both sides, curving upwards, lineolate on both sides. Inflorescence axillary as well as terminal heads or spikes, 2 - 3.5 cm long; involucral bracts in one or two pairs of opposite, decussate bracts, foliaceous, elliptic-lanceolate, long acuminate at apex, sessile-subsessile, similar to leaves, 2.5 - 5.5 x 0.5 - 1.9 cm; floral bracts densely imbricate, rhomboidal-cuneate, cuspidately mucronate at apex, c. 22 mm long, ciliate along the margins, glabrous on both sides; rhomboidal part c. 8 x 8 mm, cuspidate part c. 14 mm long; bracteoles ovate-lanceolate, 12 - 18 mm long, cuspidate acuminate at apex, ciliate along margins, glabrous on both sides; bracts, bracteoles, calyx enlarzing and becoming glandular hairy in fruiting. Calyx 11 - 12 mm long, divided to more than half way down, segments 6 - 7 mm long, unequal, one lobe slightly longer than the other, lanceolate, ciliate along the margins, acuminate at apex. Corolla tubular-campanulate, white, 17 - 20 mm long, tube cylindrical at base, 6 - 8 mm long, slightly shorter than upper campanulate portion, tube widens above, 4 x 8 mm, limb nearly erect, lobes 5, almost equal c. 6 x 4 mm, ovate, acute to emarginate at apex, ciliate with long hairs along margins and apex, reticulate, pigmented veins prominent with long hairs on midrib on dorsal side, otherwise glabrous outside, dense hairs in two rows, on inner side at base of two adaxial lobes to hold style and sparsely hairy inside. Stamens 4, didynamous, staminal tube 4 - 6 mm long, from apex of tube to halfway of broad part, open ended at both sides, densely pubescent with long hairs, truncate at apex; longer filament c. 5 mm long, pubescent hairy for half its length, smaller ones c. 3 mm long, slightly pubescent hairy. Disc prominent, c. 1 mm broad, fleshy. Ovary c. 1 mm long, conical,
glandular hairy at apex; style c. 12 mm long; stigma c. 3 mm long, sub-entire, one arm aborted. Capsule 15 - 18 mm long, elliptic to sub-clavate, almost glabrous, sparsely shortly glandular hairy at apex, apiculate, 2 seeded; seeds oblong-broadly elliptic, 7.5 - 8 x 5 - 6 mm, obtuse to emarginate at apex, glabrous, light brown. (Plate 10b-e; Fig. 23a-m)

**Fl. & Fr.:** August - May; flowering about every seventh year (Beddome1874).

**Habitat:** Found near streams or as an undercover in semi-evergreen forests, edges of wet deciduous forests in partial shade. Also found in evergreen or semi-evergreen forests, especially in marshy moist places in dense shade.

**Distribution:** Throughout the Western Ghats, from the Northern Western Ghats of Goa to the Southern Western Ghats of Tamil Nadu. Grows at low altitudes between 100 - 909 m. (Map 7a)

**Threat Status:** Near Threatened [NT]

The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than ten localities.

**Pollen:** Prolate or subprolate in equatorial view, circular in polar view; 58 - 71 x 33 - 43 µm in size; 3-zonicolporate; equidistant long and narrow (fusiform), gradually tapering towards either poles, ends acute, margins straight and well defined, furrow membrane smooth; pores 3 central, equatorial, circular or lalongate; protruding, pore surface smooth; exine differentiated into pseudocolpi, alternating with ridges; in some grains the ridges are twisted giving the grain a spiral appearance; the extent or presence of spiralisation is highly variable within the species. Tectum perforate (Carine & Scotland, 1998; pers. obs.).

**Note:** Cooke (1905) mentioned that there is a rudimentary fifth stamen, however it was not observed during the present study. A new variety of *S. barbatus* Nees var.
Fig. 23: *Strobilanthes barbatus* Nees – a. flowering twig; b, c. bracts, dorsal, ventral view; d, e. bracteole, dorsal, ventral view; f. calyx; g. corolla; h. corolla spread out with stamens; i. androecium; j. gynoecium; k. capsule; l. dehisced capsule; m. seed
Map 7: Distribution of *Strobilanthes barbatus* Nees, *S. canaricus* Bedd., *S. ciliatus* Nees, *S. gamblei* Carine et al. along Northern and Central Western Ghats.

a) ● *Strobilanthes barbatus*; b) ● *S. canaricus*; c) ● *S. ciliatus*; d) ● *S. gamblei*
*bonaccordensis* Santhosh & Vikraman (2001) was described based on characters such as wingless stem, petioles and peduncles. Beddome (1874) pointed out that winged and wingless forms are to be found on the same plant.

During the present study, observations from herbarium collections showed intermediate characters in which collections from Goa, Karnataka, Palghat district in Kerala and one collection from Tirunelveli district in Tamil Nadu showed winged stems. Whereas the rest of the collections from the districts of Kerala (Cannanore, Idukki, Quilon, Palghat and Pathanamithitta) and from Tamil Nadu (Coonoor and Tirunelveli) did not show winged stem but only a quadrangular stem, sulcate on all four sides and petioles scarcely winged. Thus there appears to be variations in the winged nature of the stem, petioles and peduncles and therefore the var. *bonaccordensis* does not stand. This view is shared by Venu (2006). All the collections have to be treated as *S. barbatus*.

13.09.1970, N. Satyananda 60 (JCB); Kodamane road, 25.10.1970, T. P. Ramamoorthy HFP999 (CAL). Kodagu: Sampajee Ghat, s. d., s. c. Acc. no. 37722 (MH); Madanad, 07.03.1958, G. S. Puri 31775 (BSI). Shimoga: Agumbe, Ballahali-Maladar road, 08.02.1961, R. S. Raghavan 69468 (BSI); Pokhankira Reserve Forest near Bedguli, 16.04.1962, A. S. Rao 94176 (BSI); Keri gudda in Hulical, 16.02.1963, R. S. Raghavan 86302 (BSI). Uttara Kannada: North & South Kanara, s. loc., 1873, R. A. Beddome 39541 (MH); Supa, 20.02.1889, W. A. Talbot 1849 (CAL); Supa, 20.02.1889, W. A. Talbot 1849 (BSI); s. l., February 1892, Bhiva s. n. (BSI); Yellapur, Arbail Ghat, 545.5 m, March 1919, L. J. Sedgwick 5856 (CAL); Conc an, s. d., Stocks s. n. (CAL); N. & S. Conc an, s. l., s. d., Law Acc. no. 337472 (CAL); Sirsi-Kumta road, 09.05.1956, G. S. Puri 2120 (BSI). Kerala: Idukki: Edapalayan, 850 m, 25.09.1972, B. D. Sharma 41652 (MH); Okkarai-Thekkady, 850 m, 16.03.1973, B. D. Sharma 43890 (MH); Valara R. F., 100 m, K. Ramamurthy 80897 (MH); Kulamavu, ± 700 m, 03.10.1983, C. N. Mohanan 79939 (MH); Paniaru, ± 700 m, 19.02.1984, A. G. Pandurangan, 78054 (MH); Kulamavu, ± 700 m, 23.09.1984, C. N. Mohanan Acc. No: 80146 (MH). Kannur: Canoor Ghat, November 1885, s. c. Acc. no. 37720 (MH); Manantoddy, October 1989, M. R. Morgan Acc. No: 37721 (MH); Courtallum hills, August 1864, R. H. Beddome Acc. no. 37718 (MH). Kollam: Keri, 909 m, 01.02.1894, T. F. Bourdillon 86 (MH); Kadambupara forest, Konni R.F., 20.04.1984, E. Vajravelu 80531 (MH); Kottayam: Adukkom, ± 400 m, 25.05.1984, V. T. Anthony 551 (MH); Palghat: Dhoni R.F., 100 m, 21.10.1963, J. Joseph 17803 (MH); Silent Valley R.F., 900 m, 11.10.1965, E. Vajravelu 26143 (MH). Pathanamthitta: Tenmalai, Kallada river valley, 07.02.1961, K. N. Subramanian 70356 (BSI); Kulathupuzha, Choolal reserve forest, 15.02.1961, K. N. Subramanian 70735 (BSI); Kulathupuzha, Kannimanthodu, 15.02.1961, K. N. Subramanian 70655 (BSI);


A rigid shrub up to 1 m high; Stem obscurely quadrangular, faintly sulcate, swollen at nodes, internodes 1.5 - 2.5 cm long, hirsute hairy above; tips of branches and young leaves densely clothed with caduceus yellowish woolly hairs. Leaves crowded towards the ends of the branches, opposite, petiolate; petiole 10 - 17 mm long, hirsute; lamina ovate-broadly elliptic, 3.5 - 5 x 2 - 3 cm, shortly decurrent at base, faintly wavy or sub-entire, sparsely ciliate along margins, acute at apex, cystoliths visible on upper side, lineolate beneath, lanate at base on abaxial surface, mature leaves almost glabrous, minutely hirsute on adaxial surface, mainly on nerves beneath; main veins in 8 - 9 pairs, prominent, sub-parallel, curved upwards, impressed above, raised beneath. Inflorescence short spikes unbranched, clustered in upper axils
forming a dense terminal panicle, shorter than the leaves, uninterrupted, up to 5.5 cm long; peduncle 3 - 15 mm long, densely hirsute. Flowers in sub-opposite pairs, in 4 rows; bracts elliptic or narrowly elliptic, c. 6 mm long, ciliate along margins, obscurely acuminate, glandular hairy above, glabrous or minutely pubescent beneath; bracteoles linear-lanceolate, c. 4 mm long, ciliate along margins, sub-acute at apex, shorter than calyx, slightly falcate, glandular hairy on both sides. Calyx 5-lobed, divided almost to the base, c. 6 mm long, white-hairy with red glands at apex; segments faintly scarious, narrowly lanceolate, acuminate at apex, hirsute, white-puberulous outside, sparsely hairy inside. Corolla white, tubular-ventricose, c. 15 mm long, 7 mm across, pubescent without, sparsely hairy within, more so near stamens, two rows of hair on posterior side of ventricose portion to hold style; tube very short, c. 3 mm long, gradually widening; ventricose above c. 12 mm long, much longer than tube, 5-lobed; lobes equal, ovate-orbicular, acute. Stamens 2; staminal sheath up to 1/3 length of ventricose portion; filaments hairy all over; anther cells bithecous, pointed at base, dorsifixed. Disc prominent. Ovary c. 2 mm long, glabrous; style c. 1.5 cm long, sparsely hairy; stigma sub-entire. Capsules and seeds not seen. (Plate 10f; Fig. 24a)

Fl.: December - May.

Habitat: In full sun on rocky sloping ground at high altitudes.

Distribution: Restricted to the Southern Western Ghats of Karnataka (Dakhina Kannada, Hassan) and Kerala (Idukki) at high altitudes between 1000 - 1500 m. (Map 7b)

Threat Status: Endangered [EN B2ab(iii)].

The taxon has been assigned to 'Endangered' category since area of occupancy is estimated to be less than 500 km², known to exist at not more than five localities.
Fig. 24: Strobilanthes canaricus Bedd. – a. habit
Pollen: Prolate or subprolate in equatorial view, circular in polar view; 3-colporate; equidistant, long and narrow (fusiform), pores 3, circular or lalongate; exine differentiated into pseudocolpi, alternating with ridges; in some grains the ridges are twisted giving the grain a spiral appearance; the extent or presence of spiralisation is highly variable within the species. Tectum perforate (Carine & Scotland, 1998).

Note: This species could not be collected hence the description was based on the collections from herbaria, Craine et al. (2004) and Venu (2006). Saldanha & Nicolson (1976) described this species to be common on rock sloping surfaces at Genkalbetta near the peak, in full sunlight. Santosh Kumar (1994) collected the taxon from Idukki, Kerala, this shows an extended distribution from Karnataka to Kerala.


A shrub, up to 2 m tall. Stem with diffuse branching, obtusely quadrangular to terete, glabrous, sulcate on two sides above, lenticulate, jointed at nodes, prominent, often fimbriate, swollen above the nodes. Leaves opposite, unequal; petiole 0.5 - 8 cm long, obscure due to decurrent leaf base; lamina elliptic, broadly elliptic to elliptic-lanceolate, 3.5 - 16 x 2 - 7 cm, attenuate at base, sub-entire to serrate along margin, acute-acuminate to acuminate at apex, sub-coriaceous, dark green above, glaucous below, glabrous or nearly so, lineolate, more so on upper side, cystoliths visible on dorsal side; main veins in 7 - 9 pairs, curved upwards, raised on upper side, slightly impressed beneath. Inflorescence opposite, axillary spikes, often from the older leafless axils; peduncle 1.5 - 4.5 cm long, mostly deflexed, jointed, bracteate at the joint, glabrous at first, often cottony hairs later; spikes sub-capitate to oblong, 1 - 3 cm long at first, with two bracts at base of spike, flowers 4-seriate, spikes becoming elongated, 3 - 5 cm long; bracts c. 7 x 3.5 mm, suborbicular-broadly elliptic to obovate, acute-acuminate at apex, entire to serrulate along margins, glabrous during early flowering, glandular hairy, c. 8 x 4 mm at fruiting; bracteoles c. 5 x 1 mm, linear-lanceolate, sub-acute to acuminate at apex, glabrous at first, enlarging to c. 8.5 mm at fruiting. Calyx 5 - 6.5 mm long, divided to 2/3rd its length; segments unequal, linear-lanceolate, acute at apex, almost glabrous with a few glandular hairs,
enlarging to c. 15 mm, becoming densely covered with glandular hairs on outside and sparsely glandular hairy on inside at fruiting. Corolla c. 13.5 mm long, glabrous outside, tube cylindrical, 6 - 7 mm long; campanulate above, broad portion 1 - 2 mm long; lobes 4 - 6 x 4 mm, spreading, obtuse, whitish purple with dark purple blotches at throat, veins clearly visible on lobes, hairs in two rows on inside to hold the style. Stamens 4, didynamous, staminal tube open at one end, densely hairy at open edges; filaments above the staminal tube, 6 - 9 cm long, filament of longer stamens bearded at base, almost glabrous of shorter stamens, fifth filament may be present as a rudimentary staminode, c. 2 mm long, hairy; anther lobes purple, bithecous, oblong, c. 2 mm long. Disc 1 - 1.5 mm broad, fleshy. Ovary conical, 1 - 1.5 mm long, glabrous; style c. 1.3 cm long, glabrous; stigma two, one aborted; ovules 4, orbicular, c. 0.5 x 0.5 mm. Capsule elliptic, c. 10 x 3 mm long, sub-acute at apex, glandular hairy all over, sometimes pigmented, 4 seeded; seeds sub-orbicular to oblong, 2.5 - 4.5 x 2 - 2.5 mm, obtuse at apex, glabrous, yellow vertical striae, with a thick rim, exareolate.  

(Plate 11a-d; Fig. 25a-o)

**Local name:** Karimkurinji (Malyalam).

**Fl. & Fr.:** October - April.

**Habitat:** On road side as an undergrowth, in shade and along streams in evergreen and semi-evergreen forests.

**Distribution:** From the Northern Western Ghats of Maharashtra to the Southern Western Ghats of Kerala and Tamil Nadu. (Map 7c)

**Threat status:** Least Concern [LC].

A taxon has been assigned to ‘Least Concern’ category as is a widespread and abundant taxon.
Plate 11: *Strobilanthes ciliatus* Nees - a. habit; b, c. spike, flowering and fruiting; d. pollen, equatorial view; *S. heteromallus* T. Anderson ex C. B. Clarke - e. habit
Fig. 25: *Strobilanthes ciliatus* Nees - a. flowering twig; b, c. flowering bract, dorsal, ventral view; d, e. fruiting bract, dorsal, ventral view; f, g. bracteole, dorsal, ventral view; h. calyx; i, j. corolla; k. corolla spread out with stamens; l. androecium; m. gynoecium; n. dehisced capsule; o. seed
Pollen: Prolate in equatorial view, spheroidal in ambitus; large, variable in size, 48 - 66 x 28 - 46 μm; colpi 3-zonicolporate, equidistant, long and narrow, gradually tapering towards either poles, ends acute, margins straight and well defined, furrow membrane smooth; pores 3 central, equatorial, circular, lalongate, 8 – 13 μm, protruding, pore surface smooth; exine differentiated into pseudocolpi, alternating with ridges. Pseudocolpi 12, 4 in each mesocolpium, extension sub-polar, ridges 15, 5 in each mesocolpium, surface of ridges undulating perforate (Carine & Scotland, 1998; pers. obs.).

Note: Studies of protologues shows that Strobilanthes ciliatus Nees and S. warreensis Dalzell are very similar in their morphological characters, viz., woody stem, leaf morphology, axillary, opposite spikes with bent, geniculate peduncles.

Wight (1850) drew S. ciliatus Nees (Wt. Ic. 1517), however while describing it he named it as Goldfussia zenkeriana and later asked to consider his diagram of S. ciliatus as G. zenkeriana.

Beddome described S. parviflorus Bedd. (1874), which was same as S. warreensis Dalzell. When he described S. ciliatus Nees, he referred both Wt. Ic. 1517 and S. warreensis Dalzell (1850). Later he redrew S. ciliatus because in Wight’s diagram the corolla, inflorescence and bracts at the middle of the peduncle were not drawn correctly.

According to Talbot (1909) S. ciliatus and S. warreensis are the same, since whichever specimens of S. warreensis collected were in fruiting, whereas those of S. ciliatus were in flowering and were from the same area of distribution. Similar observations were made during the present study. While studying the flowering population at Verlem, Goa, showed that during the early stages of flowering the peduncles, bracts and calyx were glabrous which developed peduncles with cottony
hairs while both bracts and calyx developed glandular hairs during the later stages of flowering. Intermediate forms as well as both types were found in the same population. Thus, it could be concluded that the two are conspecific, hence merged. Since *S. ciliatus* is an earlier name (1832), it has to be conserved over *S. warreensis* which is a later name (1850).

(BSI, CAL); Nilkund, 02.12.1895, W. A. Talbot 3535 (BSI, CAL); Nilkund, 25.02.1889, W. A. Talbot 1859 (CAL); s. loc., s. d., T. Cooke Acc. no. 337573 (CAL); Mirjan, 150 m, November 1929, Ambo 6874 (CAL); Balicop forest, Siddapur, 19.11.1957, S. K. Jain 29812 (BSI); Kolegar, 14 km from Murdeshwar, 19.02.1962, R. S. Raghavan 79519 (BSI). Kerala: Idukki: Kulamavu, 08.06.1984, C. N. Mohanan 82033 (MH); Kulamavu, 08.06.1984, C. N. Mohanan 82035 (MH); Kadampara, Pooyamkutty, 100 m, 15.12.1988, P. Bhargavan 89928 (MH); HBC Camp Shed, Pooyankutty, 50 m, 20.12.1988, P. Bhargavan 90023 (MH). Kannur: Kannoth, Malabar, 11.12.1913, s. c. 9574 (MH); Kannaavam, ± 140m, 16.02.1978, V. S. Ramachandran 54007 (MH); Kannoth R. F., ±150 m, 04.11.1978, V. S. Ramchandran 58215 (MH); Panathur, ± 350 m, 28.01.1979, V. S. Ramchan 59275 (MH); Kannoth, ± 150 m, 21.02.1979, V. S. Ramchandran 60068 (MH); Payyauur, 350 m, 21.12.1980, R. Ansari 69928 (MH); Panathur, 450 m, 28.12.1980, R. Ansari 70057 (MH); Ambayathode, 03.12.2001, Betty 10607 (FRLH). Kottayam: Panayampala, ± 100 m, 28.01.1984, V. T. Anthony 228 (MH); Kollam: Quilon: s. loc. October 1835, Wight 1949 (2620) (Acc. no. 337560) (CAL!); Travancore boundry, December 1886, T. F Bourdillon Acc. no. 37779 (MH); near Keni, 12.12.1894, T. F Bourdillon 448 (MH). Thrissur: Advaiapalli R F, ± 100 m, 10.12.1965, K. M. Sebastine 26724 (MH). Maharashtra: s. loc., November 1891, Sawant Wagh 7145 (BSI). Ratnagiri: Tira, 6 km from Bhedshi, 19.02.1966, M. Y. Ansari 108413 (BSI); Khanale, 8 km from Bhedshi, 20.02.1966, M. Y. Ansari 108456 (MH); Way to Ramghat-Bhedshi, 02.11.1969, B. G. Kulkarni 119372 (BSI); Konal R F, 15 km from Bhedshi, 30.04.1971, B. G. Kulkarni 129416A (BSI). Sindhudurg: Sawantwadi, November 1891, s. c. Acc. no. 7145 (BSI); Amboli, 22.01.1983, S. M. Almeida s. n. (BLAT); Ramghat, 22.10.1983, S. M. Almeida 5144 (BLAT); Ramghat, December 1983, S. M.
Almeida 4721 (BLAT); Savantwadi, Golharr, 17.01.1987, M. R. Almeida MRA4740 (BLAT); Tamil Nadu: Nilgiris: Canoor Ghat, Nov. 1885, s.c. Acc. no. 37781 (MH).

Tirunelveli: Type: Courtallum, s. d., Wight 1949 (K, photograph!); monte prope Courtallum, s. d., Wight 2415 (isotype CAL!)


An undershrub, up to 1 m high. Stem obtusely quadrangular-terete, sulcate, minutely lenticellate, prominent nodes, glabrous below, tawny coloured woolly hairy above. Leaves opposite, unequal, petiolate; petiole 2.5 - 6 cm long, obscure due to decurrent leaf base, tawny coloured hairs present; lamina ovate to elliptic or broadly elliptic, attenuate at base, symmetrical or slightly asymmetrical, entire along margin, long, fine acuminate at apex, adaxial surface strongly lineolate, dark green, glabrous, abaxial surface glaucous-white, densely tawny coloured woolly hairs; main veins in 5 - 9 pairs, prominent on both sides, slightly raised on the abaxial surface. Inflorescence axillary and terminal, uninterrupted or interrupted, narrow spikes, often trichomous, recurved, 5 - 9 cm long, glandular pubescent in fruit; axis sparsely to densely covered with cream or tawny coloured woolly hairs; bracts ovate-elliptic, 6 - 8 x 2 mm, equal to or shorter than calyx, acuminate at apex, adaxial (outer) surface and margins with cream or tawny coloured woolly hairs, glandular hairs present, abaxial (inner) surface sparsely hairy with a few glandular hairs at the apex, prominent midrib; bracteoles 2, linear- lanceolate, 6 - 7.5 x 1 mm, acute-acuminate at apex, adaxial surface and margins with cream or tawny coloured hairs, glandular hairs present, abaxial surface
hairy more towards the upper half, prominent midrib; secondary abortive bud present in the axil. Calyx c. 1.35 cm long, lobes unequal, two lobes shorter than the rest, divided to about ¾th of the length; segments lanceolate, 6.5 - 8.5 mm long, acute-acuminate at apex, outer surface with cream or tawny coloured woolly hairs, glandular hairs present, inner surface with white hairs at base and sparsely hairy at apex, acrescent in fruit, c. 1.6 cm long. Corolla light lilac in colour, c 1.5 x 0.6 cm; tube cylindric, c. 4.5 mm long; ventricose above, c. 9 mm long; lobes broadly triangular, 3 - 5.5 x 2 - 4.5 mm wide, two adaxial lobes partly fused; often covered densely with short cream downward pointed hairs on outer surface, tufts of white hairs in two rows at posterior side below the two fused lobes to hold the style, lilac nerves visible. Stamens 2, exserted; staminal tube fused from base of tube to base of ventricose part, pubescent at the open ends; filaments c. 10 mm long, densely pubescent to woolly hairy at base to 3 mm of its length; anthers bithecous, c. 2 mm long, parallel, oblong. Disc present, 0.25 mm broad. Ovary 1 - 1.5 mm long, oblong to obovate, sparsely pubescent at apex; style 9.9 - 13.5 mm long, hairy in the middle. Capsule elliptic, c. 13 x 3 mm, glabrous, hairy at apex, mucronate, 4 seeded; seeds oblong to sub-orbicular, c 2.5 x 2 mm, with prominent oblong areole, dense hygroscopic hairs present. (Plate 10g-h; Fig. 26a-j)

Fl. & Fr.: October - April.

Habitat: On rocky slopes exposed to sunlight, along stream banks and at forest margins.

Distribution: Found in the Central Western Ghats of Karnataka (Chikmagalur and Kodagu) and Southern Western Ghats of Kerala and Tamil Nadu. (Map 7d)

Threat Status: Vulnerable [VU B2ab(iii)].
Fig. 26: *Strobilanthes gamblei* Carine et al. – a. habit; b, c. bract, dorsal, ventral view; d, e. bracteole, dorsal, ventral view; f. calyx; g. ventricose part of corolla showing pubescence; h. gynoecium; i. capsule; j. seed
The taxon has been assigned to 'Vulnerable' category as the area of occupancy is estimated to be less than 2000 km$^2$ and is known to exist at no more than 10 localities.

**Pollen:** Prolate or subprolate in equatorial view, circular in polar view; 3-zonicolporate; equidistant long and narrow (fusiform), gradually tapering towards either poles, ends acute, margins straight and well defined, furrow membrane smooth; pores 3 central, equatorial, circular or lalongate; protruding, pore surface smooth; exine differentiated into pseudocolpi, alternating with ridges; in some grains the ridges are twisted giving the grain a spiral appearance; the extent or presence of spiralisation is highly variable within species. Tectum perforate (Scotland *et al.*, 1990; Carine & Scotland, 1998).

**Note:** As shown by Carine *et al.* (2004) and from personal observation (literature, herbarium and type photographs) it is seen that *Strobilanthes gamblei*, *S. pushpangadanii* and *S. consanguinea* are similar in having two adaxial lobes of corolla partly fused to form a hood and exserted stamens, whereas *S. lawsonii* and *S. lanata* have corolla lobes equally divided and included stamens. Venu (2006) treats *S. gamblei* and *S. pushpangadanii* as synonyms of *S. lawsonii*.

Herbarium collections studied at MH showed that the specimens from Kerala exhibited characters of *S. gamblei*, while those from Tamil Nadu exhibited characters of *S. lawsonii*, however, flowers and seeds of these specimens were not observed.

The collection (in flowering) made during the present study and the herbarium collection at JCB, shows that the characters of *S. gamblei* are in accordance with Carine *et al.* (2004). Hence *S. gamblei* is treated as a distinct species in the present study.

**Specimens examined:** Karnataka: Chikmagalur: Charmadi ghat, 750 m, 13.11.1978, *C. J. Saldanha & P. Prakash* KFP 4160 (JCB); Jenukallu, Charmadi

**Kollam:** on way to Chandanathode, 27.02.1978, *V. S. Ramachandran* 61957 (CAL, MH).


**Palghat:** Karapara river side, 100 m, 29.10.1976, *E. Vajravelu* 48748 (MH).

**Wyanad:** Tambracheri Ghat, 21.01.1903, *C. A. Barber* 5686 (*isotype MH!*).


A shrub up to 6 m high; stem obtusely quadrangular, hirsute. Leaves opposite, unequal, petiolate; petiole 1 - 6 cm long, obscure due to decurrent leaf base, hirsute; lamina broadly ovate-elliptic, 2.8 - 22 x 2.2 -14 cm, attenuate at base, entire to crenulate along margins, acute at apex, coriaceous, rugose, with bulbous based hairs above in centre of stellately arranged cystoliths on adaxial side, villous beneath; main veins in 6 - 10 pairs, curved upwards, lineolate beneath. Inflorescence axillary and terminal heads, often trichotomous panicles, with a pair of spathulate involucral bracts, sessile or shortly pedunculate, *c.* 18 mm broad; heads *c.* 18 x 18 mm, obovate;
bracts elliptic-ovate, 13.5 x 6 mm, serrulate, ciliate along margins, hirsute on both sides; bracteoles linear-lanceolate, c. 14 mm, ciliate along margins, acuminate at apex, fulvous hairy on both sides. Calyx c. 14 mm long, divided almost to base; segments equal, linear-lanceolate, hairy at upper half. Corolla c. 2.5 cm long, tube almost as long as ventricose part; tube white, c. 12 mm long; ventricose part pale blue, c. 15 mm long, lobes orbicular, emarginate at apex, glabrous outside, hairy on the inside at the posterior side of ventricose portion to hold style. Stamens 4, included, staminal sheath, from base to middle of ventricose part, conical at apex, hairy along margins; filaments arising at different levels, longer filament c. 10 mm long, shorter one c. 5 mm long, all hairy at base; anther lobes bithecous, c. 2 mm long, parallel, oblong. Disc c. 1 mm broad, prominent. Ovary c. 2 mm long, fulvous hairy at apex, style c. 17 mm long, sparsely hairy till half way up; stigma sub-entire. Capsule ellipsoid, c. 15 mm long, hairy at apex; seeds 4, ovate, c. 4 x 3 mm, acute at apex, glabrous on faces, with prominent ridge in middle, hairy along margin, exarate. (Plate 11e)

Fl. & Fr.: August - May.

Habitat: Evergreen forests, at high altitudes between 1080 - 1800 m.

Distribution: From to Central Western Ghats of Karnataka (Uttara Kannada) to the Southern Western Ghats of Kerala (Kannur) and Tamil Nadu (Coimbatore, Dindigul and Nilgiris). (Map 8a)

Threat Status: Vulnerable [VU B 2ab(iii)].

The taxon has been assigned to ‘Vulnerable’ category as the area of occupancy is estimated to be less than 2000 km² and is known to exist at no more than 10 localities.

Pollen: Prolate or subprolate in equatorial view, circular in ambitus; 3-zonicolporate; equidistant, long and narrow or fusiform, gradually tapering towards either poles, ends acute; pores 3 central, equatorial, circular or lalongate; exine differentiated into

a) ● *Strobilanthes heteromallus*, ● *S. meeboldii*; b) ● *S. integrifolius*

c) ● *S. ixiocephalus*; d) ● *S. microstachya*
pseudocolpi, alternating with ridges; each ridge with aggregates of exine along the middle, more or less continuous (Carine & Scotland, 1998).

**Note:** As the taxon could not be collected, the description was based on the collections outside the study area found in local herbaria and Venu (2006). A single collection from the study area exists in DD which could not be studied.

The flowering period of this plant is given as 14 years (Gamble, 1923).

**Specimens examined:** Tamil Nadu: Coimbatore: Perumalmudi, 1080 m, 21.04.1970, *M. V. Vishwanathan* MVV554 (MH). Dindigul: Kodaikanal, Pulneys, 11.12.1898, *Bourne* Acc. no. 37817 (MH). Nilgiris: Coonoor ghat May 1884, *M. A. Lawson* Acc. no. 37815 (MH); Coonoor ghat, 01.02.1885, *s. c. Acc. no. 37819* (MH); Sailiar, 1200 m, June, 1885, *J. S. Gamble* 16265 (BSI); Coonoor ghat, Benhope, 1212 m, October 1886, *J. S. Gamble* 18384 (MH); Sigur Ghat, 17.03.1886, *s. c. Acc. no. 37821* (MH); Sigur ghat, November 1886, *s. c. 18446* (MH); Carolina Tea Estate, Coonoor, 17.08.1934, *C. E. Brown s. n.* (MH); On way to Anaikatty from Bikkapatti Mund, 1800 m, 27.11.1970, *G. V. Subbarao* 37375 (MH); Kinnakurai, 1800 m, 02.01.1971, *B. V. Shetty* 37659 (MH); Madanad R. F., 1500 m, 23.01.1972, E. Vajravelu 39610 (MH); Kottakombai, 1400 m, 03.02.1972, E. Vajravelu 39749 (MH); Coonoor-Morappalam, 1300 m, 01.03.1972, *B. D. Sharma* 40359 (MH).

**Strobilanthes integrifolius** (Dalzell) Kuntze, Rev. Gen. Pl.2: 499. 1892; Gamble, Fl. Madras 2; 1043. 1924; Venu, *Strobilanthes* Blume (Acanthaceae) in Peninsular India 117. 2006. *Endopogon integrifolius* Dalzell in J. Bot. (Hooker) 2: 342. 1850; Dalzell & Gibson, Bombay Fl. 185. 1861; Birdwood, Cat. Fl. Matheran & Mahabaleshwar *Leptacanthus alatus* Wight, Ic. Pl. Ind. Orient. 220. t. 1527. 1850. **Type:** (India), Malabar, Concan, *s. d.*, *Stocks, Law* Acc. no. 338231 (CAL!). *Strobilanthes*

An undershrub, up to 2 m high. Stem obtusely quadrangular, sulcate, swollen and bent above the nodes, prominent scars of leaf bases at nodes, lenticellate, glabrous. Leaves opposite, unequal, petiolate; petioles 1 - 6 cm long, obscure due to decurrent leaf base, winged, auricled at base; lamina 4 - 17.5 x 1.5 - 6 cm, elliptic-lanceolate, attenuate at base, entire, undulate to sparsely dentate along margins, acuminate at apex, glabrous, lineolate on both sides, light coloured beneath, cystoliths visible, arranged along the veins as well as on the entire surface on adaxial surface, only along veins on abaxial surface; main veins in 7 pairs, veins prominent. Spikes opposite, axillary, terminal or at nodes of older leafless portion in the axils of fallen leaves, often only one developed, the opposite one aborted, strong smelling, simple or compound, interrupted, elongated, scorpionid in arrangement, 3.5 - 5.5 cm long, one or two lower nodes sterile; inflorescence axis sharply quadrangular, glandular as well as
simple hairy; hairs multicellular, c. 5 celled, glandular hairs, c. 3 celled with a large flat cell at apex; bracts 8 - 12 mm long, oblong-lanceolate, ciliate with long, short glandular and simple hairs along margins, sub-acute at apex, almost glabrous on dorsal side, glandular hairy on ventral side, pigmented, recurved; bracteoles similar to bracts, 5 - 8 mm long, linear-lanceolate, ciliate with long, short glandular and simple hairs along margins, sub-acute at apex, sparsely glandular hairy on both sides, pigmented. Calyx divided almost to the base, segments 6 -13 mm long, unequal, one longer than the others, the other four in two equal pairs, oblong-lanceolate, obtuse or sub-acute at apex, glandular as well as simple hairy on outer side, sparsely glandular hairy on inner side at apex, viscous, pigmented and recurved. Bracts, bracteoles, calyx enlarges and becomes densely covered with glandular hairs during fruiting. Corolla violet, c. 3.3 cm long, tubular-infundibuliform, narrow tubular portion c.12 mm long, shorter than ventricose portion; ventricose part 1 - 2 cm long; lobes c. 1 x 1 cm, lobes almost equal, rounded, fringed glandular hairy outside, scarcely hairy inside from middle of tube to base of ventricose portion, especially above the stamens there are two rows of densely placed hairs to hold the style. Stamens 4, included; staminal tube adnate to corolla, c. 6 mm long, open ended at both edges, hairy along edges towards apex; filaments of long stamens c. 5 mm long, hairy, bearded with long hairs on outer side almost to apex, shorter filaments c. 1 mm long, glabrous; anther lobes c. 3 mm long, oblong, purplish. Disc c. 0.5 mm thick. Ovary c. 2 mm long, glandular at apex; style glandular hairy, 1.8 - 2 cm long, swollen at base of stigma; stigma sub-entire; one lobe aborted, the other lobe c. 2 mm long. Capsules 9 - 10 x 4 - 5 mm, brown, elliptic, tapering at both ends, compressed, glabrous, broadly mucronate, glandular hairy and apiculate at apex, 2 seeded; seeds 3 -3.5 x 2.5 mm, ovoid to sub-orbicular, slightly apiculate at apex, covered with long, soft, elastic hygroscopic, white hairs,
Plate 12: *Strobilanthes integrifolius* (Dalzell) Kuntze – a. habit; b. flower; c. pollen, equatorial view; *S. ixiocephalus* Benth. – d. habit; e. spike; f. flower; g. spike, fruiting; h. pollen
Fig. 27: *Strobilanthes integrifolius* (Dalzell) Kuntze – a. habit; b, c. bract, dorsal, ventral view; d, e. bracteole, dorsal, ventral view; f. calyx; g. corolla spread out showing stamens; h. androecium; i. gynoecium; j. capsule; k. seed
areole c. 2 mm long, occupying almost half the length of seed. (Plate 12a-c; Fig. 27a-k)

**Local name:** Waiti (Marathi)

**Fl. & Fr.:** November - May.

**Habitat:** Growing gregariously in almost pure strands generally as an undergrowth or along the edges of forests. It can also be found in open situations and also long streams, at an altitude of 150 - 500 m.

**Distribution:** From the Northern Western Ghats of Maharashtra to Central Western Ghats of Karnataka. (Map 8b)

**Threat Status:** Least Concern [LC].

The taxon has been assigned to ‘Least Concern’ category as it is a widespread and abundant taxon.

**Pollen:** Prolate or subprolate in equatorial view, spheroidal in ambitus; large in size, 43 - 63 x 25 - 35 μm; 3-zonicolporate, equidistant, broad in the centre, gradually tapering towards poles, extension circumpolar, acute ends, well defined margins, furrow membrane smooth; pores 3, central, equatorial, circular or lalongate, conspicuous, protruding beyond the general surface, pore surface smooth; exine differentiated into pseudocolpi and ridges; pseudocolpi 12, 4 in each mesocolpium, narrow, extension subpolar, acute ends, well defined margins, ridges alternating with pseudocolpi, broad, converging at the poles, finely reticulate, the lumen of which is perforate (Chaubal, 1966; pers. obs.).

**Note:** In January 2006 there was a general flowering at Amboli, where it was observed that the gamopetalous flowers of *S. integrifolius* full of nectar were eaten by monkeys. The viscid spikes with densely glandular hairs are strongly scented with a permanent and penetrating smell similar to *S. callosus* and *S. ixiocephalus.* After
completing flowering and fruiting the plants died leaving no trace behind. During the next season (January 2007) there were only young plants, contrary to the observation made by Santapau that they being not truly pleistesial.

The flowering period of this plant is given as 3 years (Birwood, 1897), 7 years (Gamble, 1923; Talbot, 1909) and 6 years Venu (2006).

25.01.1889, W. A. Talbot 1101 (BSI); Wesoi Ghat, 02.03 1889, W. A. Talbot 1808 (BSI); Guddshalli, 454.5 m, March 1919, Bell 5757 (CAL); Mirjan, 05.02.1905, W. A. Talbot 4409 (BLAT); Mirjan, October 1919, Hallberg & Mc. Cann 34126 (BLAT); Devimann, 19.03.1949, J. Fernandez JF194 (BLAT); Bhatwade, 24.02.1951, J. Fernandez JF2179 (BLAT); Kolegar, 14 km from Murdeshwar, 19.02.1962, R. S. Raghavan 79535 (BSI). Maharashtra: Malabar, Concan, s. d., Stocks Law 442 (MH).

Kolhapur: Gaganbavda, s. d., M. M. Sardesai 384 (SU). Mumbai: Bombay Ghats, s. loc., s. d., s. c. Acc. no. 69519 (MH). Pune: Lonavala, 21.05.1902, G. A. Gammie s. n. (BSI); Kodawli, Rajapur, 31.05.1904, R. K. Bhide Acc. no. 338235 (CAL); Khandala valley, 16.05.1909, R. K. Bhide s. n. (BSI); Khandala Tiger's leaf, Water course, October 1918, H. Santapau 36149 (BLAT); Khandala, April 1941, H. Santapau 152.4H (BLAT, BSI); Khandala, Kune stream-field, 05.11.1943, H. Santapau 3045 (BLAT); Khandala, Slopes under Elphiston Point, 20.12.1943, H. Santapau 3311 (BLAT); Khandala, St. Mary’s Ravine, 23.12.1943, H. Santapau 3405 (BLAT); Khandala, Slopes under Elphiston Point, 05.03.1944, H. Santapau 3667 (BLAT); Khandala, St. Xavier’s Ravine, 20.01.1945, H. Santapau 5783 (BLAT); Khandala-Forbay, 27.01.1945, H. Santapau 5871 (BLAT); Khandala, St. Xavier’s Ravine-foot of Duke’s Nose, 29.01.1945, H. Santapau 5937 (BLAT); Khandala, Plains behind Hotel, 26.01.1951, H. Santapau 12126 (BLAT); Khandala stream, 19.02.1952, H. Santapau 15306 (BLAT); Khandala, Kune Stream, 19.12.1952, H. Santapau 15307 (BLAT); Khandala, near Shingaroba temple, 21.03.1956, S. K. Jain 12092 (BSI); Khandala, Ravines below St. Xavier’s Villa, 21.02.1960, H. Santapau 23366 (BLAT); Tungar, Chandip, 25.01.1961, N. Y. Das NYD3026 (BLAT); Sakar Pathar plateau, 08.03.1962, R. S. Rao & B. V. Redi 77728 (BSI, CAL); NaneGhat, Tokavada Range, ± 630 m, 13.06.1967, K. V. Billoro 110932 (BSI); Tungar hill- Mandi range,
19.01.1968, K. V. Bille 113890 (BSI, CAL); Sidgad foot hill slopes, Murbad Range, 12.04.1968, K. V. Bille 113890 (BSI, CAL); Umfer dara, near Chand Ghat, ± 620 m, 25.05.1968, K. V. Bille 116040 (CAL); Mazirsli Range Forest, Kanramdurg slope, Mandvi Range, 23.11.1968, K. V. Bille 115868 (BSI). Ratnagiri: Mangaon, 9 km from Aheri, 14.02.1966, M. Y. Ansari 107756 (BSI). Sindhudurg: Amboli, July 1994, M. P. Bachulkar-Cholekar s. n. (SUK); Amboli, 21.01.2006 M. E. Mascarenhas 139 (GUH); Amboli, 21.01.2007, M. E. Mascarenhas & M.K. Janarthanam 301 (GUH). Thane: Matheran, March 1886, T. Cooke Acc. no. 58265 (BLAT); Matheran, March 1886, s. c. 23839 (BLAT); Matheran, January 1892, s. c. s. n. (BSI); Matheran, near P. W. D. bungalow, 28.01.1901, G. S. Puri 10919 (CAL); Kandavli Rajapur, 31.05.1904, R. K. Bhide, 338235 (CAL); Taliparambe farm, Malabar, March 1907, C. A. Barbar 7882 (MH); Matheran, s. d., s. c. 37893 (MH); Matheran, March 1925, R. D. Acland ACK923 (BLAT); Jumatti-Dasturi Point, 28.12.1959, N. A. Irani NI4827 (BLAT); Matheran, s. d., R. K. Bhide 338238 (CAL); Kaneri Caves, 04.04.1904, R. K. Bhide s. n. (BSI); Matheran-Neral Road., 01.02.1949, J. Fernandez JF70 (BLAT); Matheran, 12.05.1957, G. S. Puri 12833 (CAL); N. P. Borivli, 18.12.1960, H. Santapau 23565 (BLAT).


A shrub, up to 1.5 m high. Stem obtusely quadrangular, sulcate on 2 sides, constricted above the nodes, glabrous below, slightly hairy above. Leaves petiolate, opposite, unequal in a pair; petioles 1.5 - 6 cm long; lamina elliptic-lanceolate, 4.5 - 15.5 x 1.5 cm, attenuate at base, unequal-sided, serrate along margins, acuminate at apex, lineolate on both sides, cystoliths visible on dorsal side, stellately arranged with a hair arising from the middle, dark green above and paler below, the upper side and the nerves beneath are rough with short stiff hairs; main nerves in 7 - 8 pairs, slender, prominent, raised on both sides. The inflorescence axis is obtusely tetragonal, hispid-glandular hairy. Flowers in pedunculed, ovoid viscid short spikes, 1 - 3.5 cm long, with a balsamic odor, in branched, mostly ternate cymes, which are axillary or terminally clustered; bracts elliptic, 29 x 6 mm, acuminate at apex, viscous hairy, floral bracts elliptic-ovobvate, 14 - 20 x 5 - 6 mm, acuminate at apex, penninerved, veins prominent, densely glandular hairy on outer surface and margins, less so on
inner surface; bracteoles linear-spathulate, 9 - 10 mm long, glandular hairy on the outer surface, glabrous on the inside. Calyx enlarged in fruit, 13.5 - 16 mm long, divided almost to the base, sub-equal, viscous hairy on the outside, segments linear-lanceolate, acute-obtuse apex, hairy at base on inner side, margins ciliate with glandular and long hairs. Corolla lilac, infundibuliform, 20 - 28 mm long, tube cylindric, 5 - 10 mm long, ventricose portion 14 - 15 mm long, hairy on the outside, and also on the inside with 2 rows of hairs to hold the stigma. Stamens 4, didynamous, monadelphous, staminal tube open on one side, hairy along the edges; longer filament hairy, shorter filament curved; anther lobes parallel, c. 1 mm long, oblong. Disc c. 1 mm thick. Ovary c. 2 mm long, glabrous except for a few glandular hairs at apex; style filiform, with hairs arranged on one side along the length of the style; stigma sub-entire, with one lobe suppressed. Capsule c. 1 cm long, glabrous, obovoid, narrowed at base, compressed, mucronate, 2-seeded; seeds c. 4 mm long, ovoid, subacute, flattened, with hygroscopic hairs, very densely so along the margin, with a large areole. (Plate 12d-h; Fig. 28a-s)

Local name: Pit karvi (Kannada); Karvi (Marathi).

Fl. & Fr.: November - March.

Habitat: Mostly as an undergrowth along the edges of forests and along roadsides, growing gregariously.

Distribution: From the Northern Western Ghats of Maharashtra to the Central Western Ghats of Karnataka. (Map 8c)

Threat Status: Least Concern [LC].

The taxon has been assigned to ‘Least Concern’ category as it is a widespread and abundant taxon.
Fig. 28: *Strobilanthes ixiocephalus* Benth. — a. flowering twig; b, c. bract, dorsal, ventral view; d, e, f, g, h. bracts (variations); i, j. bracteole, dorsal view; k, l. bracteole, ventral view; m. calyx in flowering; n. calyx in fruiting; o. corolla; p. androecium; q. gynoecium; r. capsule; s. seed
**Pollen:** Spheroidal; 53 - 66 x 53 - 66 μm in size; 3-brevicolporate, equatorially situated; ectoapertures brevicolpate, fusiform, gradually tapering towards either poles, ends acute, furrow membrane smooth; pores 3 central, equatorial, circular or lalongate; pore surface smooth, conspicuous; exine differentiated into raised, circular, perforate, discrete areas with underlying columellae which end in a large mamellate spine. The raised areas are discrete in some species, whilst in others the columellae layer is continuous but greatly reduced between the raised areas (Carine & Scotland, 1998; pers. obs.).

**Note:** A very common gregarious undershrub, in forests or along edges of forest and along roadsides as an undergrowth. Strong smelling with rather pleasant balsamic odour. Flowers turning white with age. Bee boxes are kept in the vicinity of these plants during their flowering season.

*S. ixiocephalus* shows a lot of continuous variation between the specimens from different localities. Some of the differences are:

- At the time of flowering, most of the older leaves fall off and only the very young leaves are present at the apex while in others leaves of normal size are present throughout.

- In some the spikes are closely clustered at the apex, whereas in others the spikes are arranged in lax panicles.

- The bracts vary in shape from elliptic lanceolate, acuminate at apex to ovate, acuminate; oblong, obovate, obtuse at apex.

- The acrescent bracts and calyces are also variable. The bracts in some become broadly ovate and undulate along margins, whereas in others the bracts are elliptic lanceolate with entire margins. Some are with very dense glandular hairs.
Some plants have flowers up to 2 cm long, whereas others have flowers 2.5 - 3 cm long.

Pollen grains of the species from all localities have globose, spiny pollen grains in which the sexine is differentiated into raised circular discrete areas which end in a spine. Although sometimes the spines appear to be crowded in some and not so in others.

Specimens examined: Goa: North Goa: Ilhas, Kampal hill top, 10.11.1962, R. S. Rao 84615 (BSI); After Ponda village, 16.11.1962, R. S. Rao 84850 (BSI, CAL); Satari, Jamad forests near Nandare, 03.05.1963, K. C. Kanodia 88395 (BSI, CAL); Satari, Caranzol hill, 07.05.1963, K. C. Kanodia 88473 (BSI); Satari, Valpoi, Nanecha Dongar, on way between Codal-Amchegol, 24.03.1964, K. C. Kanodia 96465 (BSI); Ilhas, Bambolim, 27.01.2005, M. E. Mascarenhas 13 (GU); Ponda, Bondla, 06.03.2005, M. E. Mascarenhas 39 (GU); Ponda, Bondla, 27.12.2005, M. E. Mascarenhas 114 (GU); Bondla, 27.12.2005, M. E. Mascarenhas (115); Satari, Codal, 26.01.2006, M. E. Mascarenhas 154 (GU); Satari, Kerim, Climb to Anjunem dam, 12.03.2006, M. E. Mascarenhas 219 (GU); Satari, Kerim, near Anjunem dam, 12.03.2006, M. E. Mascarenhas 227 (GU); Ponda, Bondla, 28.01.2007, M. E. Mascarenhas 328 (GU); Satari, Nagargao, 04.02.2007, M. E. Mascarenhas 335 (GU); Pilar, 09.02.2008, M. E. Mascarenhas 480 (GU); Satari, Nagargao, 06.01.2008, M. E. Mascarenhas 503 (GU); Satari, Valpoi, 09.04.2008, M. E. Mascarenhas 509 (GU).

South Goa: Canacona, near Tudal, 20.04.1963, K. C. Kanodia 88168 (BSI); Canacona, Yed, on way from Bhutpal to Nadquem, 13.03.1964, K. C. Kanodia 96235 (BSI, CAL); Sanguem, Molem, along roadside, 22.11.1996, V. C. Joshi, S. Rajkumar 411 (GU); Sanguem, Molem-Anmode, 04.12.1997, V. C. Joshi, S. Rajkumar 1237 (GU); Sanguem, Molem-Anmode, 29.10.1998, V. C. Joshi, S. Rajkumar 1677 (GU);


*Uttara Kannada*: s. loc., 10.01.1885, s. c. Acc. no. 7160 (BSI); Supa, January 1888, W. A. Talbot 1590 (BSI); Cooniberwada, 20.02.1889, W. A. Talbot 1829 (BSI); Ainshi ghat, February 1889, W. A. Talbot 1834 (BSI); Ainshi, 450 m, April 1918, T. R. Bell 3935 (CAL); Guddshalli, 450 m, March 1919, T. R. Bell 5756 (CAL); Castle Rock, March 1919, Hallberg & McCann 27768 (BLAT); Castle Rock, April 1928, R. D. Ackland ACK924 (BLAT); Jog, 18.01.1950, J. Ferdandez JF827 (BLAT); Ramanguli, 07.01.1951, J. Ferdandez JF2055 (BLAT); Kadra, 02.03.1951, J. Ferdandez JF2201 (BLAT); Castle Rock, Dudhsagar, 20.12.1953, H. Santapau 17754 (BLAT); Jog falls, 30.12.1955, P. V. Bole Bole1540 (BLAT); Sirsi-Kumta Road, 01.05.1956, S. D. Mahajan 1625 (BSI); Kalkeri, 15.02.1962, R. S. Raghavan 79433 (BSI); Kolegar, 14 km from Murdeshwar, 19.12.1962, R. S. Raghavan 79534 (BSI); Castle Rock, 27.12.1966, C. J. Saldanha CJS11011 (JCB); Ulvi Range, 09.02.1980, K. P. Sreenath & S. R. Ramesh KFP10852 (JCB); s. loc., s. d., S. K. Jain 12135 (BSI); 36 km after
Kumta, Kangad's 30 km from Siddapur, 01.02.2006, M. E. Mascarenhas 161 (GU).

**Maharashtra:** Concan Vc., s. loc., s. d., s. c. Acc. no.337654 9(CAL). **Kolhapur:**
4 km before Amboli, 30.01.1980, *N. Kameswara Rao* 68 (CAL); Burki, s. d., *M. M. Sardesai* 85 (SUK); Dajipur, s. d., *M. M. Sardesai* MMS-708 (SUK).

**Mumbai:**

**Pune:**
Sarkar Patar, 06.12.1902, *G. A. Gammie* 15942 (BSI); Lonavala, 13.05.1903, *G. A. Gammie* 16297 (BSI); Lonavala, 12.11.1904, *L. D. Garade* s. n. (BSI); Bhorghat, 600 m, April 1906, *A. Meebold* 4899 (CAL); Sarkar Patar, 1906, *W. A. Talbot* 4835 (BSI); Nigdala forest, 22.03.1907, *G. M. Ryan* 1743 (BSI); Purandhar, January 1918, s. c. 23096 (BLAT); Khandala, St. Xavier's Ravine, 25.03.1942, *H. Santapau* 152.69 (BLAT); Khandala, Duke's Nose Point, 08.11.1942, *H. Santapau & C. McCann* 1324 (BLAT); Khandala, Echo Point Ravine, 11.12.1943, *H. Santapau* 3211 (BLAT);

**Rajgadh:**
Khandala, St. Xavier's Ravine, 18.12.1943, *H. Santapau* 3237 (BLAT); Khandala, Meroli Plateau, 15.01.1944, *H. Santapau* 3549 (BLAT); Khandala, St. Xavier's Ravine, 15.03.1944, *H. Santapau* 3788 (BLAT); Khandala, St. Xavier's Ravine, 21.05.1944, *H. Santapau* 4275 (BLAT); Khandala, Monkey hill plateau, 29.10.1944, *H. Santapau* 5388 (BLAT); Khandala, St. Xavier's Ravine, 20.01.1945, *H. Santapau* 5785 (BLAT); Khandala, Forbay, 27.01.1945, *H. Santapau* 5872 (BLAT); Khandala, St. Xavier's Ravine, 15.03.1945, *H. Santapau* 6118 (BLAT); Behind Khandala Hotel, 25.11.1945, *H. Santapau* 8052 (BLAT); Khandala, St. Xavier's Ravine, 16.02.1946, *H. Santapau* 8654 (BLAT); Khandala, Slopes below Elphinston point, 13.04.1946, *H. Santapau* 8807 (BLAT); Khandala, Forbay, 26.12.1951, *H. Santapau* 8052 (BLAT); Rajgadh, 06.06.1951, *Razi* 17 (BLAT); Khandala s. loc., 25.01.1959, *H. Santapau* 23047 (BLAT); Khandala Ravine below St. Xavier's Villa, 21.02.1960, *H. Santapau* 23367 (BLAT); Bhovargiri, along the river bed, 24.12.1960, *K. P. Janardhanan*
70075 (BSI); Foot of Budha Kar Dhar, Bhovargiri, 21.02.1961, K. P. Janardhanan
69096 (BSI); Harami hill, Bhovargiri, 22.02.1961, K. P. Janardhanan 69164 (BSI);
Kokur pata near Bhimashankar, 23.02.1961, K. P. Janardhanan 69193 (BSI); Top of
Choura hill, Bhimashankar, 23.02.1961, K. P. Janardhanan 69198 (BSI);
Nagphanimal, Bhimashankar, 24.02.1961, K. P. Janardhanan 69210 (BSI); Forest
sample plot no. 25, Bhimashankar, 25.02.1961, K. P. Janardhanan 69259 (BSI);
Slopes of Choura hill, Bhimashankar, 26.02.1961, K. P. Janardhanan 69299 (BSI);
Baka Devi Ka Ran, Bhimashankar, 26.02.1961, K. P. Janardhanan 69602 (BSI); Top
of hill facing Malardi village, 06.03.1962, R. S. Rao 77634 (BSI); Khandala, Battery
hills, 07.03.1962, R. S. Rao 69728 (BSI); Khandala, Echo point, 08.03.1962, R. S. Rao
78830 (BSI); Khandala, slope of Bhoma hill, 08.03.1962, R. S. Rao 78869 (BSI);
Khandala, Top of Bhoma hill, 23.12.1962, R. S. Rao 83486 (BSI); Malvand dara near
Bhivda Khurd, Junnar, 23.09.1968, Hemadri K. 118017 (BSI); s. loc., Forest Research
nursery, 14.04.1978, M. P. Nayar 153115 (BSI); Tungar foot hill, Mandvi Range, ±
500 m, 19.06.1989 K. V. Billore 173657 (BSI); Lonavala-Akola-Al nagar, 21.10.1991,
D.K. Kulkarni 18242 (MACS).
Ratnagiri: Top of Rasache Mal, near Gadad, Khed, 05.12.1961, K. P. Janardhanan 76284 (BSI); Khanale, 8 km from Bhedshi,
20.02.1966, M. Y. Ansari 108447 (BSI); Ramghat, 09.02.1970, B. G. Kulkarni 119589
(BSI); Satara: Mahabaleshwar, s. d., s. c. 23841 (BLAT); Mahabaleshwar, s. loc., s.
d., T. Cooke Acc. no. 58248 (BLAT); Panchgani, 01.12.1890, G. M. W. s. n. (BSI);
Mahabaleshwar, Arthur’s Seat, 10.11.1950, H. Santapau 11932 (BLAT); Mahabaleshwar, Fitzgerald ghat, 29.12.1950, P. V. Bole Bole 108 (BLAT);
Mahabaleshwar, Bhilar estate, 23.10.1951, P. V. Bole Bole 490 (BLAT);
Mahabaleshwar, s. loc., 27.12.1957, H. Santapau 22169 (BLAT); Mahabaleshwar, Lingmala, 28.12.1957, H. Santapau 22220 (BLAT); Mahabaleshwar, Lingmala,
Plate 13: *Strobilanthes meeboldii* Craib – a. habit; *S. minor* Talbot – b. habit; *S. microstachya* Benth. ex Hohen. – c. habit; *S. neilgherrensis* Bedd. – d. habit; *S. newii* Bedd. ex C. B. Clarke – e. habit; *S. neoasper* Venu & P. Daniel – f. habit; g. spike

A shrub. Stem obtusely quadrangular, sulcate at younger parts, nodes not so prominent, constricted above nodes. Leaves unequal, opposite; petiole 2 - 4.5 cm long, minutely hairy, almost glabrous, channeled above, swollen at base; lamina 9 - 12.5 x 4.3 - 6.6 cm, elliptic-ovate, unequal, shortly attenuate at base, sub-serrate, ciliate along margins, long acuminate at apex, dark above, paler below, sparsely strigose, almost glabrous above, short cystoliths above, glabrous below; 6 - 7 pairs of main veins, curved, raised on both sides. Inflorescence axillary, trichotomous, deflexed, peduncle 2 - 3 cm long, with foliar bracts at the base of capitate heads; heads c. 1 cm long, bracts ovate to spatulate, c. 5 x 3 mm, subscarious, persistent, softly hairy, ciliate along margins, acute at apex; bracteoles two, linear, c. 5 mm long, ciliate along margins. Calyx 5-lobed; lobes spatulate to lanceolate, c. 6.5 x 1.5 mm, ciliate and black punctuate along margins, subacute at apex. Corolla tubular ventricose; tube c. 5 mm long; upper ventricose part c. 12 mm long, glabrous outside, pilose inside. Stamens 4, didynamous, staminal sheath long, white-hairy; longer filaments exserted, 7 - 12 mm long. Ovary glabrous; style same length as the long filaments. Capsules and seeds not seen. (Plate 13a)

Fl.: November.

Habitat: Occurring from plains up to an altitude of 500 m.
**Distribution:** Known from only Central Western Ghats of Karnataka (Uttara Kannada & Mysore). (Map 8a)

**Threat Status:** Critically Endangered [CR B2ab(iii)].

The taxon has been assigned to ‘Critically Endangered’ category as the area of occupancy is estimated to be less than 10 km² and known to exist at only a single location.

**Note:** It is known from a single collection housed at CAL. The description of this species is based on the type specimen at CAL, the protologue and Venu (2006). Craib (1910) in the protologue observed that this species is similar to *S. ixiocephalus*, but differs from it in having minute spikes with glandular-pubescent bracts.

**Specimens examined:** The type specimen as cited above.


An undershrub up to 60 cm high. Stem quadrangular, edges prominent, hirsute, glandular hairs may be present, bent above nodes. Leaves opposite, unequal, petiolate; petiole 1 - 5.5 cm long, obscure due to decurrent leaf base, grooved on
ventral side, hirsute; lamina elliptic-lanceolate, 4-16 x 1.5-5 cm, attenuate at base, entire to sub-crenate, ciliate along margins, acuminate at apex, dark green above, paler below, cystoliths visible on abaxial side, sparsely hairy above, more so on nerves below, minutely red punctuate on adaxial side; main veins in 5-7 pairs, veins prominent, raised on both sides, more so beneath. Inflorescence axillary as well as terminal, often 2 in the axil of leaf, sometimes trichotomous; peduncle 2-5 cm long, quadrangular, hirsute, glandular hairy; spikes dense, short, 7-12 mm long; bract foliaceous, ovate-elliptic, c. 2 x 5 mm, acute at apex, with prominent midrib, slightly reflexed, lineolate, glandular hairy; bracteoles linear-lanceolate, c. 5 mm long, ciliate along margins, red punctuate, hairy on abaxial side. Calyx divided to the base, 5 lobed; lobes subequal, lanceolate, c. 5 mm long, ciliate along margins, acute at apex. Corolla white, c. 15 mm long; tube cylindric, small, c. 3 mm long; ventricose part c. 12 mm long, pubescent without, with white hairs within to hold stigma, 5 lobed; lobes equal, obtuse with an acute tip, c. 3 x 5 mm. Stamens 4, didynamous; Staminal sheath adhering to corolla tube, almost glabrous; longer filaments c. 4 mm long; shorter c. 2 mm long; anthers oblong, muticous. Disc c. 0.5 mm long. Ovary c. 3 mm long, densely glandular hairy; style linear, c. 10 mm long, glabrous; ovules 2 in each locule. Capsule oblong-ellipsoid, c. 15 mm long, thin-walled, glandular-hairy, 4-seeded; seeds slightly shallow on one side, c. 5 x 4 mm, glabrous, exareolate. (Plate 13c)

Fl. & Fr.: July - April; flowering once in 5 years.

Habitat: As an undergrowth of forest from 375 m to 850 m.

Distribution: From the Central Western Ghats of Karnataka (Dakshina Kannada) to the Southern Western Ghats of Tamil Nadu (Tirunelveli), but is widely distributed in the evergreen forests of Kerala and Tamil Nadu. (Map 8d)

Threat Status: Near Threatened [NT]
The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km$^2$, known to exist at more than ten localities.

**Pollen:** Prolate or subprolate in equatorial view, circular in polar view. 3-zonicolporate; equidistant, long and narrow (fusiform), gradually tapering towards either poles, ends acute; pores 3, central, equatorial, circular or lalongate; exine differentiated into pseudocolpi, alternating with ridges; ridges unequal in length, some of which completely encircle the poles; tectum perforate (Carine & Scotland, 1998).

**Note:** This description was based on collections from the various local herbaria and Venu (2006) since it could not be collected. All the collections observed in the herbaria were very old and no collections after 1976 were found.


Fig. 29: *Strobilanthes minor* Talbot— a. habit
(Acanthaceae) in Peninsular India. 2006. Type: (India, Karnataka), N. Kanara, Supa, banks of Kala nadi, 10.09.1885, W. A. Talbot 1338/7048 (BSI holotype!).

A very small shrub, up to 60 cm high. Stem obtusely quadrangular, sulcate, scabrously hairy at younger parts, nodes prominent. Leaves opposite, unequal in a pair; petioles 1-3 cm long, obscure due to decurrent leaf base; lamina ovate-elliptic, 2.5 - 7.5 x 1.5 - 4 cm, unequal, attenuate at base, crenate-serrulate, ciliate along margins, acute to acuminate at apex, dark green, lineolate above, paler below, glabrous on both sides, cystoliths visible on dorsal side; main veins in 4 - 5 pairs, prominent on both sides. Inflorescences small, subglobose heads on older leafless parts of stem as well as axillary in position, c. 10 mm long, peduncles up to 5 mm long. Flowers c. 8 mm long; bracts ovate to broadly elliptic, acute at apex; bracteoles two, ligulate, 6 mm long, ciliate along margin. Calyx divided almost to the base, ob lanceolate, unequal, segments 5. Corolla blue, tube cylindrical, short, slightly hairy outside, very hairy within, lobes obtuse. Stamens 4; filaments hairy at lower part. Style hairy, very long, twice as long as ovary; stigma entire or sub-entire. Capsules not found. (Plate 13b; Fig. 29a)

Fl.: September; fruiting not known.

Habitat: Found on the banks of Kala nadi, Supa.

Distribution: Known from the Central Western Ghats of Karnataka (Uttara Kannada). (Map 9c)

Threat Status: Critically Endangered [CR B2ab(iii)].

The taxon has been assigned to ‘Critically Endangered’ category as the area of occupancy is estimated to be less than 10 km² and known to exist at only a single location. It is known from a single collection, housed at BSI.

Pollen: Spheroidal, echinate, having a small neck at top (Venu, 2006).
Note: It has not been collected after type. The only collections available are the holotype and isotype at BSI. The description was based on the holotype and Venu (2006). Bremekamp (1944) has placed it under 'genus adhuc incertum' (uncertain genus). This species is similar to S. heyneanus which has ovoid to sub-globose spikes that are 18-20 mm long; orbicular, obtuse, glabrous, pinkish white bracts and obovoid-oblong, glabrous capsules whereas S. minor has smaller sub-globose heads that are c. 10 mm long; ovate to broadly elliptic, acute bracts. It is also allied to S. ixiocephallus, sharing only the pollen character which is spheroidal and echinate. Other than this S. ixiocephallus is entirely different from S. minor, in having hairy stem, elliptic-lanceolate leaves, short axillary or terminally branched clustered inflorescences and viscid bracts and bracteoles.

Specimens examined: Karnataka: Uttara Kannada: Supa (Kala nadi), 10.09.1885, W. A. Talbot 1338/7049 (BSI isotype!); Supa (Kala nadi), 10.09.1885, W. A. Talbot 1338/7050 (BSI isotype!).


Fig. 30: *Strobilanthes neilgherrensis* Bedd. – a. habit; b, c. bract, dorsal, ventral view; d, e. bracteole, dorsal, ventral view; f. calyx; g. corolla spread out showing stamens; h. gynoecium

a)  ● *Strobilanthes neilgherrensis*; b)  ● *S. neoasper*; c)  ● *S. newii*; d)  ● *S. reticulatus* var. 1. var. nov.; e)  ● *S. minor*; f)  ● *S. reticulatus* var. *reticulatus*
A large shrub, up to 2 m high. Stem quadrangular, sulcate, densely hirsute at younger parts, nodes prominent. Leaves opposite, unequal, petiolate; petiole 1 - 6.5 cm long, densely hirsute; lamina ovate, 9.5 - 14.0 x 5.0 - 8.0 cm, attenuate at base, crenate-serrate, ciliate with long hairs along margins, acuminate at apex, slightly rugose, hispid hairy on abaxial side; main veins in 7 - 8 pairs. Inflorescence axillary as well as terminal sessile, capitate head, simple, densely hispid; peduncles 2 - 5 cm long, densely hirsute; a pair of small leaves of 2.0 - 4.5 x 1.2 - 1.6 cm subtends each head; bracts oblong, densely hispid, cuspidate, c. 2 cm long; bracteoles lanceolate, 1.3 - 2.2 cm long, acuminate at apex, densely hispid. Flowers subsessile. Calyx c. 10 mm long, enlarged in fruit, lobes 5, segments unequal, united at the basal part, acuminate at apex, scarious along margins, long ciliate apically. Corolla white, tubular below, ventricose above, c. 17 mm long; tube 3 - 10 mm long, curved, white; ventricose part 14 - 15 x 10 mm, bluish, 5-lobed; lobes puberulous on outside; upper lobes c. 0.4 mm long, acute at apex. Stamens 4, included; filaments connate in pairs, hairy at base; longer ones c. 15 mm long; shorter ones c. 6 mm long; anthers c. 3 mm long. Ovary c. 2 mm long; style c. 20 mm long; stigma sub-entire, one lobe acute, the other suppressed, dilated at base of stigma. Capsules ellipsoid, c. 12 mm long, 4-seeded; seeds suborbicular, c. 3 mm broad, glabrous. (Plate 13d; Fig. 30a-h)

Fl. & Fr.: September - March. The flowering period is about 8 years.

Habitat: Forest undergrowth often along streams or growing in moist soil in tropical forest conditions.

Distribution: Restricted to the Central Western Ghats of Karnataka (Hassan) and the Southern Western Ghats of Tamil Nadu (Tirunelveli). (Map 9a)

Threat Status: Near Threatened [NT]
The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km$^2$, known to exist at more than ten localities.

**Pollen:** Prolate or subprolate in equatorial view, circular in polar view; 3-colporate; ectoapertures long and narrow (fusiform), endoapertures circular or lalongate; exine divided into longitudinal ribs; in some grains the ribs are twisted giving the grain a spiral appearance; the extent or presence of spiralisation is highly variable within and between species. Tectum perforate (Carine & Scotland, 1998).

**Note:** The species could not be collected during the present study and so the description is based on the collections available at the herbaria and Venu (2006).


An undershrub, up to 1 m high. Stem obtusely quadrangular, sulcate on two faces, glabrous below, hirsute above, swollen and bent above nodes. Leaves opposite, unequal, petiolate; petiole 1.3 - 8 cm long, hirsute, obscure due to decurrent leaf base; lamina broadly ovate to elliptic-ovate, 4.5 - 11 x 2 - 8.5 cm, attenuate at base, crenate, ciliate along margins with pigmented hairs, acuminate at apex, dark green above, paler below, lineolate on both sides, rugose, hispid hairy, hairs on midrib pigmented, more so on lower side and on nerves, cystoliths stellately arranged around the hairs on the upper surface; main veins in 7 - 8 pairs. Inflorescences axillary or terminal panicles with capitate spikes in pairs, one solitary and the other trichotomous. Peduncles quadrangular, hirsute, glandular hairy, that of solitary spikes shorter then
that of the trichotomous; spikes mostly elongated up to 6.5 cm long. Bracts broadly ovate, crenate, ciliate along margins, densely hispid with pigmented non-glandular hairs on both surfaces. Bracteoles lanceolate, ciliate along margins, densely hispid with pigmented non-glandular hairs on both surfaces acuminate at apex. Calyx c. 10 mm long, divided almost to the base; segments linear-lanceolate, equal, densely glandular-hairy at upper half, thinly so or glabrous at the lower. Corolla c. 15 mm long; tube short, c. 3 mm long; ventricose c. 12 mm long, 8 mm across, pubescent on outside at upper part of ventricose part on nerves and lobes. Stamens 4, didynamous, included; staminal sheath up to one-third of ventricose portion, hairy on the open ends; filaments hairy, longer filaments from base of ventricose portion, c. 4 mm long; shorter filaments arising from top of sheath, c. 2 mm long; anthers dorsifixed, c. 1 mm long, white. Disc prominent. Ovary c. 1.5 mm long, glandular-hairy at apex; style slender c.9 mm long, hairy; stigma sub-entire. Capsule elliptic, 4 seeded; seeds orbicular-ovate, c. 3 mm broad, hygroscopic hairs present, areole round, prominent, glabrous. (Plate 14f, g)

**Fl. & Fr.:** September - March

**Habitat:** Margins of the evergreen forest between 1200 - 1800 m.

**Distribution:** From the Central Western Ghats of Karnataka (Chikmagalur) to Southern Western Ghats of Tamil Nadu (Tirunelveli). (Map 9b)

**Threat Status:** Near Threatened [NT]

The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than 10 localities.

**Pollen:** Prolate or subprolate in equatorial view, circular in polar view; 3-colporate; ectoapertures long and narrow (fusiform), endoapertures circular or lalongate; exine divided into longitudinal ribs; in some grains the ribs are twisted giving the grain a
spiral appearance; the extent or presence of spiralisation is highly variable within and between species. Tectum perforate (Carine & Scotland, 1998).

**Note:** Following Bremekamp (1944), Santapau (1952) named this taxon as *Nilgirianthus asper*. But when treating *Strobilanthes* Blume in the broad sense, the name *S. asper* Wight cannot be applied as it is a later homonym of *S. asper* Decne which is an entirely different plant. Therefore, Venu & Daniel (2006) gave the new name as *S. neosper* Venu & P. Daniel.

**Specimens examined:** Karnataka: Chikmagalur: Bramagiri, 1500 m, 06.12.1907, s. c. Acc. no. 58056 (BLAT); Kulhuffy, Bababoodan, 1212 m, November 1908, A. Meebold 4871 (CAL). Dakhina Kannada: S. Kanara Ghat, s. loc., s. d., s. c. Acc. no. 337964 (CAL); Concan, s. loc., s. d., Stocks Acc. no. 337973 (CAL). Kodagu: Bramagiri, 1500 m, 06.12.1907, s. c. Acc. no. 58056 (BLAT); Karavala badige, side road on way to Golf Link, 21.09.1961, A. S. Rao 74489 (BSI); Murnad Road, 26.09.1961, A. S. Rao 74678 (BSI); Mercara, on way to Abbi Falls through Glenmore estate, 20.10.1963, A. S. Rao 94916 (BSI); Tadiandamol, 1800 m, 18.09.2006, M. E. Mascarenhas & M. K. Janarthanam 259 (GUH); Near Abby falls, 27.12.2009, M. K. Janarthanam s. n. (GUH). Mysore: Kavaladurg, 11.02.1967, R. S. Raghavan 95718 (BSI). Kerala: Kannur: Top of Theerthundamalai, Chandanathode, ± 975 m, 24.02.1979, V. S. Ramachandran 61371 (MH); On way to Brahmagiri, ± 875 m, 04.03.1979, V. S. Ramachandran 62047 (MH); Chandranathode, ± 800 m, 20.12.1979, V. S. Ramachandran 65349 (MH). Palghat: Below Karasuryamalai, 1200 m, 20.04.1977, E. Vajravelu 49720 (CAL, MH); Way to Chemungi, ± 1250 m, 08.03.1979, M. Mohanan 61713 (CAL); Panthenthode to S. V. Damsite, 850 m, 19.01.1980, P. Bhargavan 65602 (MH); Aruvampara slopes, 850 m, 19.01.1980, P. Bhargavan 65592 (MH); Aruvampara slopes, 850 m, 06.12.1980, N. C. Nair 69148
(MH); Way to Poochhipara, Silent valley Range Forest, 1000 m, 10.12.1980, N. C. Nair & P. Bhargavan 69505 (CAL, MH). **Thirunavanthapuram**: Mutthu Kali Vagal, 1364 m, 02.10.1894, T. F. Bourdillon 341 (MH); Way to Chemungi, ± 1250 m, 08.03.1979, M. Mohanan 61713 (MH). **Tamil Nadu**: **Coimbatore**: Attakatti to Valparai-Anamalais, 1200 m, 14.12.1960, N. P. Balakrishnan & J. L. Ellis 11723 (MH); Konalar, Anamalai, 1900 m, 15.11.1980, Chandrabose Acc. no. 57772 (CAL).

**Madurai**: Aruna Estate, 1500 m, 28.04.1960, B. V. Shetty 10339 (MH). **Nilgiri**: Nilgiris, Naduvattum-Gudalur, 25.12.1861, M. A. Lawson Acc. no.337965 (CAL); Goodaloor Ghat, September 1883, M. A. Lawson Acc. no. 37828 (MH); Goodaloor Ghat, November 1883, M. A. Lawson Acc. no. 37829 (MH); Sholas Naduvattam, October 1884, s. c. Acc. no. 37832; Sholas near Pykara, October 1884, s. c. Acc. no. 37833 (MH); Goodaloor Ghat, 1515 m, October 1890, s. c. Acc. no. 37835 (MH); Naduvattam, 1818 m, 02.11.1891, s. c. Acc. no. 37834 (MH); Sispara Ghat, Nilgiris, s. d., s. c. Acc. no. 37836 (MH); Naduvattam, 04.10.1956, N. P. Balakrishnan 226 (MH); Balmadies Estate Shola, 1450 m, 02.02.1971, s. c. 37826 (MH); Naduvattam-Gudalur road, 1600 m, 25.02.1972, B. D. Sharma 39900 (MH); Mulaikadu-Ouchterlony Valley, 1490 m, 17.10.1972, J. L. Ellis 43201 (MH). **Periyar**: Periyar Range, 470 m, 27.01.1932, M. Ratnavelu 157 (MH). **Tirunelveli**: Pachaiyar Estate, Chinna, Cane Plot, 1500 m, 10.10.1992, S. R. Srinivasan 99258 (MH); Deviyan Estateboundry, 1500 m, 14.10.1992, S. R. Srinivasan 100033 (MH); Naraikkadu, Kannunni, 1400 m, 06.10.2002, C. Murugan 114524 (MH).


A small shrub; stem sharply quadrangular, pubescent, glandular hairy above, glabrous below. Leaves opposite, unequal, petiolate, upper leaves sessile; petiole 2 - 16 mm long, quadrangular, pubescent; lamina ovate to broadly ovate, rounded or cordate at base, prominently serrate, sparsely ciliate along margins, acuminate at apex, dark green on adaxial surface, pale on abaxial surface, minutely scabrous-hispid above, pubescent below; main veins in 4 - 6 pairs, prominent on both sides, lineolate, more so beneath. Inflorescence much interrupted panicled spikes, c. 15 cm long, hairy, flowers in opposite pairs; bracts small, linear, c. 6 mm long, smaller than calyx lobes, ciliate along margins, sub-acute at apex, glandular hairy on both sides, early caducous; bracteoles linear, much smaller than calyx, caducous, sub-scarious, ciliate along margins, glandular hairy. Calyx 8 - 9 mm long, divided to two-third its length; segments one longer than the others, oblong-lanceolate, obtuse at apex, glandular hairy on outside. Corolla curved, deep purple, tubular-ventricose, c. 2.7 cm long; tubular part a little contracted at base, c. 5 mm long; ventricose portion much inflated, c. 2.2 cm long, 5-lobed; lobes orbicular, veined, glabrous without. Stamens 4, didynamous; sheath slightly hairy at open ends; filaments glabrous, inner two shorter. Disc present. Ovary puberulous at apex; style c. 2.6 cm long glabrous or sparsely hairy at base; stigma sub-entire, simple. Capsules c. 1.5 cm long, glandular pubescent, 4-seeded; seeds ovate, c. mm long, hairy with a small areole. (Plate 13e)

Fl. & Fr.: Flowering and Fruiting period not known.

Habitat: Western Ghats c. 1000 m.
**Distribution:** Known from only Central Western Ghats of Karnataka. (Map 9c)

**Threat Status:** Critically Endangered [CR B2ab(iii)].

The taxon has been assigned to ‘Critically Endangered’ category as the area of occupancy is estimated to be less than 10 km$^2$ and known to exist at only a single location.

**Note:** It has not been collected after type. There are only two type collections from Manjeerabad in Mysore district at MH which are selected as the lectotype and isotype during the present study. The description was based on the type and Venu (2006).

Beddome (1874) wrongly published this species in his Icones (t. 202) as *S. extensus* Nees, to which it is closely allied, but differs in leaves and bracts. In *S. newii* the leaves are petioled, subcordate at base, acute at apex; bracts lanceolate and early caducous whereas in *S. extensus* the leaves are subsessile, cordate at base, acuminate at apex; bracts ovate, lower persistent while the upper bracts deciduous. Later Clarke (1885) validly published it as *S. newii*, quoting Beddome’s collection as well as Icon (t. 202). Phytogeographically also *S. newii* is found to occur only at Western Mysore near Manjeerabad whereas *S. extensus* is distributed at Sylhet, Assam and Khasya.

**Specimens examined:** Karnataka: Western Mysore, Manjeerabad, *s. d.*, Beddome 106 (Acc. no. 37889) (MH!).

**Strobilanthes reticulatus** Stapf

Key to the varieties:

1a. Petioles 1/3rd length of lamina (1 - 5 cm long), lamina acuminate at apex, cystoliths stellately arranged; bracts broadly ovate to orbicular, glabrous to sparsely hairy on outside ........................................... var. reticulatus

b. Petioles short (5 - 10 mm long), pertioled, acute to short acuminate at apex, cystoliths mainly along margins; bracts broadly oblong to ovate, densely pubescent with simple long and glandular hairy on outside ........................................... var. 1 var. nov.

An undershrub, 30 - 40 cm high; stems in clumps; clumps c. 1 m wide. Stem obtusely quadrangular, sulcate, pigmented along grooves; nodes prominent, swollen above nodes and narrows towards the upper nodes, densely short strigose to hispid. Leaves opposite, isophyllous or slightly anisophyllous; petiole 1 - 5 cm long, about one-third length of the lamina, sub-sessile at apex, strigose hairy, winged or slightly winged at apex; lamina ovate-lanceolate, 1.7 - 8.3 x 1 - 4 cm, rounded to sub-cordate at base, prominently crenate, ciliate along margins, acuminate at apex, coriaceous, stiff, strigose hairy on upper side, mainly on nerves beneath, cystoliths visible on dorsal side, often stellately arranged around a strigose hair, dark green above, paler below; main veins in 6 - 8 pairs, parallel, curved upwards, prominent on both sides, slightly impressed on dorsal side, raised beneath, reticulate venation visible between main veins on under surface, lineolate, more so beneath. Inflorescence axillary, opposite, from the upper 5 - 6 axils as well as terminal spikes; spikes pedunculate,
strobilate, 1.5 - 4 cm long, axillary spikes solitary or cymose or terminal spikes in monochasial cymes; peduncles 0.5 to 2.5 cm long, hispidulous, axillary peduncles from the lower axis reaching up to 11 cm, bearing one or two nodes with a pair of bracts, similar to leaves, smaller; spikes, tetragonal; bracts pedicellate, broadly ovate to orbicular above, concave, sometimes pigmented, c. 9 x 7 mm, sub-serrate, ciliate with white long hairs along margins, acuminate to cuspidate at apex, prominent reticulate venation on dorsal side, glabrous on both sides or sparsely hairy with white hairs on outside, cystoliths visible on outer surface in mature bracts; pedicel c. 3 mm long, winged, minutely pubescent; bracteoles 0. Calyx c. 9 mm long, divided almost to the base; segments subequal, linear-lanceolate, c. 7.5 mm long, ciliate with glandular and long spreading white hairs, acuminate and pigmented at apex, pubescent with glandular and long white hairs on outer surface, on the inner surface with minute glandular hairs on upper half and long white hairs at the base; prominent midrib with reticulate venation on both the sides of midrib. Corolla dark purple, tubular-ventricose, 2.5 - 2.8 x 1.5 cm; tube cylindrical 7 - 10 mm long, ventricose portion c. 1.5 cm long, the tubular part gradually changes into the ventricose part; lobes c. 0.6 cm long, rounded. Stamens 2, included, staminodes 2; staminal sheath extending to just beyond tube, open at one end, hairy along margins; filaments c. 7 mm long, long hairy all over with white spreading hairs, filaments of staminodes minute, teeth-like, 1 - 1.5 mm long, glabrous, brown coloured at apex; anther lobes bithecous, c. 2 mm long, oblong, parallel. Disc prominent, c. 1 mm broad. Ovary c. 1 mm long, glandular hairy at apex; style c. 1.6 cm long, pubescent all over; stigma sub-entire, one lobe c. 3 mm long, slightly swollen at base of stigma, minutely pubescent on back side, rudimentary projection of second stigma present. Capsule
Plate 14: Strobilanthes reticulatus Stapf var. reticulatus – a. habit; b. inflorescence; c. pollen, equatorial view; S. reticulatus Stapf var. l. var. nov. – d. habit; e. flowering twig; f. pollen, equatorial view
Fig. 31: *Strobilanthes reticulatus* Stapf var. *reticulatus* – a. flowering twig; b, c. bracts, dorsal, ventral view; d. calyx; e. corolla; f. corolla spread out with stamens; g. androecium; h. gynoecium
elliptic, apiculate, glandular hairy at apex, 4 seeded; seeds ovoid, with a large central areole, hygroscopic hairs along margins. (Plate 14a-c; Fig. 31a-h)

**Local name:** Gulla Karva (Marathi).

**Fl. & Fr.:** September - November; it flowers every seven years (Santapau, 1952).

**Habitat:** Grows gregariously as distinct clumps on exposed rocky plateaus, can also be found as an undergrowth in shady forests.

**Distribution:** Restricted to Northern Western Ghats of Maharashtra (Ahmednagar, Nasik, Pune, Satara and Sindhudurg). (Map 9d)

**Threat Status:** Vulnerable [VU B2ab(iii)].

The taxon has been assigned to ‘Vulnerable’ as the area of occupancy is estimated to be less than 2000 km² and is known to exist at no more than 10 localities.

**Pollen:** Prolate in equatorial view, spheroidal in ambitus; large, variable in size, 63 - 76 x 35 - 43 μm; colpi 3-zonicolporate, equidistant, broad in the centre, gradually tapering towards either poles, extension sub-polar, acute at ends, straight along margins and well defined, pore surface smooth; pores 3 central, 10 μm in diameter, equatorial, oval, lalongate, conspicuous, protruding, pore surface smooth; exine differentiated into pseudocolpi, alternating with ridges. Pseudocolpi 15, 3 in each mesocolpium, extension sub-polar, surface smooth. Ridges transversely septate, converging at the poles, lumina of septae perforate (Chaubal 1966; pers. obs.).

**Note:** Distinct clumps sometimes up to 1 m in diameter. In this respect, it is similar to *S. sessilis*, but differs from it in having petiolate leaves, 2 stamens and 2 staminodes. It is seen growing gregariously on the way to Kate’s point (Mahabaleshwar), where stray flowering was observed in September 2005 and a general flowering was seen in November 2006. This species was also observed at Panchgani on the hill slopes on the way to Wai.
The protologue is based on Cooke's collection which is available at BLAT, which is selected as the lectotype in the present study. Talbot's collection 4151 of 25.10.1909 is deposited as type at Kew which becomes the syntype.


Pune: Bhimashankar, near Hanuman tala, Vaghya, 10.10.1962, K. P. Janardhanan 81829 (BSI); Dhak forest, Junnar, 1300 m, 29.09.1965, K. Hemadri 107473 (BSI, CAL); Lonavala, 27.11.1964, B. Venkata Reddi 101191 (CAL). Satara: Mahabaleshwar, 4500 ft, 25.10.1909, W. A. Talbot 4151 (K, photograph!) (syntype selected here); Mahabaleshwar, 4500 ft, 20.10.1909, W. A. Talbot Acc. no. 7185 (BSI); Mahabaleshwar, 4500 ft, 20.10.1909, W. A. Talbot Acc. no. 7186 (BSI); Mahabaleshwar, 4500 ft, 20.10.1909, W. A. Talbot Acc. no. 7187 (BSI); Old Mahabaleshwar, October 1924, R. D. Acland ACK888 (BLAT); Mahabaleshwar, Lingmala falls, 07.11.1950, H. Santapau 11802 (BLAT); Mahabaleshwar, October 1955, A. R. Adatia Acc. no. 58290 (BLAT); Mahabaleshwar, 05.10.1957, G. S. Puri 25632 (BSI); Mahabaleshwar, Lingmala falls road, 12.11.1957, S. D. Mahajan 27198 (BSI); Mahabaleshwar, Lingmala falls, 15.09.1958, H. Santapau 22789 (BLAT); Mahabaleshwar, Lingmala falls, 15.09.1958, P. V. Bole 1774 (BLAT); Mahabaleshwar, Kates Point, 29.10.1958, H. Santapau 22882 (BLAT); Mahabaleshwar, Wilson Point, 05.01.1959, P. V. Bole 1861 (BLAT); Mahabaleshwar, s.d., s.c. 23838 (BLAT); Mahabaleshwar, 50 m before Kates Point, 17.09.2005, M. E. Mascarenhas 77 (GUH); Mahabaleshwar, before Kates Point, 1325 m, 17°56'40.8"N
Strobilanthes reticulatus Stapf var. 1. var. nov. Type: (India, Maharashtra), Lonavala, 08.10.2006, M. E. Mascarenhas & M. K. Janarthanam 279 (holotype CAL; isotype BSI; GUH).

An undershrub, 30 - 40 cm high, stems in clumps; clumps c. 1 m wide. Stem obtusely quadrangular, sulcate, nodes prominent, swollen, bent above nodes, densely hispid. Leaves opposite, isophyllous or slightly anisophyllous, shortly petiolate below, becoming sessile above; petioles of lower leaves 5 - 10 mm long, strigose hairy; lamina ovate-lanceolate, 3 - 9 x 1.3 - 4 cm, rounded, attenuate at base, upper leaves slightly amphlexicaul, crenate, strigose ciliate along margins, acute to short acuminate at apex, coriaceous, densely strigose hairy on dorsal side, less strigose hairy on nerves beneath, dark green above, paler below, cystoliths visible mainly along margins above, lineolate more so beneath, prominent reticulate venation between nerves on lower surface; main veins in 6 - 8 pairs, impressed above, raised below, parallel and curved upwards. Inflorescence axillary as well as terminal; peduncle 10 - 25 mm long, densely hispid, sometimes two peduncles arising in each axil; spikes strobilate, 10 - 25 mm long, axillary spikes solitary or cymose, terminal ones in monochasial cymes; bracts c. 11 x 5 mm, broadly oblone to ovate, concave, with a pedicel c. 2 mm long winged and long ciliate, upper orbicular part c. 8.4 mm long, acuminate-cuspidate at apex, somewhat concave, densely pubescent with minute, long and glandular hairs on outside, sparsely glandular hairy on inside, ciliate with glandular and long white spreading hairs prominent midrib, reticulate venation and cystoliths not visible on outer side; bracteoles 0. Calyx c. 7.5 mm long, divided to
Fig. 32: *Strobilanthes reticulatus* Stapf var. *l. var. nov.* — a. flowering twig; b, c. bracts, dorsal, ventral view; d. calyx; e. corolla; f. corolla spread out with stamens; g. androecium; h. gynoecium; i. capsule; j. seed
two-thirds the length; segments 5, linear-lanceolate, c. 4.5 mm long, ciliate with glandular and long spreading white hairs, acuminate and brown at apex, pubescent with glandular and long white hairs on outer surface, on the inner surface with minute glandular hairs on upper half and long white hairs at the base; prominent midrib with reticulate venation on both the sides of midrib. Corolla purple, c. 2.3 x 1.5 cm, tube 6 - 7 mm long, ventricose above c. 1.2 cm long, lobes 6 x 7 mm, rounded, glandular hairy outside, hairy inside especially at posterior part of corolla with two rows of hair to hold the style. Stamens 2, included, staminodes 2; staminodal sheath 4 mm long, truncate, about half of ventricose part, hairy along open margins; filament 6 - 7.5 mm long hairy all over with white spreading hairs, filament of staminode 1 - 3.5 mm long, glabrous, brown coloured at apex, almost half the length of long filament; anther lobes bithecous, 2 mm long, oblong, parallel. Disc prominent, c. 1 mm broad, obovate. Ovary c. 1.5 mm long, glandular hairy at apex; style c. 16 mm long, pubescent all over; stigma c. 2.5 mm long, sub-entire, minutely pubescent at the back, one lobe aborted, swollen at the base of the stigma. Capsule c. 8.5 mm long, elliptic, acute, glandular hairy at apex, 4 seeded; seeds ovate-oblong, with a large, broad central areole, hygroscopic hairs along margins. (Plate 14d-f; Fig. 32a-j)

Fl. & Fr.: October - November.

Habitat: Grows gregariously as distinct clumps on exposed rocky plateaus.

Distribution: Known from the Northern Western Ghats of Maharashtra (Pune - Lonavala). (Map 9c)

Threat Status: Endangered [EN B2ab(iii)].

The taxon has been assigned to 'Endangered' category since area of occupancy is estimated to be less than 500 km², known to exist at not more than five localities.
Pollen: Prolate in equatorial view, spheroidal in ambitus; large, variable in size, 56 - 63 x 30 - 35 μm in size; colpi 3-zonicolporate, equidistant, broad in the centre, gradually tapering towards either poles, extension sub-polar, acute at ends, straight along margins and well defined, pore surface smooth; pores 3 central, 5 - 8 μm in diameter, equatorial, oval, lalongate, conspicuous, protruding, pore surface smooth; exine differentiated into pseudocolpi, alternating with ridges. Pseudocolpi 15, 3 in each mesocolpium, extension sub-polar, surface smooth. Ridges transversely septate, converging at the poles, lumina of septae perforate (Chaubal 1966; pers. obs.).

Note: Santapau (1966) found that Blatter’s specimen from Khandala (October 1918, coll. no. 28425) at BLAT, was not completely matching with Stapf’s type sheet at Kew Herbarium. Still he retained it as S. reticulatus since it matched with it more closely than with any other Strobilanthes. However this collection could not be traced at BLAT during the present study.

The collection from Lonavala, made during the present study also differs from the type photograph at Kew, although it is very allied to the typical variety. It is very much similar to S. sessilis var. ritchiei, but differs from it in the shape, size, indumentum of the leaves and bracts as well as in the number of stamens (Table 7).

Venu’s (2006) description of S. reticulatus has characters of both the specimens, that is from Mahabaleshwar (typical variety) and Lonavala (var. 1. var. nov.), whereas the diagram is of Lonavala specimen.

The pollen grain is homologous to S. reticulatus var. reticulatus, S. callosa and S. sessilis var. sessilis, var. ritchiei and var. sesiloides in having transversely banded ridges.
Table 7: Differences between *S. reticulatus* var. *reticulatus* and *S. reticulatus* var. *1. var. nov.*

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Character</th>
<th><em>Strobilanthes reticulatus</em> var. <em>reticulatus</em></th>
<th><em>S. reticulatus</em> var. <em>1. var. nov.</em>*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stem</td>
<td>grooved, grooves pigmented, swollen above nodes &amp; narrows towards upper node, shortly strigose</td>
<td>sulcate, internodes uniform, not pigmented, nodes prominent, densely hispid</td>
</tr>
<tr>
<td>2</td>
<td>Petiole of lower leaves</td>
<td>1-4 cm long, c. 1/3rd length of the lamina</td>
<td>short, 0.5 - 1 cm long</td>
</tr>
<tr>
<td>3</td>
<td>Dorsal surface of leaf</td>
<td>scabrous, cystoliths visible often stellately arranged around a central hair</td>
<td>densely scabrous, cystoliths not clearly visible except along margins</td>
</tr>
<tr>
<td>4</td>
<td>Nerves on lower leaf surface</td>
<td>strigosely hairy</td>
<td>less strigosely hairy</td>
</tr>
<tr>
<td>5</td>
<td>Lamina base</td>
<td>rounded to sub-cordate</td>
<td>rounded, shortly attenuate.</td>
</tr>
<tr>
<td>6</td>
<td>Lamina apex</td>
<td>short acuminate</td>
<td>acute-acuminate</td>
</tr>
<tr>
<td>7</td>
<td>Lamina margins</td>
<td>deeply crenate</td>
<td>crenate</td>
</tr>
<tr>
<td>8</td>
<td>Inflorescence</td>
<td>single peduncle in each axil</td>
<td>sometimes 2 peduncles in each axil</td>
</tr>
<tr>
<td>9</td>
<td>Bracts surface</td>
<td>generally glabrescent on the outside, cystoliths visible on the outer surface, pinkish in colour</td>
<td>hispidulous on the outside and cystoliths not visible on outer surface, green in colour.</td>
</tr>
<tr>
<td>10</td>
<td>Bracts margins</td>
<td>densely ciliate with long white hairs along margins</td>
<td>ciliate</td>
</tr>
</tbody>
</table>

**Specimens examined:** Maharashtra: Pune: Open area near Ghusalgaon-Ambavane-Mulshi Taluk, ± 1200 m, 10.09.1964, B. Venkata Reddi 99160 (BSI, CAL); Near Ghusalgaon - Ambavne-Mulshi Taluka, 27.11.1964, B. Venkata Redi 101191 (BSI, CAL); Lonavala, Lion’s Point, 759 m, 18°42′ 022″ N 073°23′163″ E, 08.10.2006, M.E. Mascarenhas 278 (GUH); Lonavala, Echo Point, 761.5 m, 18°41′81.8″ N 073°23′18.4″ E 24.11.2007, M. E. Mascarenhas 441 (GUH); Lonavala, Lion’s Point, 24.11.2007, M. E. Mascarenhas 443 (GUH).

A woody shrub, up to 1 m high, leafless in flowering. Stem obtusely quadrangular, glabrous and lenticular at older part, nodes prominent and closely arranged, hispid at younger parts. Leafless except a few at apex; petiole 0.7 - 2 cm long, obscure due to decurrent leaf base, pubescent; apical leaves with lamina elliptic, 3 - 6 x 1.5 - 2.4 cm, tapering at base, crenate, ciliate along margins, acuminate at apex, scarcely hairy, mainly on nerves on upper surface, pubescent on lower, cystoliths densely scattered on upper surface; main veins in 6 - 7 pairs. Inflorescence on leafless stem, opposite, axillary or terminal; peduncle 3 - 20 mm long, glandular. Outer bracts sterile, obovate, 5.5 - 7.5 x 3 - 6 mm, ciliate along margins, acute at apex, few glandular hairs on the outside at apex, pubescent on both sides; inner bracts fertile, oblong-ovovate, 6 - 9 x 2 - 3 mm, ciliate with glandular hairs along margins, sub-acute at apex, glandular on outside, sparsely hairy on inside mainly at upper end with few glandular hairs, midrib with veins visible on both sides; bracteoles linear-lanceolate, c. 7 mm long, ciliate with glandular hairs along margin, subacute-obtuse at apex, glandular hairy outside, sparsely hairy inside, prominent midrib. Calyx 7.5 - 8 mm long, segments 5, divided almost to the base; each segment linear-lanceolate, acute at apex, glandular hairy on outside, hairy on inside. Corolla purple, tubular at base, ventricose above; tube cylindric, c. 5 mm long, resupinate; ventricose part
Plate 15: *Strobilanthes scrobiculatus* Dalzell ex C. B. Clarke – a. habit; b. flowering twig; c. pollen, equatorial view; *S. tristis* (Wight) T. Anderson – d. habit; *S. sessilis* Nees var. *sessilis* – e. inflorescence

a) • *Strobilanthes scrobiculatus*, • *S. sessilis* var. *sessilis*; b) • *S. sessilis* var. *ritchiei*; c) • *S. sessilis* var. *sessiloides*; d) • *S. tristis*
c.1 cm long; lobes obtuse, c. 5 x 4 mm, glabrous on outside, with 2 rows of hairs on inside of throat to support style. Stamens 4, didynamous; staminal tube open at the edges and hairy along margins; filaments glabrous, longer filaments c. 5 mm long; shorter filament c. 3 mm long; anther bithecous, oblong, c. 2 mm long, acute at base. Disc c. 0.5 mm broad. Ovary c. 1.5 mm. long, glabrous; style c. 1.4 cm long, glandular hairy all over; stigma two lobed, one lobe rudimentary. Capsule elliptic, c. 7.5 x 2.5 mm, glabrous, 4-seeded; seeds ovate, c. 2.5 x 1.5 mm with a small areole and dense hygroscopic, yellowish hairs around the areole. (Plate 15a-c)

Local name: Pitchkodi (Marathi).

Fl. & Fr.: November - March; it flowers after a period of 16 years.

Habitat: Mostly on hill slopes near water falls.

Distribution: Restricted to the Northern Western Ghtas of Maharashtra (Pune, Satara) and the Central Western Ghats of Karnataka (Uttara Kannada). (Map 10a)

Threat Status: Vulnerable [VU B2ab(iii)].

The taxon has been assigned to 'Vulnerable' as the area of occupancy is estimated to be less than 2000 km² and is known to exist at no more than 10 localities.

Pollen: Prolate or subprolate in equatorial view, circular in polar view; 38 - 51 x 30 - 41 µm in size; 3-zonicolporate; equidistant, fusiform, gradually tapering towards either poles, ends acute, margins straight and well defined, furrow membrane smooth; pores 3, central, equatorial, circular or lalongate, protruding, pore surface smooth; exine differentiated into pseudocolpi, alternating with ridges; pseudocolpi 12, 4 in each mesocolpium, extension sub-polar, ridges 15, 5 in each mesocolpium, each ridge with a coarse reticulum the lumina of which is perforate (Chaubal 1966; pers. obs.).

Note: A leafless shrub during flowering, with purple flowers and bracts with sticky glandular hairs and a pleasant smell. Normally this species is found on the slopes near
waterfalls, but the present collection was found as a single bush, by the edge of the road, near a dried up puddle in the open on the plateau. The flowering was a stray flowering. After completing flowering and fruiting the plant died leaving no trace behind.

The flowering period is supposed to be one of the longest among the species from the genus *Strobilanthes* being 16 years. Most of the specimens observed in the various herbaria are from Mahabaleshwar, except the one at SUK which is from Vasota and two other collections from Uttara Kannada.

**Specimens examined:** Karnataka: Uttara Kannada: Dursing, 28.02.1888, W. A. Talbot 1610 (BSI, CAL); Anmode, 1.03.1889, W.A. Talbot 1872 (BSI, CAL).

Strobilanthes sessilis Nees

Key to the varieties:

1a. Bracts broadly ovate; cuspidate at apex .........................2
   b. Bracts ovate; broadly acuminate at apex ............................ var. ritchiei

2a. Leaves softly villous on both sides; corolla slightly glandular hairy outside .................................................. var. sessilis
   b. Leaves scabrous hispid above, bristly on nerves beneath;
      Corolla hairy outside .................................................. var. sessiloides


A small perennial herb, with a number of simple shoots arising from a many headed rhizome, forming discrete clumps. Stem 30 - 45 cm high, erect, obtusely quadrangular, densely villous, swollen at the nodes. Leaves, opposite, isophyllous, sub-sessile; petiole 2.5 - 5 mm long, densely villous on both sides; lamina 4 - 5.1 x 3 - 4 cm, ovate to sometimes broadly ovate, nearly as broad as long, but mostly longer than broad, base rounded to sub-cordate, crenate, ciliate along margins, acute to acuminate at apex, green above, lighter below; main veins in 5 - 6 pairs; curving upwards, prominent on both sides, impressed on adaxial side, raised on abaxial side. Inflorescence 3 - 3.8 cm long, sub-strobilate, tetragonal, axillary, opposite or terminal,
sometimes cymose; peduncles 1 - 2 cm long, hispid hairy; bracts pedicellate, ovate to broadly ovate, concave, upper bracts pigmented at older stage, 1 - 1.3 x 0.5 - 0.9 cm, sub-serrate, densely ciliate along margins, cuspidate at apex, densely softly villous on outer side, mainly on midrib, short glandular hairs on outside at base, sparsely hairy on inside, midrib prominent; pedicel c. 2 mm long; bracteoles 0. Calyx 9.5 - 10.5 mm long, divided almost to two-third its length, segments 5, unequal, lanceolate, c. 6.5 mm long, ciliate with long and glandular hairs along margins, acute-acuminate at apex, densely softly villous, glandular hairy outside, sparsely glandular-hairy above and densely hairy with long hairs at base on inside, prominent midrib. Corolla purple, c. 2.4 cm, tubular-ventricose shortly pubescent, glandular hairy outside, sparsely hairy on inside, two rows of hairs on posterior side to hold the style; tube cylindric, c. 7 x 2 mm, glabrous; ventricose portion, c. 12 x 8 mm; lobes c. 6 x 6 mm, orbicular, veins visible. Stamens 4, didynamous, monadelphous; staminal sheath c. 2.2 cm long, from base of tube to about half the ventricose portion, truncate, open at one end, hairy along both the edges; long filament c. 8 mm long, hairy all over, short filament c. 2 mm long, glabrous; anthers bithecous, oblong, parallel, c. 2 mm long, glabrous; rudimentary staminode c. 1 mm long. Disc c. 1 mm thick, cream in colour. Ovary c. 2 mm long, elliptic, glabrous with a few glandular hairs at apex; style c. 16 mm long, sparsely hairy; stigma sub-entire, one lobe linear, c. 3 mm long, the other obsolete. Capsule c. 9 x 3 mm, elliptic, apiculate at apex, glabrous, except at apex glandular hairy, 4 seeded; seed brown, c. 2 x 1.5 mm, ovate, oblong to sub-orbicular, obtuse at apex, softly hygroscopic hairy along periphery, with a large, oblong, areole, on both faces. (Plate 15e)

**Fl. & Fr.:** August to December; it flowers almost every year (Gamble, 1924; Fyson, 1986).
Habitat: On open meadows, exposed hills of sholas among grasses and grasslands of semi-evergreen forests, evergreen forests.

Distribution: From the Central Western Ghats of Karnataka (Kodagu, Mysore & Dakshina Kannada) to the Southern Western Ghats of Tamil Nadu (Nilgiris & Coimbatore). (Map 10a)

Threat Status: Endangered [EN B2ab(iii)].

The taxon has been assigned to ‘Endangered’ category because area of occupancy is estimated to be less than 500 km², known to exist at no more than five localities.

Pollen: Prolate to subprolate in equatorial view, spheroidal in ambitus; large, variable in size; colpi 3-zonicolporate, gradually tapering, extension circumpolar, acute at ends, well defined along margins, furrow membrane smooth; pores 3, central, equatorial, circular, lalongate, conspicuous, slightly depressed, pore surface smooth; exine differentiated into pseudocolpi and ridges. Pseudocolpi 12, 4 in each mesocolpium, pseudocolpi narrow, gradually tapering towards poles, extension subpolar, ends acute, margins well defined, furrow membrane smooth. Ridges 15, 5 in each mesocolpium, closely arranged, extension polar, margins well defined, transversely septate, the lumina of septa perforate (Chaubal 1966; pers. obs.).

Note: It is a perennial herb having a many headed rhizome and new shoots are produced every year and shows a different mode of living from the general Strobilanthes (this feature is common to all the varieties of S. sessilis), the name Pleocaulus refers to this habit. The leaves of var. ritchiei are nearly glabrous, except on nerves beneath; bracts long acuminate and bristly, ciliate with long, jointed hairs, while the leaves of var. sessilioides are larger, more bristly, rugose; bracts are more densely arranged bristly hairs on outside, on nerves beneath and along margins. Whereas in var. sessilis, the leaves are softly villous on both sides, mainly on nerves
below; bracts are also softly villous. The flowers of var. *sessiloides* are larger than those of the other two varieties.

Cooke (1905), Talbot (1909) stated that the seeds are covered with hygroscopic hairs all over but Fyson (1986) in his diagram of the seed (*S. sessilis*) has shown the presence of an areole. Observations made during the current study reveals that the seeds show the presence of a large, oblong, areole on both the faces occupying almost two-third the area of the seed and the remaining one-third with hygroscopic hairs.

Talbot's (1909) descriptions of *S. sessilis* are actually of *S. sessiloides*. He gives the distribution of both var. *ritchiei* and var. *sessiloides* and does not give of var. *sessilis*. This species resembles *S. reticulatus* morphologically, which is also observed by Talbot, but differs from it in having branching stem and only two fertile stamens.

Almeida (2003) says *S. sessilis* is found at Khandala, but no collection from here was observed in any of the local herbaria. After critically observing the herbarium collections of *S. sessilis* in the various local herbaria especially with respect to the leaf and bract characters, the identity of a number of them was changed. Uttara Kannada collections put under var. *sessilis* in Venu (2006) have been shifted to var. *sessiloides*. Similarly, two collections from Nilgiris, collections from Idukki, Palghat & Wyanad have been shifted to var. *sessiloides* and collections from Suvasni Ghat are shifted to var. *ritchiei*.

**Specimens examined:** Karnataka: Dakshina Kannada: Charmady, 05.02.1997, K. Ravikumar, G. S. Goraya & S. R. Ramesh 09752 (FRLH). Kodagu: Talacauvery, 02.02.1976, B. C. Banerjee 11474 (CAL); Top of Tadiandamol hill, 1800 m, 10.02.1976, B. C. Banerjee 11632 (CAL); Tadiandamol, 1330 m and above, 12° 13' 59.5" N 75° 37' 32.8" E, 18.09.2006, M. E. Mascarenhas & M. K. Janarthanam 255

A small perennial herb, with a number of simple shoots arising from a many headed rhizome, forming discrete clumps; stem obtusely quadrangular, sulcate, scabrous. Leaves opposite, isophyllous, sessile or nearly so; lamina ovate, 3.7 - 5 x
Plate 16: *Strobilanthes sessilis* Nees var. *ritchiei* C. B. Clarke – a. habit; b. spike; c. flower; d. pollen, equatorial view; *S. sessilis* Nees var. *sessiloides* (Wight) C. B. Clarke – e. habit; f. inflorescence; g. flower; h. pollen, equatorial view
Fig. 33: *Strobilanthes sessilis* Nees var. *ritchiei* C. B. Clarke – a. habit; b, c. bract, dorsal, ventral view; d. calyx; e. androecium; f. gynoecium
2.5 - 3 cm, rounded at base, crenate, ciliate along margins, acuminate at apex, slightly bullate, cystoliths visible on the adaxial side, lineolate and sparsely strigose hairy on adaxial surface, nearly glabrous on the abaxial surface except on the nerves which are bristly; main veins in 6 - 8 pairs, parallel, curving upwards, prominent on the abaxial side. Inflorescence in strobiliform axillary as well as terminal, pedunculate or subsessile spikes, 3 - 4 cm long; peduncles 0.5 - 2 cm long, bristly hairy; bracts ovate, c. 1.5 cm long, denticulate, bristly hairy, ciliate along margins, strigosely hairy on outer surface, sparsely hairy on the inner surface mainly at the base and apex; prominent midrib, penninerved, longer than the calyx, imbricate, persistent. Flowers solitary in the axils of bracts; bracteoles 0. Calyx divided to the base, c. 11 mm long; segments lanceolate, subequal, central segment narrower, ciliate-glandular hairy on outside, on inside densely hairy at base inside and glandular hairy above, acute at apex. Corolla purple or light lilac, tubular-ventricose, c. 1.7 cm long, tubular at base, tube cylindrical, c.7 mm long, shorter than the ventricose portion; ventricose above, c. 10 mm long, lobes subequal, obcordate (reute) at apex, hairy outside, slightly hairy inside, especially at the insertion of the stamens, two rows of hair present to hold style and stigma. Stamens 4, didynamous, the longer pair slightly exserted, monadelphous; filaments of the longer pair hairy along their whole length, shorter filament, shorter filaments glabrous. Disc prominent. Ovary shortly hairy with glandular hairs at the apex; ovules 2 in each locule; style hairy all along, slightly swollen at the base of the stigma; stigma shortly hairy at back, one branch linear, the other obsolete. (Plate 16a-d; Fig. 33a-f)

**Local name:** Bukra (Marathi).
**Fl. & Fr.:** September - January. According to Talbot (1909), it is said to be flowering every 7 years although scattered flowering clumps are seen to flower annually during September to October.

**Habitat:** On exposed plateau among grass, *Impatiens* and some ground orchids, etc. often subjected to strong wind influence.

**Distribution:** Restricted to the Northern Western Ghats of Maharashtra (Pune, Satara, Kolhapur and Sindhudurg) to Central Western Ghats of Karnataka (Uttara Kannada). (Map 10b)

**Threat Status:** Vulnerable [VU B2ab(iii)].

The taxon has been assigned to 'Vulnerable' as the area of occupancy is estimated to be less than 2000 km² and is known to exist at no more than 10 localities.

**Pollen:** Prolate to subprolate in equatorial view, spheroidal in ambitus; large, variable in size, 78 - 89 x 51 – 61 µm; colpi 3-sonicolporate, gradually tapering, extension circumpolar, acute at ends, well defined along margins, furrow membrane smooth; pores 3, central, equatorial, circular, lalongate, c. 13 µm in diameter, conspicuous, slightly depressed, pore surface smooth; exine differentiated into pseudocolpi and ridges. Pseudocolpi 12, 4 in each mesocolpium, pseudocolpi broad in the centre, gradually tapering towards poles, extension sub-polar, ends acute, margins well defined, furrow membrane smooth. Ridges 15, 5 in each mesocolpium, extension polar, margins well defined, transversely septate, the lumina of septa perforate (Chaubal 1966; pers. obs.).

**Note:** The entire plateau at Kas is covered with this species along with *Impatiens* spp. and some ground orchids. The plants are exposed to very high wind velocity, lot of humidity and water. The plants were seen in stray flowering in September 2005, 2006 and a general flowering was seen in 2008.
From Herbarium data and collection data of *S. sessiloides* it was seen to possess larger, more bristly-rugose leaves and larger flowers than in var. *ritchiei*. According to Talbot (1909), var. *ritchiei* is common on lateritic Konkan Ghats in the Uttara Kannada and Belgaum districts; the same view is shared in the present study. Collections of *S. sessilis* var. *sessilis* by Gammie, Hodgson and Almeida and those of *S. reticulatus* by Kulkarni and Almeida from Amboli are treated as *S. sessilis* var. *ritchiei* in the present study after critical analysis of their morphological characters.

Specimens examined: Karnataka: Belgaum: Ramghat, 600 m, 21.11.1889, W. A. Talbot 2119 (BSI); Poondra, 06.10.1900, W. A. Talbot 4317 (BSI, CAL); Between Belgaum and coast at Vengurla, between Pondra and Amboli, 16.11.1902, J. H. Burkill 16976 (CAL); Uttara Kannada: Ghats between Devimane and Surey, 18.11.1882, W. A. Talbot 37 (CAL); Mundgud road, near Surey, 03.09.1883, W. A. Talbot 623 (BSI, CAL); Nilkund, 04.12.1895, W. A. Talbot 3510 (BSI); Castle Rock, 25.10.1902, G. A. Gammie 15642 (BSI); Sampkhand, October 1919, Hallberg & Mc Cann 34647 (BLAT). Maharashtra: Kolhapur: Burki, s. d., M. M. Sardesai mmS150 (SUK). Pune: Torna, 25.01.1951, B. A. Raji 6101 (MACS); Torna fort, 25.11.1951, H. Santapau 13944 (BLAT); Torna, 4000 ft, 28.09.1952, V. D. Vartak 6103 (MACS); Rajgad, 3800 ft, 04.11.1954, V. D. Vartak 201 (MACS). Satara: Kas, October 1970, s.c. 10 (MACS); Kas, October 1991, M. P. Bachulkar-Cholekar 5253 (SU); Vasota, Chalkewadi, October 1995, M. P. Bachulkar-Cholekar 20281 (SU); Kasarni plateau, 17°43′39.9″ N 073°49′55.9″ E, 1223 m, 18.09.2005, M. E. Mascarenhas & M. K. Janarthanam 82 (GUH). Sindhudurg: Amboli Ghat, January 1889, W. A. Talbot, s. n. (BSI); Ramghaut, 600 m, November 1889, W. A. Talbot 2119 (BSI, CAL); Amboli Ghat, January 1891, W. A. Talbot, s. n. (BSI); Suvasni Ghat, 08.12.1902, G. A. Gammie 16000 (BSI); Amboli Ghat, 1917, Hodgson

A small perennial herb, with a number of simple shoots arising from a many headed rhizome, forming discrete clumps; stem 30- 45 cm. high, numerous, erect obtusely quadrangular, sulcate, articulate, bent and swollen above nodes, densely hispid. Leaves opposite, isophyllous, sessile to sub-sessile; petiole 2 - 8 mm long, bristly hairy; lamina broadly ovate, nearly as broad as long, 2.5 - 7 x 1.8 - 4.2 cm, rounded-cordate or amphlexicaul at the base, crenate-serrate, bristly hairy and ciliate, acute at apex, thick, coriaceous, very rugose or bullate, hispid or densely strigose, bristly on the nerves beneath; 6 - 8 pairs of main veins, prominent, impressed on
Fig. 34: *Strobilanthes sessilis* Nees var. *sessiloides* (Wight) C. B. Clarke – a. habit; b, c. bract, dorsal, ventral view; d. calyx; e. androecium; f. gynoecium; g. capsule; h. dehisced capsule; i. seed
adaxial side, raised on abaxial side. Flowers in strobiliform or tetragonal, axillary and terminal pedunculate or subsessile spikes, 3 - 5 cm long, often 3 - 5 together at the apex of the branches, spikes with pigmented bracts; peduncles of variable length, 0.6 - 1.5 cm, bristly hairy; bracts c. 1.3 x 1 cm, broadly ovate, cuspidate, tinged with purple or purple dots along the margins, bristly hairy and ciliate with long jointed hairs; bracteoles 0. Calyx c. 5 mm long divided almost to the base; segments subequal, c. 4.7 mm long, lanceolate, ciliate with glandular and long white hairs along margins, acute at apex, densely hairy, glandular hairy on the outside, on the inside sparsely glandular-hairy at upper half and dense long hairs at base. Corolla purple or dark lilac, 2.5 - 3 cm long, tubular at base, ventricose above, glandular hairy outside, densely hairy on the inside at the insertion of the stamens; tube cylindrical, 5 - 8 mm long, shorter than the ventricose portion; ventricose part 1.2 - 2.1 cm long; lobes ovate, 4 - 8 x 5 - 7 mm. Stamens 4, didynamous, included; long filaments c. 7 mm long, hairy all along the length, the shorter c. 2 mm long, glabrous or with 2 or 3 hairs. Disc c. 1 mm thick, prominent. Ovary c. 1.7 cm long, glandular-hairy at apex; style c. 1.6 cm long, hairy more so towards lower part, slightly swollen at base of stigma; stigma of one long linear branch, c. 3 mm long; the other obsolete, hairy at back. Capsule linear-elliptic, c. 13 mm long glabrous, with a few glandular hairs at the apex. Seeds brown, c. 3 mm in diameter, sub-orbicular, flattened, hygroscopically hairy all over except for the oblong areole about half the size of the seed on both the faces. (Plate 16e-h; Fig. 34a-i)

Fl. & Fr.: September - December. It flowers almost every year.

Habitat: On exposed grassy mountain slopes on the windward sides of semi-evergreen and evergreen forests.
**Distribution:** From the Central Western Ghats of Karnataka (Belgaum, Chikmagalur & N. Kanara) to the Southern Western Ghats of Kerala (Kannur, Wyanad, Palghat & Idukki). (Map 10c)

**Threat Status:** Vulnerable [VU B2ab(iii)].

The taxon has been assigned to ‘Vulnerable’ category as the area of occupancy is estimated to be less than 2000 km² and is known to exist at no more than 10 localities.

**Pollen:** Prolate to subprolate in equatorial view, spheroidal in ambitus; large, variable in size, 76 - 83 x 40 - 51 μm; colpi 3-zonicolporate, gradually tapering, extension circumpolar, acute at ends, well defined along margins, furrow membrane smooth; pores 3, central, equatorial, circular, lalongate, c. 8 μm in diameter, conspicuous, slightly depressed, pore surface smooth; exine differentiated into pseudocolpi and ridges. Pseudocolpi 12, 4 in each mesocolpium, pseudocolpi narrow, gradually tapering towards poles, extension sub-polar, ends acute, margins well defined, furrow membrane smooth. Ridges 15, 5 in each mesocolpium, closely arranged, extension polar, margins well defined, transversely septate, the lumina of septa perforate (Chaubal 1966; pers. obs.).

**Note:** Gregarious growth in almost pure strands. Spikes turning reddish at the upper end or on the side facing the sun. In 2005, there was a general flowering at Kemmangundi and in 2006 stray flowering was observed at Manikyadhan, near Dattatreya Petta in Chikmagalur District.

Venu (2006) uses pigmented or coloured bracts of var. *sessilioides* as a key character to differentiate it from the remaining two varieties *sessilis* and *ritchiei*. But from observations of live specimens, data from herbarium sheets and literature it is seen that var. *sessilioides* has pigmented bracts, the other two varieties also develop
pigmentations on their upper bracts at a later stage of development when the
flowering is almost over (Table 8).

Table 8: Differences between the three varieties of *Strobilanthes sessilis*

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Character</th>
<th><em>S. sessilis</em> var. <em>sessilis</em></th>
<th><em>S. sessilis</em> var. <em>ritchiei</em></th>
<th><em>S. sessilis</em> var. <em>sessilioides</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leaf size</td>
<td>4-5.1 x 3 - 4 cm</td>
<td>3.7-5 x 2.5-3 cm</td>
<td>2.5 -7 x 1.8 - 4.2 cm</td>
</tr>
<tr>
<td>2</td>
<td>Leaf shape</td>
<td>ovate to broadly ovate, rounded to sub-cordate at base</td>
<td>ovate-lanceolate, rounded at base</td>
<td>broadly ovate almost orbicular, amphicaleaul or cordate at base</td>
</tr>
<tr>
<td>3</td>
<td>Hairiness</td>
<td>densely softly villous on both sides</td>
<td>slightly strigose hairy on adaxial side nearly glabrous beneath except on nerves bristly</td>
<td>bristly hairy, densely strigose on nerves beneath</td>
</tr>
<tr>
<td>4</td>
<td>Leaf apex</td>
<td>acute-acuminate</td>
<td>acuminate</td>
<td>acute</td>
</tr>
<tr>
<td>5</td>
<td>Leaf surface</td>
<td>slightly bullate</td>
<td>slightly bullate</td>
<td>very rugose or bullate</td>
</tr>
<tr>
<td>6</td>
<td>Bracts</td>
<td>ovate to broadly ovate, upper ones pigmented</td>
<td>ovate lanceolate, upper ones pigmented</td>
<td>broadly ovate, pigmented</td>
</tr>
<tr>
<td>7</td>
<td>Bracts size</td>
<td>1-1.3 x 0.5-0.9 cm</td>
<td>c. 1.5 cm</td>
<td>c. 1.3 x 1 cm</td>
</tr>
<tr>
<td>8</td>
<td>Bract apex</td>
<td>cuspidate</td>
<td>acute acuminate</td>
<td>cuspidate</td>
</tr>
<tr>
<td>9</td>
<td>Hairiness</td>
<td>softly villous on outer side, mainly on midrib, short glandular hair on outside at base</td>
<td>strigose on outer surface, sparsely on inner</td>
<td>bristly hairy</td>
</tr>
<tr>
<td>10</td>
<td>Flower</td>
<td>c. 2.4 cm, purple</td>
<td>c. 1.7 cm, light purple</td>
<td>2.5 - 3 cm, dark purple</td>
</tr>
</tbody>
</table>

Murthy KFP 4754 (CAL, JCB); Bababudan hills, 1500 m, 26.09.1979, C. J. Saldanha KFP9507 (JCB); Bababudan hills, 1600 m, 27.09.1979, C. J. Saldanha KFP9556 (JCB); Samse-Malleswara, 900 m, 07.10.1979, C. J. Saldhanha KFP9685 (JCB); Bababudan hills, 1300 m, 05.09.1980, C. J. Saldanha KFP12170 (JCB); Bababudan hills, 1350 m, 23.12.1980, C. J. Saldanha & S. R. Ramesh KFP12486 (JCB); Bababudangiri, 1350 m, 17.10.1981, C. J. Saldanha KFP13811 (JCB); Bababudangiri, 1550 m, 28.10.1981, C. J. Saldanha, B. G. Singh & Shivaprakash KFP 13898 (JCB); Kemmangundi, Bababudangiri hills, Lingadahalli, Tarike, 1600 m, 14°30' N 74° 35' E, 29.09.1996, K. V. Devar 8724 (FRLH); Kemmangundi near Z point, 17.11.2004, M. K. Janarthanam & M. E. Mascarenhas 10 (GUH); Chikmagalur to Kemmangundi, 1590 m, 13° 2.4' 05.5" N 75° 44' 02.6" E, 05.09.2005, M. E. Mascarenhas & M. K. Janarthanam 62 (GUH); On way to Kemmangundi after forest check post, 05.09.2005, M. E. Mascarenhas & M. K. Janarthanam 66 (GUH); 10 km from Kemmangundi, 05.09.2005, M. E. Mascarenhas & M. K. Janarthanam 69 (GUH); Manikyadhan, 20.02.2006, M. E. Mascarenhas & M. K. Janarthanam 192 (GUH).

Kerala: Idukki: Meenmutty, ± 700 m, 24.09.1984, C. N. Mohanan 80166 (MH); Kulamavu, ± 600 m, 10.10.1985, C. N. Mohanan 74533 (MH). Kannur: Brahmagiri, ± 850 m, 15.11.1978, V. S. Ramachandran 58744 (MH). Palghat: Silent Valley RF, 900 m, 21.12.1969, E. Vajravelu 33201 (MH); Kundipuzha Dam, 1000m, 06.11.1976, E. Vajravelu 48859 (MH); Silent Valley Dam area, 08.10.1979, N. C. Nair, 64398 (MH). Wyanad: Road to Avalanch, 19.08.1883, R. H. Beddome Acc. no. 37882 (MH); Brahmagiri, s. d., s. c. Acc. no. 37885 (MH).

Fig. 35: *Strobilanthes tristis* (Wight) T. Anderson – a. habit; b. spike; c. calyx; d. corolla spread out showing stamens; e. gynoecium

An erect or scandant shrub. Stem glabrous, obtusely quadrangular, sulcate on two sides, slightly constricted above nodes. Leaves opposite, unequal; petiole 2.5 - 7.5 cm long obscure due to decurrent leaf base, glabrous; lamina elliptic-lanceolate, 9.5 - 20 x 3 - 8 cm, decurrent at base, crenulate along margins, acuminate at apex, subcoriaceous, glabrous on both sides, densely lineolate above, not so below, cystoliths small, more prominent on adaxial (above) side; main veins in 5 - 7 pairs, raised and curved upwards. Inflorescences lax, paniculate spikes or 2 - 3 flowered heads; spikes lanceolate, c. 2 cm long, peduncled; peduncle 1.8 - 2 cm long, deflexed; involucral bracts lanceolate, hirsute hairy along margins, acuminate at apex; bracts lanceolate, long, acuminate at apex; bracteoles 0. Calyx lobes five, subequal, lanceolate, ciliate with long hairs along margins, acuminate at apex. Corolla white, 2.7 - 3.6 cm long, tubular at base, funnel shaped above; tube 6 - 7 mm long, cylindrical at base, very short; funneled part 2.2 - 2.7 cm long, hairy within and pubescent on the outside; lobes 5, ovate, rounded at apex. Stamens 4, didynamous, included; staminal tube c. 10 mm long, from base of funneled part to one third length of corolla; filaments hairy, longer filaments c. 10 mm long, hairy all over; anthers bithecous, c. 3 mm long, oblong, glabrous. Disc present, annular. Ovary superior, two-celled, with two light ovules in each cell; style sparsely hairy. Capsules narrowly
ellipsoid, 4-seeded; seeds oblong, obtuse, sub-truncate, shaggy adpressed hairs, except on areole; areolate, areole large, oblong from base. (Plate 15d; Fig. 35a-c)

Fl. & Fr.: September - April.

Habitat: Found along roadside, in open areas and also in the dense sholas at high altitudes from 950 - 1500 m in wet evergreen forests.

Distribution: From the Central Western Ghats of Karnataka to the Southern Western Ghats of Kerala and Tamil Nadu. (Map 10d)

Threat Status: Near Threatened [NT].

The taxon has been assigned to ‘Near Threatened’ category since area of occupancy is estimated to be more than 20,000 km², known to exist at more than 10 localities.

Pollen: Prolate or subprolate in equatorial view, circular in polar view, 3-colporate; equidistant, long and narrow, gradually tapering towards either poles, ends acute; pores 3, central, equatorial, circular or lalongate; exine differentiated into pseudocolpi, alternating with ridges; ridges unequal in length, some of which completely encircle the poles; tectum perforate (Carine & Scotland, 1998).

Note: This species could not be collected and so the taxon is described based on the herbarium specimens from the local herbaria, Clarke (1884) and Venu (2006). Mass flowering was observed at Kanniyakumari (Upper Kothayar) in 2002 as per Murugan’s collection (114144) deposited at MH.

Wight has mentioned that the capsules are four seeded, of which the two basal seeds may often abort, whereas Venu (2006) says the number of seeds is two.


Kerala: Kannur: Tirunelli R.F., ± 825 m, 06.03.1979, V. S. Ramachandran, 62100
(MH); Top of Theerthundamalai, Chandranathode, ± 975 m, 23.02.1979, V. S. Ramchandran, 61340 (MH). **Kottayam**: Devicolam, 1580 m, 11.09.1968, D. B. Deb 30732 (MH). **Palghat**: Way to Valiyaparthode, 850 m, 05.12.1980, N. C. Nair 69128 (MH). **Pathanamthitta**: Kaki Forest-Pamba, ±1050 m, 29.01.1992, R. Chandrasekaran 98728 (MH). **Tamil Nadu**: Coimbatore: Anamallays, 6000 ft, 1865, R. H. Beddome Acc. no. 37802 (MH); dense shola in Ouchterlony Valley, January 1885, s. c. Acc. no. 37805 (MH); Attakatti to Valperai-Anamalais, 1200 m, 14.12.1960, N. P. Balakrishnan & J. L. Ellis 11720 (MH); Lower Nirar to Ilaliyar, ± 950 m, 06.09.1983, K. Ramamurthy 78434 (MH). **Kanniyakumari**: Upper Kodayar, ± 1300 m, 14.03.1979, A. N. Henry 60700 (MH); Upper Kothayar, 1300 m, 11.08.2002, C. Murugian 114144 (MH); **Madurai**: Aruna Estate, 1500 m, 28.04.1960, B. V. Shetty 10340 (MH). **Nilgiri**: Neilgherries, s. d., Wight Acc. no. 337598 (isotype CAL !); Nilgiris, s. loc., 1867, R. H. Beddome Acc. no. 37803; Mulaikadu- Ouchterlony Valley, 1490 m, 17.10.1972, J. L. Ellis 43206 (MH). **Tirunelveli**: Tirunelveli, s. loc., 1880, R. H. Beddome Acc. no. 37953 (MH); Naterikal, 20.09.1914, R. A. Beddome Acc.no. 37807 (MH); Tirunelveli hills, s. d., s. c. Acc. no. 37806 (MH); Cane plot, Chinna-Pachaiyar Estate, 1300 m, 09.10.1992, S. R. Srinivasan 99237 (MH); Cane plot, Chinna-Pachaiyar Estate, 1500 m, 10.10.1992, S. R. Srinivasan 99253 (MH).
(b) Analysis

The present study resulted in identifying 46 taxa of Acanthaceae spread over 13 genera that are endemic to Western Ghats but distributed in the Northern and parts of Central Western Ghats (Table 9). Ahmedullah & Nayar (1986) reported 144 species and 11 varieties spread over 42 genera to be endemic to the Peninsular India. Of these, 67 endemic taxa spread over 27 genera were earlier considered to be present in the study area (Sharma et al., 1984; Ahmedullah & Nayar, 1986; Nayar, 1996). However, the number of genera is not in agreement with the earlier studies as the genus Strobilanthes Blume is considered in the broad sense, a view which is supported by Wood (1994, 1995), Carine & Scotland (1998) and Scotland & Vollesen (2000). Genera such as Mackenziea, Nilgirianthus, Phlebophyllum, Pleocaulus, Thelepaepale, Xenacanthus, etc. are all considered as congeneric to genus Strobilanthes and hence the number of endemic genera is less. Further in the present study 21 taxa have been excluded, as they are found to occur beyond the Western Ghats (Table 10).

Of the 46 taxa dealt in the present work, 14 taxa could not be collected. From these, seven taxa, viz. Acanthopale jogensis, Barleria sepalosa, Hygrophila anomala, Hypoestes lanata, Strobilanthes meeboldii, S. minor and S. newii have not been collected after the Type collection. The remaining seven taxa, are represented by only few collections from the study area. They are Strobilanthes anamallaica, S. aurita, S. canarica, S. heteromallus, S. microstachya, S. neilgherrensis and S. tristis (Table 11). Thus their rarity together with the infrequent flowering patterns of Strobilanthes makes it difficult to collect them.

Among the taxa collected, those with few collections are Barleria gibsonioides, B. grandiflora, Dicliptera ghatica, D. nasikensis, Rungia linifolia var.
<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Taxa</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Acanthopale jogensis</em> Gilli</td>
<td>Uttara Kannada</td>
</tr>
<tr>
<td>2</td>
<td><em>Barleria gibsonioides</em> Blatter</td>
<td>Pune, Satara</td>
</tr>
<tr>
<td>3</td>
<td><em>B. grandiflora</em> Dalzell</td>
<td>South Goa, Shimoga, Uttara Kannada, Pune, Raigad</td>
</tr>
<tr>
<td>4</td>
<td><em>B. involucrata</em> Nees var. <em>elata</em> (Dalzell) C. B. Clarke</td>
<td>Chikmagalur, Dakshina Kannada, Hassan, Kodagu, Mysore, Shimoga, Uttara Kannada, Kannur, Palghat, Thrissur, Wyanad, Pune, Satara, Sindhudurg, Thane, Nilgiri, Periyar</td>
</tr>
<tr>
<td>5</td>
<td><em>B. seplosa</em> C. B. Clarke</td>
<td>Konkan region</td>
</tr>
<tr>
<td>6</td>
<td><em>B. terminalis</em> Nees</td>
<td>North Goa, South Goa, Uttara Kannada, Kolhapur, Pune, Raigad, Satara, Sindhudurg</td>
</tr>
<tr>
<td>7</td>
<td><em>Calacanthus grandiflorus</em> (Dalzell) Radlk.</td>
<td>North Goa, South Goa, Dakshina Kannada, Shimoga, Uttara Kannada, Kolhapur, Pune, Raigad, Satara, Sindhudurg, Thane</td>
</tr>
<tr>
<td>8</td>
<td><em>Dicliptera ghatica</em> Santapau</td>
<td>Pune</td>
</tr>
<tr>
<td>9</td>
<td><em>D. nasikensis</em> Lakshmin. &amp; Sharma</td>
<td>Nasik, Kolhapur</td>
</tr>
<tr>
<td>10</td>
<td><em>Eranthemum capense</em> L. var. <em>concanensis</em> (C. B. Clarke) Santapau</td>
<td>Chikmagalur, Dakshina Kannada, Hassan, Mysore, Shimoga, Udupi, Uttara Kannada</td>
</tr>
<tr>
<td>11</td>
<td><em>Gymnostachyum febrifugum</em> Benth.</td>
<td>Dakshina Kannada, Kodagu, Kottayam, Malappuram</td>
</tr>
<tr>
<td>12</td>
<td><em>G. glabrum</em> (Dalzell) T. Anderson</td>
<td>North Goa, South Goa, Uttara Kannada, Kolhapur, Sindhudurg</td>
</tr>
<tr>
<td>13</td>
<td><em>G. latifolium</em> (Dalzell) T. Anderson var. <em>latifolium</em></td>
<td>Chikmagalur, Dakshina Kannada, Hassan, Kodagu, Shimoga, Uttara Kannada, Kolhapur</td>
</tr>
<tr>
<td>14</td>
<td><em>G. latifolium</em> (Dalzell) T. Anderson var. <em>decurrens</em> Gamble</td>
<td>South Goa, Kodagu, Shimoga, Uttara Kannada, Kannur, Wyanad</td>
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<tr>
<td>15</td>
<td><em>G. polyanthum</em> Wight</td>
<td>Shimoaga</td>
</tr>
<tr>
<td>16</td>
<td><em>Haplanthodes plumosus</em> (T. Anderson) Panigrahi et G. C. Das</td>
<td>Bombay, Nasik, Pune, Sindhudurg, Raigad, Thane</td>
</tr>
<tr>
<td>17</td>
<td><em>Hygrophila anomala</em> (Blatter) Almeida</td>
<td>Bombay</td>
</tr>
<tr>
<td>18</td>
<td><em>H. pinnatifida</em> (Dalzell) Sreem.</td>
<td>Goa, Belgaum, Uttara Kannada, Shimoga, Kolhapur, Ratnagiri, Satara, Sindhudurg</td>
</tr>
<tr>
<td>19</td>
<td><em>Hypoestes lanata</em> Santapau</td>
<td>Bombay, Raigad, Ratnagiri</td>
</tr>
<tr>
<td>20</td>
<td><em>Justicia santapaui</em> Bennet</td>
<td>South Goa, Chikmagalur, Dharwar, Shimoga, Uttara Kannada, Palghat, Satara, Coimbatore, Tirunelveli</td>
</tr>
<tr>
<td>21</td>
<td><em>J. wynaadensis</em> Heyne</td>
<td>North Goa, South Goa, Chikmagalur, Hassan, Kodagu, Shimoga, Uttara Kannada, Palghat, Pathanamthitta, Kolhapur, Ratnagiri, Satara, Coimbatore</td>
</tr>
<tr>
<td>22</td>
<td><em>Neuracanthus trinervius</em> Wight</td>
<td>Uttara Kannada, Bombay, Nasik, Pune, Raigad, Thane</td>
</tr>
<tr>
<td>23</td>
<td><em>Rungia linifolia</em> Nees var. <em>linifolia</em></td>
<td>Uttara Kannada</td>
</tr>
<tr>
<td>24</td>
<td><em>R. linifolia</em> Nees var. <em>saldanhae</em> Mascar. et Janarth.</td>
<td>Chikmagalur, Hassan</td>
</tr>
<tr>
<td></td>
<td>Species Name</td>
<td>Locations</td>
</tr>
<tr>
<td>---</td>
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<td>------------------------------------------------</td>
</tr>
<tr>
<td>25</td>
<td><em>Strobilanthes anamallaica</em> J. R. I. Wood</td>
<td>Dakshina Kannada, Kollam, Palghat, Coimbatore, Tirunelveli</td>
</tr>
<tr>
<td>26</td>
<td><em>S. aurita</em> J. R. I. Wood</td>
<td>Chikmagalur, Dakshina Kannada, Hassan, Idukki, Kannur, Palghat, Wyanad</td>
</tr>
<tr>
<td>27</td>
<td><em>S. barbatus</em> Nees</td>
<td>North Goa, Chikmagalur, Hassan, Kodagu, Uttara Kannada, Shimoga, Idukki, Kannur, Kollam, Kottyam, Palghat, Pathanamthitta, Thirunavanthapuram, Tirunelveli</td>
</tr>
<tr>
<td>28</td>
<td><em>S. canarica</em> Bedd.</td>
<td>Dakshina Kannada, Hassan, Idukki</td>
</tr>
<tr>
<td>29</td>
<td><em>S. ciliatus</em> Nees</td>
<td>North Goa, South Goa, Chikmagalur, Dakshina Kannada, Hassan, Kodagu, Shimoga, Uttara Kannada, Udupi, Idukki, Kannur, Kottyam, Kollam, Thrissur, Bombay, Ratnagiri, Sindhudurg, Nilgiri, Tirunelveli</td>
</tr>
<tr>
<td>30</td>
<td><em>S. gamblei</em> Carine et al.</td>
<td>Chikmagalur, Kannur, Idukki, Kottyam, Palghat, Wyanad</td>
</tr>
<tr>
<td>31</td>
<td><em>S. heteromallus</em> T. Anderson ex C. B. Clarke</td>
<td>Uttara Kannada, Coimbatore, Dindigul, Nilgiri</td>
</tr>
<tr>
<td>32</td>
<td><em>S. integrifolius</em> (Dalzell) Kuntze</td>
<td>North Goa, South Goa, Dakshina Kannada, Kodagu, Shimoga, Uttara Kannada, Bombay, Kolhapur, Pune, Ratnagiri, Sindhudurg, Thane</td>
</tr>
<tr>
<td>33</td>
<td><em>S. ixiocephalus</em> Benth.</td>
<td>North Goa, South Goa, Shimoga, Uttara Kannada, Kolhapur, Pune, Ratnagiri, Satara, Sindhudurg, Thane</td>
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<tr>
<td>34</td>
<td><em>S. meeboldii</em> Craib</td>
<td>Mysore</td>
</tr>
<tr>
<td>35</td>
<td><em>S. microstachya</em> Benth. ex Hohen.</td>
<td>Dakshina Kannada, Kannur, Idukki, Kollam, Malappuram, Wyanad, Coimbatore, Kanniyakumari, Nilgiri, Tirunelveli</td>
</tr>
<tr>
<td>36</td>
<td><em>S. minor</em> Talbot</td>
<td>Uttara Kannada</td>
</tr>
<tr>
<td>37</td>
<td><em>S. neilgherrensis</em> Bedd.</td>
<td>Hassan, Kannur, Kozhikode, Palghat, Wyanad, Coimbatore, Nilgiri, Tirunelveli</td>
</tr>
<tr>
<td>38</td>
<td><em>S. neoasper</em> Venu &amp; P. Daniel</td>
<td>Chikmagalur, Dakshina Kannada, Kodagu, Mysore, Kannur, Palghat, Thirunavanthapuram, Coimbatore, Madurai, Nilgiri, Periyar, Tirunelveli</td>
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<tr>
<td>39</td>
<td><em>S. newii</em> Bedd. ex C. B. Clarke</td>
<td>Mysore</td>
</tr>
<tr>
<td>40</td>
<td><em>S. reticulatus</em> Stapf var. <em>reticulatus</em></td>
<td>Ahmednagar, Nasik, Pune, Satara</td>
</tr>
<tr>
<td>41</td>
<td><em>S. reticulatus</em> Stapf var. <em>J. var. nov.</em></td>
<td>Pune</td>
</tr>
<tr>
<td>42</td>
<td><em>S. scrobiculatus</em> Dalzell ex C. B. Clarke</td>
<td>Uttara Kannada, Pune, Satara</td>
</tr>
<tr>
<td>43</td>
<td><em>S. sessilis</em> Nees var. <em>sessilis</em></td>
<td>Dakshina Kannada, Kodagu, Mysore, Nilgiri</td>
</tr>
<tr>
<td>44</td>
<td><em>S. sessilis</em> Nees var. <em>ritchiei</em> C. B. Clarke</td>
<td>Belgaum, Uttara Kannada, Kolhapur, Pune, Sindhudurg</td>
</tr>
<tr>
<td>45</td>
<td><em>S. sessilis</em> Nees var. <em>sessiloides</em> (Wight) C. B. Clarke</td>
<td>Chikmagalur, Idukki, Kannur, Palghat, Wyanad, Nilgiri</td>
</tr>
<tr>
<td>46</td>
<td><em>S. tristis</em> (Wight) T. Anderson</td>
<td>Chikmagalur, Dakshina Kannada, Kannur, Kottyam, Palghat, Pathanamthitta, Coimbatore, Kanniyakumari, Madurai, Nilgiri, Tirunelveli</td>
</tr>
</tbody>
</table>
Table 10: Taxa excluded from the present study area

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Taxa</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Andrographis lineata Wall. ex Nees</td>
<td>Tumkur, Bellary (E. Karnataka)</td>
</tr>
<tr>
<td>2</td>
<td>Asystasia dalzelliana Santapau</td>
<td>Chittoor, Godavari (Andhra Pradesh); Shiruvani (Tami Nadu); Bellary (E. Karnataka)</td>
</tr>
<tr>
<td>3</td>
<td>Barleria lawii T. Anderson</td>
<td>Vishakapatnam (Andhra Pradesh)</td>
</tr>
<tr>
<td>4</td>
<td>B. prattensis Santapau</td>
<td>Saurashtra (Gujarat); Kurnool, Chittoor, Mahaboobnagar (Andhra Pradesh); Banswara, Bundi (Rajashtan)</td>
</tr>
<tr>
<td>5</td>
<td>Cynarospermum asperrima (Nees) Vollesen</td>
<td>Saurashtra (Gujarat)</td>
</tr>
<tr>
<td>6</td>
<td>Dyschoriste dalzelliana O. Kuntze</td>
<td>Akola (E. Maharashtra)</td>
</tr>
<tr>
<td>7</td>
<td>Eranthemum roseum (Vahl) R. Br.</td>
<td>Aurangabad, Buldhana, Akola (E. Maharashtra); Banswara, Kota, Sirohi (Rajashtan); Gulbarga (E. Karnataka)</td>
</tr>
<tr>
<td>8</td>
<td>Gantelbua urens (Heyne ex Roth) Bremek.</td>
<td>Aurangabad, Nanded, Buldhana, (E. Maharashtra); Guntur, Kurnool (Andhra Pradesh); Bharatpur, Kota (Rajashtan)</td>
</tr>
<tr>
<td>9</td>
<td>Gymnostachyum canescens T. Anderson</td>
<td>Godavari (Andhra Pradesh)</td>
</tr>
<tr>
<td>10</td>
<td>Haplanthodes neilgherrensis (Wight) Majumdar</td>
<td>Nanded, Osmanabad, Prabhani (E. Maharashtra); Jodhpur (Rajashtan)</td>
</tr>
<tr>
<td>11</td>
<td>Hemigraphis latebrosa (Heyne ex Roth) var. latebrosa</td>
<td>Aurangabad, Nanded, Buldhana (E. Maharashtra); Guntur, Kurnool (Andhra Pradesh); Banswara, Bundi (Rajashtan)</td>
</tr>
<tr>
<td>12</td>
<td>Indoneesiella longipedunculata (Sreemadh.) Sreemadh.</td>
<td>Nalgonda, Vishakapatnam (Andhra Pradesh)</td>
</tr>
<tr>
<td>13</td>
<td>Justicia neesii Ramam.</td>
<td>Raichur, Tumkur; Chitradurg (E. Karnataka)</td>
</tr>
<tr>
<td>14</td>
<td>J. neilgherrensis (Nees) Wall. ex T. Anderson</td>
<td>Bangalore (E. Karnataka)</td>
</tr>
<tr>
<td>15</td>
<td>J. trinervia Vahl.</td>
<td>Chittoor (Andhra Pradesh); Jalna, Aurangabad, Prabhani, Buldhana (E. Maharashtra); Jaipur (Rajashtan)</td>
</tr>
<tr>
<td>16</td>
<td>Lepidagathis bandraensis Blatter</td>
<td>Nanded (E. Maharashtra); Jodhpur (Rajashtan)</td>
</tr>
<tr>
<td>17</td>
<td>L. subramata (C. B. Clarke) Gamble</td>
<td>Gulbarga (E. Karnataka); Karnool (Andhra Pradesh)</td>
</tr>
<tr>
<td>18</td>
<td>Neuracanthus sphaerostachyus (Nees) Dalzell</td>
<td>Banswara, Durgapur (Rajashtan)</td>
</tr>
<tr>
<td>19</td>
<td>Strobilanthes callosus Nees</td>
<td>Bharuch, Dangs (Gujrat); Mt. Abu (Rajashtan)</td>
</tr>
<tr>
<td>20</td>
<td>S. heyneanus Nees</td>
<td>Godavari (Andhra Pradesh)</td>
</tr>
<tr>
<td>21</td>
<td>S. membranaceus Talbot</td>
<td>Hoshangabad (Madhya Pradesh); Korapur (Orissa)</td>
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</tbody>
</table>
Table 11: Taxa showing few collections in Herbaria which could not be collected during the present study

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Taxa</th>
<th>Total no. of collections</th>
<th>Central Western Ghats</th>
<th>South Western Ghats</th>
<th>Latest collection found in herbaria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Strobilanthes anamallaica</em></td>
<td>9</td>
<td>(1) Dakshina Kannada (Beddome’s 39555, 1880)</td>
<td>(8) Kerala, Tamil Nadu</td>
<td>Coimbatore, 1983 coll. no. 18099 (MH)</td>
</tr>
<tr>
<td>2</td>
<td><em>S. aurita</em></td>
<td>14</td>
<td>(5) Chikmagalur, Dakshina Kannada, Hassan</td>
<td>(9) Kerala</td>
<td>Kannur, 1995 coll. no. 10131 (FRLH)</td>
</tr>
<tr>
<td>3</td>
<td><em>S. canaricus</em></td>
<td>3</td>
<td>(2) Dakshina Kannada, Hassan</td>
<td>(1) Kerala</td>
<td>Idukki, 1994 coll. no. 17570 (FRLH)</td>
</tr>
<tr>
<td>4</td>
<td><em>S. heteromallus</em></td>
<td>15</td>
<td>(1) Uttara Kannada (not seen)</td>
<td>(15) Tamil Nadu</td>
<td>(3) Nilgiris, 1972 coll. no. 39610, 39749, 40359 (MH)</td>
</tr>
<tr>
<td>5</td>
<td><em>S. microstachya</em></td>
<td>14</td>
<td>(1) Dakshina Kannada</td>
<td>(13) Kerala, Tamil Nadu</td>
<td>Wyanad, 1994, coll. no. 1007, (FRLH)</td>
</tr>
<tr>
<td>6</td>
<td><em>S. neilgherrensis</em></td>
<td>21</td>
<td>(7) Hassan</td>
<td>(14) Kerala, Tamil Nadu</td>
<td>Wyanad, 2002 coll. no. 13355 (FRLH)</td>
</tr>
<tr>
<td>7</td>
<td><em>S. tristis</em></td>
<td>24</td>
<td>(3) Chikmagalur, Dakshina Kannada</td>
<td>(21) Kerala, Tamil Nadu</td>
<td>Pathanamthitta, 1992, coll. no. 98728 (MH); Tirunelveli, 1992 coll. no. 99237, 99253 (MH)</td>
</tr>
<tr>
<td>Sr No</td>
<td>Taxa</td>
<td>No. of collections</td>
<td>Latest collection in herbarium</td>
<td>Present collection</td>
<td></td>
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<td>--------------------------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td><em>Barleria gibsonioides</em></td>
<td>4 (Pune, Satara)</td>
<td>Pune, 1959, 1354 (BLAT)</td>
<td>Pune, October 2006</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><em>Rungia linifolia var. linifolia</em></td>
<td>7 (Uttara Kannada)</td>
<td>Uttara Kannada, 1979, KFP6048 (JCB)</td>
<td>Uttara Kannada, April 2007</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><em>R. linifolia var. saldanhae</em></td>
<td>4 (Chikmagalur), 3 (Hassan)</td>
<td>Hassan, 1971, HFP1369 (JCB)</td>
<td>Chikmagalur, February 2006</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><em>S. reticulatus var. J. var. nov.</em></td>
<td>2 (Pune)</td>
<td>Pune, 1964, 101191 (BSI, CAL)</td>
<td>Pune, October 2006</td>
<td></td>
</tr>
</tbody>
</table>
Graph 1: Genera vs number of endemic taxa

Graph 2: Threat status of endemic taxa
linifolia, R. linifolia var. saldanhae, Strobilanthes gamblei, S. neoasper, S. reticulatus var. 1. var. nov. and S. sessilis var. sessilis are known only from few collections (Table 12).

The genus Strobilanthes Blume with 22 taxa has maximum number of endemic species in the study area (Table 9). Even at global level Strobilanthes is the second largest genus in the family Acanthaceae and is distributed in tropical and subtropical regions of Asia (Wood, 1994). Venu (2006) reported 47 species and three varieties of Strobilanthes as endemic to Peninsular India of which 19 species and three varieties are present in the study area. Barleria L. and Gymnostachyum Nees come second with five endemic taxa each. Genera represented by two endemic species each are: Dicliptera Juss., Hygrophila R. Br. and Justicia L. Seven genera are with one endemic species each (Table 9; Graph 1).

Phytogeographical distribution

Nayar (1980) dealt with the phytogeography of Peninsular India in relation to distribution and characteristics of endemic species. He reported that Peninsular India has an endemic concentration of 32%, while the rest of India has about 27% endemics. In the present study, of the 46 taxa reported, 28 taxa, belonging to 12 genera are strictly endemic to Northern and Central Western Ghats. While Northern Western Ghats has nine taxa, Central Western Ghats have eight taxa that are strictly endemic. Northern and Central Western Ghats together have 11 taxa, belonging to six genera that are strictly endemic. Twelve taxa spread over two genera are endemic to the Central and Southern Western Ghats, and six taxa belonging to four genera are present throughout the entire Western Ghats (Table 13).

Within the present study area, the Central Western Ghats has the highest number of endemic taxa with 31 species and 7 varieties, spread over 10 genera (Table
Table 13: Distribution endemic taxa in different regions of Western Ghats

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name</th>
<th>NWG</th>
<th>CWG</th>
<th>SWG</th>
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<td>1</td>
<td>Acanthopale jogensis</td>
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<tr>
<td>2</td>
<td>Barleria gibsonoides</td>
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<td></td>
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<tr>
<td>3</td>
<td>B. grandiflora</td>
<td>√</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>B. involucrata var. elata</td>
<td>√</td>
<td>√</td>
<td>√</td>
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<tr>
<td>5</td>
<td>B. seplosa</td>
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<td>6</td>
<td>B. terminalis</td>
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<td>7</td>
<td>Calacanthus grandiflorus</td>
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<td>√</td>
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<td>8</td>
<td>Dicliptera ghatica</td>
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<td></td>
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<tr>
<td>9</td>
<td>D. nasikensis</td>
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<td>10</td>
<td>Eranthemum capense var. concanensis</td>
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<tr>
<td>11</td>
<td>Gymnostachyum febrifugum</td>
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<td>√</td>
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<td>12</td>
<td>G. glabrum</td>
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</tr>
<tr>
<td>13</td>
<td>G. latifolium var. latifolium</td>
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<td>14</td>
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<td>√</td>
<td>√</td>
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<td>G. polyanthum</td>
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<td>Haplanthodes plumosus</td>
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<td>Hygrophila anomala</td>
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<td>18</td>
<td>H. pinnatifida</td>
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<td>Hypoestes lanata</td>
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<td>Justicia santapauai</td>
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<td>21</td>
<td>J. wynaadensis</td>
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<td>22</td>
<td>Neuracanthus trinervius</td>
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<td>23</td>
<td>Rungia linifolia var. linifolia</td>
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<td>24</td>
<td>R. linifolia var. saldanhae</td>
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<td>25</td>
<td>Strobilanthes anamallaica</td>
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<tr>
<td>26</td>
<td>S. aurita</td>
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<td>27</td>
<td>S. barbatus</td>
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<tr>
<td>28</td>
<td>S. canarica</td>
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<td>29</td>
<td>S. ciliatus</td>
<td></td>
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<tr>
<td>30</td>
<td>S. gamblei</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>31</td>
<td>S. heteromallus</td>
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<td></td>
</tr>
<tr>
<td>32</td>
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<td>S. minor</td>
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<td>S. neoasper</td>
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<td>S. newii</td>
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<td>S. reticulatus var. reticulatus</td>
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<tr>
<td>41</td>
<td>S. reticulatus var. J. var. nov.</td>
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<td>S. scrobiculatus</td>
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<td>43</td>
<td>S. sessilis var. sessilis</td>
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<td>44</td>
<td>S. sessilis var. ritchiei</td>
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</tr>
<tr>
<td>45</td>
<td>S. sessilis var. sessiloides</td>
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<tr>
<td>46</td>
<td>S. tristis</td>
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</table>

NWG: Northern Western Ghats; CWG: Central Western Ghats; SWG: Southern Western Ghats
13. The Northern Western Ghats has a total number of 26 endemic taxa with 24 species and two varieties, spread over 10 genera (Table 13).

Uttara Kannada (Karnataka) in the Central Western Ghats has the highest number of endemic taxa. They are: Acanthopale jogensis, Barleria grandiflora, B. involucrata var. elata, B. terminalis, Calanthisus grandiflorus, Eranthemun capense var. concanensis, Gymnostachyum glabrum, G. latifolium var. latifolium, G. latifolium var. decurrens, Hygrophila pinntifida, Justicia santapaui, J. wynaadensis, Neuracanthus trinervius, Rungia linifolia var. linifolia, Strobilanthes barbatus, S. ciliatus, S. integrifolius and S. ixiocephalus.

In the Northern Western Ghats, Pune (Maharashtra) has the highest number of endemic taxa comprising of 13 species and one variety spread over six genera. They are: Barleria gibsonioides, B. grandiflora, B. involucrata var. elata, B. terminalis, Calanthisus grandiflorus, Dicliptera ghatica, Haplanthodes plumosus, Neuracanthus trinervius, Strobilanthes scrobiculatus, S. integrifolius, S. ixiocephalus, S. reticulatus var. reticulatus, S. reticulatus var. 1 var. nov. and S. sessilis var. ritchiei.

Eight taxa have been reported as endemic to Goa (Northern Western Ghats) by Rao (1985) and Joshi (2000). However, three more taxa have been added to the list during the present study. The 11 endemic taxa found in Goa are: Barleria grandiflora, B. terminalis, Calanthisus grandiflorus, Gymnostachyum glabrum, G. latifolium var. decurrens, Hygrophila pinntifida, Justicia wynaadensis, Strobilanthes barbatus, S. ciliatus, S. integrifolius and S. ixiocephalus.

Taxa restricted to only one district are Acanthopale jogensis (Uttara Kannada); Barleria sepalosa "Konkan", Dicliptera ghatica (Pune), Gymnostachyum polyanthum (Shimoga), Hygrophila anomala (Bombay), Strobilanthes meeboldii (Mysore), S.
minor (Uttara Kannada), S. newii (Mysore), S. reticulatus var. I var. nov. (Pune) and Rungia linifolia var. linifolia (Uttara Kannada).

Taxa restricted to two districts are Barleria gibsonioides (Pune, Satara); Dicliptera nasikensis (Kolhapur, Nasik) and Rungia linifolia var. saldanhae (Chikmagalur, Hassan). Taxa distributed in one or two adjacent districts are treated in this work as narrow endemics.

The results from the present study are in accordance with Singh & Raghavan (1986). They reported Acanthopale jogensis, Gymnostachyum polyanthum, Strobilathes warreensis, S. canaricus, Rungia linifolia as endemic to Karnataka (Central Western Ghats). Whereas Barleria gibsonioides, B. sepalosa, Dicliptera ghatica, Hygrophila anomala, Hypoestes lanata and Strobilanthes reticulatus are reported to be endemic to Maharashtra (Northern Western Ghats).

Strobilanthes species are found growing mostly at high altitudes. Wherever they occur, they are mostly seen growing gregariously in pure strands and each one occupying a niche along the altitude, mostly as open formations on hill slopes and sometimes as undergrowths.

**Threat status**

According to IUCN’s Threatened Plants Committee about 10% (20,000 - 25,000) of the World’s flowering plants are dangerously rare or under threat (Nayar & Sastry, 1987). Hence working out their threat status helps in understanding conservation measures.

The threat status for the endemic species has been worked out according to IUCN 2001 Categories & Criteria (Version 3.1). The present study on the endemic species revealed that of the 46 taxa, seven taxa are assigned the status of Critically
Endangered (CR), 10 taxa each are Endangered (EN) and Vulnerable (VU), 16 as Near Threatened (NT) and three as Least Concern (LC) (Table 14; Graph 2).

Most of the endemic taxa (31 taxa) were not assigned any threat status by earlier workers (Ahmedullah & Nayar, 1986; Nayar & Sastry, 1988; 1990; Nayar, 1996; Mishra & Singh, 2001). Among the earlier assessed taxa the threat status remains the same for two taxa (*Haplanthodes plumosus* and *Strobilanthes meeboldii*), while the remaining 13 taxa showed either an improved or deteriorating threat status (Table 15).

One third species of *Strobilanthes* (seven taxa) are presumed to be CR (3 taxa) or EN (4 taxa) and are highly restricted endemics. *Strobilanthes* plants are found mainly at high altitude in the wet zone and flowers after very long intervals being plicatesial species (Santapau, 1952; Janzen, 1976; Wood, 1994). The possible reasons for rarity of taxa studied could be loss of natural habitat due to natural calamities or anthropogenic interference (eg. shifting cultivation, uncontrolled grazing, etc.).

**Taxonomy**

In the present study, 46 taxa were circumscribed using standard revisionary methods and their nomenclature was updated in accordance with ICBN. Critical evaluation of the taxa and comparison with the types led to the discovery of two new varieties, reinstatement of one species, merging of two species and typification of some of the taxa.

During the present study a new variety *Rungia linifolia* var. *saldanhae* was erected. They were not segregated by earlier collectors as distinct entity, using morphological characters and SEM of seeds, a new variety has been raised (Plate 17). Similarly, *Strobilanthes reticulatus* var. *j var. nov.*, differing from the typical variety
Table 14: Endemic taxa and their threat status

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name</th>
<th>CR</th>
<th>EN</th>
<th>VU</th>
<th>NT</th>
<th>LC</th>
<th>Criteria</th>
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<td>CR B2ab(iii)</td>
</tr>
<tr>
<td>2</td>
<td>Barleria gibsonioides</td>
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<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>EN B2ab(iii)</td>
</tr>
<tr>
<td>3</td>
<td>B. grandiflora</td>
<td></td>
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<td>✓</td>
<td></td>
<td></td>
<td>VU B2ab (iii, iv)</td>
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<tr>
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<td></td>
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<tr>
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<td>B. seplosa</td>
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<td></td>
<td>CR B2ab (iii, iv)</td>
</tr>
<tr>
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<td></td>
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<tr>
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<td></td>
<td></td>
<td>NT</td>
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<tr>
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<td>Dicliptera ghattica</td>
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<td></td>
<td></td>
<td></td>
<td>EN B2ab(iii)</td>
</tr>
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<td>D. nasikensis</td>
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<td></td>
<td></td>
<td>EN B2ab(iii)</td>
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<td>Eranthemum capense var. concanensis</td>
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<tr>
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<td>Gymnostachyum febrifugum</td>
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<td></td>
<td></td>
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<tr>
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<td>G. glabrum</td>
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</tr>
<tr>
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</tr>
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<td></td>
<td></td>
<td>EN B2ab(iii, iv)</td>
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<td></td>
<td></td>
<td>EN B2ab(iii, iv)</td>
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<tr>
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<tr>
<td>26</td>
<td>S. aurita</td>
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</tr>
<tr>
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<td></td>
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<td>✓</td>
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</tr>
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<td>S. reticulatus var. reticulatus</td>
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<td></td>
<td></td>
<td>✓</td>
<td>VU B2ab(iii)</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>✓</td>
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<tr>
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<td>S. scrobiculatus</td>
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<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>VU B2ab(iii)</td>
</tr>
<tr>
<td>43</td>
<td>S. sessilis var. sessilis</td>
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<td></td>
<td></td>
<td>✓</td>
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</tr>
<tr>
<td>44</td>
<td>S. sessilis var. richiei</td>
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<td></td>
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</tr>
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<td>S. tristis</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
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<td>NT</td>
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</table>
Table 15: Taxa showing change in the threat status with respect to status in literature

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Genera</th>
<th>Status in literature</th>
<th>Status in Present Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Barleria gibsonioides</em></td>
<td>Rare (Nayar &amp; Sastry, 1988); possibly extinct (Mishra &amp; Singh, 2001)</td>
<td>EN</td>
</tr>
<tr>
<td>2</td>
<td><em>B. grandiflora</em></td>
<td>Critical (Mishra &amp; Singh, 2001)</td>
<td>VU</td>
</tr>
<tr>
<td>3</td>
<td><em>Dicliptera ghatica</em></td>
<td>Rare (Nayar, 1996); Indeterminate (Nayar &amp; Sastry, 1988); Critical (Mishra &amp; Singh, 2001)</td>
<td>EN</td>
</tr>
<tr>
<td>4</td>
<td><em>D. nasikensis</em></td>
<td>Insufficiently known (Nayar, 1996); Critical (Mishra &amp; Singh, 2001)</td>
<td>EN</td>
</tr>
<tr>
<td>5</td>
<td><em>Gymnostachyum polyanthum</em></td>
<td>Rare (Nayar, 1996)</td>
<td>EN</td>
</tr>
<tr>
<td>6</td>
<td><em>Haplanthodes plumosus</em></td>
<td>Vulnerable (Nayar, 1996)</td>
<td>VU</td>
</tr>
<tr>
<td>7</td>
<td><em>Hygrophila anomalata</em></td>
<td>Insufficiently known (Nayar, 1996)</td>
<td>CR</td>
</tr>
<tr>
<td>8</td>
<td><em>H. pinnatifida</em></td>
<td>Rare &amp; Threatened (Ahmedullah &amp; Nayar, 1986)</td>
<td>NT</td>
</tr>
<tr>
<td>9</td>
<td><em>Hypoestes lanata</em></td>
<td>Rare (Nayar &amp; Sastry, 1990); Possibly extinct (Mishra &amp; Singh, 2001)</td>
<td>CR</td>
</tr>
<tr>
<td>10</td>
<td><em>Rungia linifolia var. linifolia</em></td>
<td>Rare &amp; Threatened (Ahmedullah &amp; Nayar, 1986); Critical (Mishra &amp; Singh, 2001)</td>
<td>EN</td>
</tr>
<tr>
<td>11</td>
<td><em>Strobilanthes aurita</em></td>
<td>Rare (Nayar &amp; Sastry, 1988)</td>
<td>EN</td>
</tr>
<tr>
<td>12</td>
<td><em>S. canaricus</em></td>
<td>Rare &amp; Threatened (Ahmedullah &amp; Nayar, 1986); Endangered (Nayar, 1986)</td>
<td>EN</td>
</tr>
<tr>
<td>13</td>
<td><em>S. newii</em></td>
<td>Rare (Nayar, 1986)</td>
<td>CR</td>
</tr>
<tr>
<td>14</td>
<td><em>S. scrobiculatus</em></td>
<td>Critical (Nayar, 1996)</td>
<td>VU</td>
</tr>
<tr>
<td>15</td>
<td><em>S. meeboldii</em></td>
<td>Critical (Nayar, 1996)</td>
<td>CR</td>
</tr>
</tbody>
</table>
Plate 17: *Rungia linifolia* Nees var. *linifolia* – a, b. SEM, seed and enlarged view; *R. linifolia* Nees var. *saldanhae* Mascar. *et* Janarth. – c, d. SEM, seed and enlarged view.
in having almost sessile, ovate leaves and bracts that are pubescent on the outside has been erected (Plate 18).

*Dicliptera ghatica* which was considered as rare (Nayar, 1996), indeterminate (Nayar & Sastry, 1988) and critically endangered (Mishra & Singh, 2001) was collected after five decades. This species was reduced to a variety, *D. foetida* Forssk. var. *ghatica* by Almeida (2003). Critical study of *D. foetida* and *D. foetida* var. *ghatica* showed distinct morphological characters as shown in Table 4. SEM analysis of the seeds of the above two taxa showed dense reticulations in *D. foetida* as compared to those in *D. ghatica* on the surface of testa. Wax rods were also found in *D. foetida* whereas they were absent in *D. ghatica* (Plate 19). Since the two taxa show such gross differences they can be treated as two separate species. Therefore var. *ghatica* is reinstated back to the species rank as *Dicliptera ghatica*.

*Strobilanthes warreensis* is merged with *S. ciliatus*. Fresh collections, herbarium sheets as well photographs of *types* from Kew, reveal that both are one and the same. When the plant is in the initial flowering stage the inflorescences are small and peduncles as well as bracts are glabrous. Later, in the fruiting stage, the pedicels develop white cottony hairs, the bracts get covered with glandular hairs and spikes get elongated. The flower characters are the same for both, a campanulate corolla, four exerted stamens, anther lobes purple. Hence the two have been merged (Plate 20) and *S. ciliatus* being the earlier validly published name is retained.

Study of the *type* photographs of *Barleria sepalosa* from Kew shows that the species is similar to *B. lawii*, but without a fresh specimen or a herbarium specimen of the former in any of the herbaria consulted during the study, it is difficult to say if the two are conspecific. *B. lawii* however has been left out from the study since it is found to be occurring beyond the study area.
Plate 18: *Strobilanthes reticulatus* Stapf var. *reticulatus* – a. photograph, K; b. collection, present study (coll. no. 77); *S. reticulatus* Stapf var. 1. **var. nov.** – c. collection, present study (coll. no. 278)
Plate 19: *Dicliptera ghatica* Santapau – SEM, seed enlarged view – a. x370; c. x1,500; *D. foetida* Forssk. – SEM, seed enlarged view – b. x200; d. 2,500
Plate 20: Strobilanthes ciliatus Nees – a. type; b. young spike; c. old spike; S. warreensis Dalzell – d. type
Carine et al. (2004) considered *Strobilanthes gamblei* and *S. lawsonii* Gamble as two different species because *S. gamblei* had partly fused adaxial corolla lobes, stamens exerted and ovary hairy at apex whereas in *S. lawsonii* corolla lobes were equally divided, stamens included and ovary glabrous at apex. However, Venu (2006) considered *S. gamblei* as a synonym of *S. lawsonii* as it had similar leaf and inflorescence characters except for the differences in corolla lobes and ovary apex. During the present study *S. gamblei* was collected in flowering and on critical analysis the characters were found to be in accordance with Carine et al. (2004). Hence *S. gamblei* is accepted in the present study as a distinct taxon (Plate 21).

During the present study, some collections earlier identified as *G. latifolium* were identified as *G. latifolium* var. *decurrens* and therefore, shows an extended distribution from the Southern Western Ghats (Kerala) to the Northern Western Ghats (Goa).

Lectotypes and neotypes are selected during the present study. Lectotypes were selected for *Gymnostachyum latifolium* var. *decurrens* at MH from the three syntypes, two at MH and one at K; from the two types of *Haplanthodes plumosus* at CAL, a lectotype was selected; from the two type collections of *Adenosma pinnatifidum* a lectotype was selected at CAL; a lectotype was also selected for *Hemichoriste montana* from the four types at CAL; for *Rungia linifolia* var. *linifolia*, a lectotype was selected from among the two types at CAL; a lectotype was selected for *Strobilanthes anamallaica* at CAL; a lectotype is selected for *S. ciliatus* at K; a lectotype was selected for *S. newii* from the two types at MH; for *S. reticulatus* var. *reticulatus*, a lectotype is selected at BLAT; a neotype was selected from the single collection (Shah 6761) of *Hygrophila anomala* which was placed among the general
Plate 21: Strobilanthes gamblei Carine et al. – a. type; b. habit
collections at BLAT; a holotype at CAL and isotype at BSI and GUH is selected for
*Rungia linifolia* var. *saldanhae* and for *Strobilanthes reticulatus* var. *I* var. *nov.*

**Anatomy**

The stem anatomy of six taxa viz. *Carvia callosa* Bremek., *Mackenziea integrifolia* Nees, *Nilgirianthus ciliatus* (Nees) Bremek., *N. heyneanus* (Nees) Bremek., *Pleocaulus Ritchiei* Bremek. and *Thelepaepale ixiocephala* Benth., was studied in detail to confirm whether the spilt genera of *Strobilanthes* Blume stand. Analysis of the T. S. and T. L. S. of the matured wood samples of the above taxa revealed that they shared several common features such as ring porous wood, broad vessels with bordered pits, annual or spiral thickening. Generally fibre tracheids and libriform fibres are present. Xylem fibres are broad regions with simple pits on their radial walls as well as on their tangential walls separating the vessels. Rays are paratrachael and apotrachael, heterogenous with square and upright cells, simple pitted, thick walled and septate.

However, a few anatomical differences were observed among these genera such as the width of the rays, the presence and absence of tyloses and oil globules in the vessels and parenchyma cells (Table 16). All these differences are not significant enough to keep them as separate genera (Plate 22). Hence they are considered as congeneric and all are treated under *Strobilanthes* Blume following Carine *et al.* (2004).

**Pollen morphology**

In the present study pollen grains were described according to Chaubal (1996); Carine & Scotland (1998) and Scotland & Vollesen (2000).

Family Acanthaceae is eurypalynous (Raj, 1961). The morphology of pollen grains is conserved across the sub-tribes: Ruelliinae, Andrographideae, Justiciinae and
<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Character</th>
<th>Carvia callosa</th>
<th>Mackenziea integrifolia</th>
<th>Nilgirianthus ciliatus</th>
<th>N. heyneanus</th>
<th>Thelepaepale ixiocephalus</th>
<th>Pleocaulus ritchiei</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Growth rings</td>
<td>very prominent</td>
<td>prominent</td>
<td>prominent</td>
<td>prominent</td>
<td>not well defined</td>
<td>not well defined</td>
</tr>
<tr>
<td>2</td>
<td>Vessels arrangement</td>
<td>radial rows but not very orderly</td>
<td>radial rows</td>
<td>radial rows</td>
<td>radial rows</td>
<td>broad regions of xylem with no vessels</td>
<td>radial rows but not very orderly</td>
</tr>
<tr>
<td>3</td>
<td>Vessels grouping</td>
<td>one to two</td>
<td>one to three</td>
<td>one to three</td>
<td>one to three</td>
<td>one to six</td>
<td>mostly solitary</td>
</tr>
<tr>
<td>4</td>
<td>Vessel perforations</td>
<td>bordered pits</td>
<td>bordered xylem with no vessels</td>
<td>bordered pits</td>
<td>bordered pits</td>
<td>bordered pits</td>
<td>bordered pits</td>
</tr>
<tr>
<td>5</td>
<td>Tyloses</td>
<td>very prominent</td>
<td>very prominent</td>
<td>prominent</td>
<td>not seen</td>
<td>not seen</td>
<td>not prominent</td>
</tr>
<tr>
<td>6</td>
<td>Rays</td>
<td>uniseriate to biseriate</td>
<td>uniseriate to tetraseriate with crystals</td>
<td>uniseriate to triseriate</td>
<td>uniseriate to triseriate</td>
<td>uniseriate to triseriate</td>
<td>uniseriate to biseriate, raphides present</td>
</tr>
<tr>
<td>7</td>
<td>Fibre tracheids</td>
<td>very dense, crystals present</td>
<td>less dense</td>
<td>less dense</td>
<td>less dense</td>
<td>less dense</td>
<td>densely arranged</td>
</tr>
</tbody>
</table>

Table 16: Differences among the split genera of *Strobilanthes* Blume
Barleriinae. In the present study, the pollen is described based on their shape, number and type of apertures and characteristic of exine and placed into four groups as follows:

1. Spheroidal

Sub tribe Ruellinae:

i. Tectum echinate [Acanthopale jogensis; Strobilanthes ixiocephalus (Plate 12h); S. meeboldii; S. minor]

ii. Tectum open reticulate [Eranthemum capense var. concanensis (Plate 2j, k); Hygrophila anomala; H. pinnatifida]

Sub tribe Barleriinae:

i. Tectum open reticulate [Barleria gibsonioides (Plate 1d, e); B. grandiflora (Plate 1g, h); B. involucrata var. elata (Plate 2c); B. sepalosa, B. terminalis (Plate 2f)]

2. Prolate to sub-prolate

Sub tribe Ruellinae: Tectum perforate

i. Longitudinal ribs, converging together in circumpolar region [Calacanthus grandiflorus (Plate 2i, j)]

ii. Longitudinal ribs, twisted giving it spiral appearance [Strobilanthes neoasper; S. barbatus (Plate 10e); S. canarica; S. gamblei; S. neilgherrensis]

iii. Longitudinal ribs, unequal in length (Strobilanthes tristis)

iv. Longitudinal ribs, with coarse ladder like reticulum [Strobilanthes aurita; S. integrifolius (Plate 12c); S. reticulatus (Plate 14c, f); S. scrobiculatus (Plate 15c)]

v. Longitudinal ribs, undulate [S. ciliatus (Plate 11d)]

vi. Longitudinal ribs, with aggregates (raised portion) of exine along the middle (Strobilanthes anamallaica; S. heteromallus)
Sub tribe Justiciinae: tectum divided into nine longitudinal ribs, of which six are narrow and three are broad.

i. Narrow ridges not broken into insulae [Dicliptera ghatica (Plate 3c, d); D. nasikensis (Plate 3f, g); Justicia santapaui (Plate 7f)]

ii. Narrow ridges broken into insulae [Justicia wynaadensis (Plate 8c, d); Rungia linifolia (Plate 9c, g)]

3. Prolate to sub-oblate

Sub tribe Andrographidae: apeturate margin, thick and distinct

i. Prolate [Gymnostachyum febrifugum; G. glabrum (Plate 4e, f); G. latifolium (Plate 5c, h); G. polyanthum (Plate 6c, d)]

ii. Sub-oblate [Haplanthodes plumosus (Plate 6g, h)]

4. Prolate spheroidal, exine uniform, depressed; margins thick, granular [Neuracanthes trinervius (Plate 8g, h)].

The pollen study made during the current work shows that, the pollen morphology is conserved across the sub-tribes: Ruelliinae, Andrograpgideae, Justiciinae and Barleriinae and it supports the existing classification proposed by earlier workers such as Scotland and Vollesen (2000). Pollen morphology for many of the endemic Acanthaceae, viz. Barleria gibsonioides, B. grandiflora, B. involucrata var. elata, B. terminalis, Eranthemum capense var. concanensis, Dicliptera ghatica; D. nasikensis, Gymnostachyum latifolium var. decurrens; G. polyanthum; Justicia santapaui, Neuracanthes trinervius, Rungia linifolia var. saldanhae, Strobilanthes gamblei, S. reticulatus var. 1. var. nov. was not known earlier and was done during the present study for the first time. As shown in the groupings given above pollen morphology can be used as an additional character in identification of the species.

Phylogeny
The phylogeny of Acanthaceae (Fig. 36) based on 56 taxa including several wides with *Thunbergia* (without retinacula) placed as an outgroup (i) showed that all the plants with retinacula are grouped together (ii). Similar results were presented by Scotland *et al.*, (1995) (group 1), who placed *Elytraria* and *Thunbergia* as successive sister taxa to Acanthoideae sensu Lindau (1895) (group 2 & 3) (Fig. 37) and genera with retinaculate fruits were shown to be monophyletic (group 4). In the present study *Neuracanthus trinervius* does not resolve very well from *Thunbergia* though comes as a basal group (iii). The tribe Ruellieae (iv) is split into two clades (vii, viii) with *Strobilanthes ixiocephalus* (v) and *S. minor* (vi) which are similar in their pollen structure come as successive basal sister groups.

The largest subclade (viii) consists 30 taxa of the 56 sampled taxa. Of these 30 taxa, 25 are of sub-tribe Ruelliinae and five taxa of sub-tribe Barlerinae (ix). *Eranthemum capense* var. *concanensis* (x) is nested in *Strobilanthes* clade. Scotland *et al.*, (1995) made a similar observation wherein *Eranthemum* forms a sister to the clade containing *Ruellia* and *Strobilanthes*. Thus the sister relationships between these split genera of *Strobilanthes* and *Eranthemum* is well supported (group 9: Fig. 37). Both *Strobilanthes* and *Eranthemum* share left contorted aestivation. However, the nesting of *Barleria* within *Strobilanthes* cannot be justified. Even Scotland *et al.*, (1995), have placed it (group 7: Fig. 37) outside the clade of *Strobilanthes* (group 9: Fig. 37) and far from it. It shows that morphological characters in isolation may not reflect the true relationship. Within the genus *Strobilanthes*, it is observed that the different species show grouping according to the split genera of Bremekamp (1944). The species with bands on the ridges of the pollen are forming a sister clade (xi). Another character that clade (xi) share is the absence of bracteoles. The *Nilgirianthus*
Nicotiana tabacum
Antirrhinum majus
Digitalis grandiflora
Buddleja davidii
Sesamum indicum
Elytraria crenata
Thunbergia alata
Cassandrea nilotica
Barleria prionitis
Crbbaea reticulata
Hypoestes toeniata
Justicia americana
Eranthemum pulchellum
Ruellia ciliosa
Sanchezia speciosa
Hemigraphis colorata
Strobilonthes dyerianus
Eremomostax polystepna
Brillantasia lamium
Hygrophila corymbosa
Myoporum mauritanium
Nicodemia divesifolia
Rezzia capensis
Nemetonthus hirsutus

Fig. 37: Molecular studies of Acanthaceae – strict consensus tree of ndhF (Figure adapted from Scotland et al., 1995)
with porate ridges of pollen form a sister clade (xiv). Similarly the split genera
*Phlebophyllum* (xiii), *Pleocaulus* (xv) and *Mackenziea* (xii) form sister clades.

*Strobilanthes barbatus* and *Acanthopale jogensis* are seen forming a distinct
clade (xvi). Although it is said that *A. jogensis* is similar to *S. ixiocephalus* (v), yet it
is seen as a sister to *S. barbatus* and both have glabrous seeds. However, this has to be
taken with caution as the details of *A. jogensis* were obtained only from protologue as
there is no other description or specimen (including type) available.

The second clade (vii) includes the taxa from all the four sub-tribes. Within
this clade there is a basal group (*Dyschoriste dalzellii*) (xvii). Remaining taxa form
two distinct clades with several subclades. One sub-clade (xviii) has *Dicliptera* of
sub-tribe Justiciinae forming a basal sister clade. *Haplanthodes* and *Gymnostachyum*
of sub-tribe Andrographinae are coming together as a clade as per the existing
classification (Scotland & Vollesen, 2000). Similarly, *Rungia, Justicia* and *Hypoestes*
of Justiciinae are clustered together. However, the cluster of *Lepidagathis* and
*Cynarospermum* with that of Justiciinae cannot be justified as they come under
different tribes in recent treatments (Scotland & Vollesen 2000). Hence further studies
are needed. Although the clade (xix) with *Hemigraphis, Hygrophila* and *Calacanthus*
are forming a clade as expected, their placement in the group (vii) cannot be
explained as it is classified along with Ruelliinae. *Lepidagathis, Hygrophila* and
*Calacanthus* share the character of a bi-lipped with Justiciinae, *Hemigraphis* has an
obscurely bi-lipped corolla and *Cynarospermum* has no upper lip. *Cynarospermum*
and *Hygrophila* are many seeded like *Gymnostachyum* of Andrographinae and
*Hypoestes* of Justiciinae. Therefore, it could be due to these reasons that these taxa
occur as sister clades.
*Neuracanthus* is kept unplaced within Acanthoideae (Scotland and Vollescen, 2000) due to lack of information of corolla aestivation. However in the present study it is observed to have ascending-cochlear aestivation, similar to the clades of Andrographinae and Justiciinae.

Thus phylogeny studies based on the morphological characters of the Acanthaceae, shows that *Thunbergia* is the out group of the retinaculate subfamily Acanthoideae. Scotland and Vollescen (2000) accepts Acanthaceae as a monophyletic group supporting the inclusion of *Thunbergia* without retinacula at the base of the clade with retinacula. *Strobilanthes* separates out as a single clade together, except for *S. barbatus* which groups with *Acanthopale* and *S. ixiocephalus* and *S. minor* with spheroidal echinate pollen, separating out as successive sisters to the entire Ruellieae. *Barleria* is within the clade of *Strobilanthes*, which is not in agreement with Scotland *et al.* (1995). However, *Strobilanthes* share with *Barleria*, characters such as four seeded capsule and hygroscopic hairs on testa of seeds. Thus, the phylogeny results are in agreement with those of recent authors like Scotland *et al.* (1995) and Scotland & Vollesen (2000), with the exception of *Barleria*. Further studies are needed in this regard to understand better some of these problems.