

Two new heterotypic synonyms in *Lepidagathis* (Acanthaceae: Barlerieae) from India

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Abstract: In the present article, two very recently described new species of *Lepidagathis* Willd. (Acanthaceae: Barlerieae), *L. decumbens* Dhatchan. & Soosairaj and *L. rajasekharae* K.Prasad & A.M.Reddy from India are recognised conspecific and their names are treated as heterotypic synonyms of *L. diffusa* C.B.Clarke and *L. fasciculata* (Retz.) Nees, respectively. Evidence to support this conclusion is provided by an updated description, comparing the diagnostic features of these species based on recent observations, type details including images and illustrations, and colour plates of photographs of living plants in their natural habitats, fresh leaves, inflorescence, flowers and micrographs of floral and fruit parts taken through light and scanning electron microscopes. A distribution map is also provided for *L. diffusa*. Furthermore, the lectotypes for the names, *Ruellia fasciculata* Retz., *L. fasciculata* var. β (beta) Nees, and *L. hirta* Nees are designated here.

Keywords: *Lepidagathis decumbens*, *Lepidagathis rajasekharae*, Multiple specimens, Taxonomic revision, Taxonomic synonyms.

Introduction

In the past, new taxa (species, subspecies, variety and forma) were described frequently based on specimens collected from a single locality, or even a single herbarium specimen without a detailed description and comparison of diagnostic characters with allied taxa (Nees von Esenbeck, 1832, 1841, 1847; Dalzell, 1850, 1851; Anderson, 1867; Clarke, 1884, 1885; Cooke, 1905; Gamble, 1924). Clarke (1884, 1885), for instance, studied only one specimen to describe *Andrographis beddomei* C.B.Clarke and two specimens for *Lepidagathis diffusa* C.B.Clarke. Furthermore, the majority of genera had very few known species at the time. Therefore, the modern-day researchers should be critical and careful while referring to such earlier literature when comparing their new taxa.

Received: 22.11.2023; Revised & Accepted: 28.12.2023

Published Online: 31.01.2024

Ideally, a taxon description is a hypothesis and the evidence used to support or reject it is always based on specimens known or available at that point in time. Over time, this hypothesis may change when the author(s) examine more specimens of a species collected over its entire native geographical distribution or even when species boundaries are better understood. A particular trait or character initially regarded as diagnostic, may later be shown to be fluid as the number of species increases in a particular genus. Therefore, sampling is essential for taxonomic studies, and as many specimens as possible should be examined and cited because they provide evidence to support or reject a taxonomic hypothesis. With several case studies, Gnanasekaran *et al.* (2023a) recently highlighted a few other essential steps to be followed prior to the description of a taxon as new to science. Based on the findings in a research project on the 'Systematics of *Lepidagathis* Willd. (Acanthaceae) in India' funded by the Science and Engineering Research Board (SERB), the authors aim to demonstrate the aforementioned taxonomic practices in this article through two case studies.

Materials and Methods

Intensive field exploration has been carried out across India during 2021–2023, especially in type localities to collect *Lepidagathis* species based on data taken from specimens housed in various herbaria and the published literature (Nees von Esenbeck, 1832, 1841, 1847; Dalzell, 1850, 1851; Anderson, 1867; Clarke, 1885; Cooke, 1905; Gamble, 1924) including the protologues of recently described species (Madhusoodanan & Singh, 1992; Remadevi & Binojkumar, 2008; Jithin & Jose, 2017; Natekar *et al.*, 2019; Biju

et al., 2020; Borude *et al.*, 2020; Chandore *et al.*, 2020; Prasad & Reddy, 2020; Dhatchanamoorthy *et al.*, 2022; More *et al.*, 2022, 2023; Brahmada ande & Nandikar, 2023; Gnanasekaran *et al.*, 2023b). Detailed descriptions documenting the complete range of morphological variation for all species under consideration (*L. decumbens* Dhatchan. & Soosairaj, *L. diffusa* C.B. Clarke, *L. fasciculata* (Retz.) Nees, and *L. rajasekharae* K. Prasad & A.M. Reddy) were prepared after study of multiple populations from across their distribution ranges using a Steini 508 stereomicroscope coupled with an Axiocam 208 camera (Zeiss, Oberkochen, Germany). Fresh material and herbarium specimens housed in different herbaria in India (BLAT, BSI, BSID, CAL, CALI, MH, RHT, SKU and SUK) and elsewhere (BM, C, E, G, K, L, M, NY and US) were studied (Indian herbaria, except BSID, were visited by the authors and specimens from elsewhere and BSID were consulted as digital images; acronyms of the herbaria follow Thiers, updated continuously). These updated descriptions were compared with the diagnostic characters, illustrations, and photoplates given in the protologues of *L. decumbens* and *L. rajasekharae* to determine their distinctiveness. The lectotypes are designated in accordance with the article 9.3 of the Shenzhen Code (Turland *et al.*, 2018).

The detailed methods pertaining to the scanning electron micrographs of pollen grains and seeds are provided in another publication in the current special issue on Acanthaceae (King *et al.*, 2023). The conservation status was evaluated as per IUCN Red List Categories and Criteria version 15.1 (IUCN, 2022). The distribution map was prepared by calculating the Extent of Occurrence (EOO) and Area of Occupancy (AOO) based on collection localities using the GeoCAT tool (Bachman *et al.*, 2011) available at <http://geocat.kew.org> and Google Earth Pro version 7.3.

Results

The ongoing research project on the Systematics of *Lepidagathis* Willd. (Acanthaceae) in India has resulted in the identification of two very recently described species from southern India, *L. decumbens* and *L. rajasekharae*, to be conspecific to previously described and widespread species in the genus, *L. diffusa* and *L. fasciculata*, respectively. Therefore, names of both species are reduced here as heterotypic (taxonomic) synonyms with evidence based on detailed morphological studies.

Case Study I

Lepidagathis diffusa C.B. Clarke versus *Lepidagathis decumbens* Dhatchan. & Soosairaj

Lepidagathis diffusa was described by Clarke (1885) based on the collections of Robert Wight from the Deccan Peninsula (K [K000950052]) and R.H. Beddome from Bellary in Karnataka (K [K000950051], BM [BM013860273]). It was compared with *L. cristata* Willd., the type of *Lepidagathis*. The specific epithet *diffusa* was taken from *Barleria diffusa* Wight, which was a name annotated on the Wight specimen at Kew. It is endemic to India, occurring in the states of Andhra Pradesh, Karnataka and Tamil Nadu (Dhatchanamoorthy *et al.*, 2017; Susmitha *et al.*, 2023) and its geographical distribution is given in Fig. 4.

Dhatchanamoorthy *et al.* (2017) reported that *L. diffusa* was rediscovered after a lapse of 142 years from Palacode in the Dharmapuri district of Tamil Nadu. A thorough consultation of herbarium specimens in various herbaria during the present study shows that the species was collected regularly by many workers in the past after its type collection, although all these specimens were misidentified as either *L. cristata* or *L. trinervis* Nees.

Recently, Dhatchanamoorthy *et al.* (2022) described a new species, *L. decumbens* Dhatchan. & Soosairaj, based on specimens collected from a single locality in Dharmapuri district, Tamil Nadu, and distinguished it from *L. diffusa*. The results of our study suggest that the differentiating diagnostic characters between *L. decumbens* and *L. diffusa* listed by the authors either overlap with those of *L. diffusa* or erroneous observations. Thus, *L. decumbens* is reduced here to the synonymy of the widespread endemic species, *L. diffusa*. A comparison of diagnostic characters with critical notes based on our present observations are given in Table 1. In a recently published synopsis of Indian *Lepidagathis*, Brahmada ande and Nandikar (2023) recognised *L. decumbens* as a distinct species, but we do not follow this conclusion here as outlined above.

Lepidagathis diffusa C.B. Clarke in Hook.f., Fl. Brit. India 4: 518. 1885. *Lectotype* (designated by Dhatchanamoorthy *et al.*, 2017): INDIA, **Deccan Peninsula**, R. Wight s.n. (K [K000950052, digital image!]).

Lepidagathis decumbens Dhatchan. & Soosairaj, Adansonia, sér. 3, 44(24): 322. 2022, **syn. nov.**

Type: INDIA, **Tamil Nadu**, Dharmapuri district, Thippampatti village, c. 358 m, 25.10.2013, *N. Dhatchanamoorthy* 1295 (holo HIFP; iso RHT).

Barleria diffusa Wight ex C.B. Clarke in Hook.f., Fl. Brit. India 4: 518. 1885, *pro syn.* **Figs. 1–4**

Prostrate to decumbent perennial herbs with woody rootstock; stems 30–45 cm long, greenish when young, ash-coloured when old, 4-angled, tomentose to hirsute when young terete, glabrous when old; internodal distance 0.8–2.5 cm. Leaves sessile, opposite-decussate, linear, oblong-elliptic or oblanceolate to obovate, 1–5 × 0.2–0.7 cm, base cuneate or obtuse, margins entire or minutely serrulate, apex acute with a mucronulate to spinous process, sparsely scabrous throughout; lateral veins 3–5 pairs; leaves at the base of inflorescence linear-oblong, 15–18.5 × 1.7–2 mm, stiff and grooved, sericeous towards base. Inflorescence a spike, 1–4 cm long, arising from the lower nodes and less frequent from the axils of leaves on branches; basal spikes often dried or charred (to 4 cm long) with fresh annual spikes 1–3 cm long. Bracts: sterile bract 1 per node, lanceolate-ovate, 8–12 × 2.5–3.2 mm, apex caudate to acuminate with a spinous process, densely tomentose intermixed with sericeous throughout, basal sterile bracts scale-like, 1–2 pairs at the base of each spike; fertile bracts 1 per flower, lanceolate to lance-ovate to oblong, or elliptic, 8.8–13.2 × 2.4–3.5 mm, otherwise as sterile bracts. Bracteoles 2 per flower, dimorphic, lanceolate to lance-ovate or elliptic, 8.6–11.5 × 1.4–2.8 mm, otherwise as bracts. Calyx 5-lobed; lobes heteromorphic, apex caudate to acuminate with a spinous process, densely tomentose intermixed with sericeous hairs throughout; anticus lobes 2, equal, elliptic to lance-ovate, 8.5–12 × 3–4 mm, connate at base (more than half of their total length, *i.e.*, 4.4–7.3 mm long); posticus lobe lance-ovate to narrowly elliptic, 9–12.8 × 2.8–3.6 mm; lateral lobes 2, linear, 8.4–11.6 × 0.8–1.5 mm. Corolla 12–14 mm long, pinkish-white with many purplish-brown markings on throat and limb inside and yellow patches on palate; tube 7.3–8 mm long, cylindrical below for 3.7–4 mm, abruptly expanded above for 3.6–4 mm, retrorsely hirsute outside; upper lip arcuate, 2.3–2.5 × 4.3–5 mm, margins entire, minutely 2-lobed (0.2–0.4 mm long) at apex, each lobe 3-veined; lower lip 3-lobed, with a membranous portion on either side of the centre of the palate with a line of silky hairs, 4.6–5.3 mm long including lobes; middle lobe broader than the lateral lobes, suborbicular, 2.4–3 × 3.8–4.3 mm, crenulate, 3-veined; lateral lobes oblong, 2.5–3.3 × 2–2.4 mm,

3-veined. Stamens 4, didynamous; filaments white with purplish-brown spots, adnate at the base of the expanded corolla tube, glabrous, anticus filaments 3–3.6 mm long, posticus filaments 2–2.4 mm long; anthers bithecos, oblong, divergent, 1.3–1.8 mm long, purplish-brown to white, sparsely hairy at base of the suture and at the connectives, dehiscing longitudinally. Pollen grains prolate, 30.6–32.4 × 18.7–20.3 μm, tricolporate; tectum reticulate more open in area adjacent to apertures. Ovary subglobose, 1.4–1.7 × 1–1.3 mm, glabrous, 2-loculed; ovules 2 in each locule; nectary disk cupulate; style 6.2–6.7 mm long, bristled-glandular-hairy; stigma entire. Capsules ovoid, 5.5–7 × 2.2–3 mm, glabrous, yellowish; seeds 2 per capsule, ovoid, 3–4.5 × 2–3 mm, densely clothed with hygroscopic hairs (longer than seeds) on both surfaces.

Flowering & fruiting: Flowering from October to January and fruiting from November to February.

Habitat: Grows on dry open and lightly wooded scrubs and abandoned farmlands, at elevations ranging from 100 to 400 m.

Distribution: Endemic to India.

Specimens examined: INDIA, Peninsula Indiae Orientalis, *s.d.*, *s.coll.* Wight 2647 (E [E01024272] digital image). **Karnataka**, Mysore, 1857, *s.coll.* *s.n.* (MH [MH00110011]); Mysore, 3000 ft., October 1910, *A. Meebold* 11392 (CAL); Mysore, Hassan district, Tiptur to Arsikere road, 19.12.1968, *C.J. Saldanha* 11912 (US [02863729] digital image); Arsikere town, 20.06.1969, *C.J. Saldanha* 13815 (CAL, US [02863726, digital image]); Hassan, 25.11.1958, *B.M. Wadhwa* 44699 (BSI [BSI0000069387]); Tiptur to Arsikere road, 25.01.1971, *T.P. Ramamoorthy* HFP1262 (US [02863728] digital image); Bellary, *s.d.*, *R.H. Beddome s.n.* (K [K000950051], BM [BM013860273] digital images); Bellary, on open hill, Gadiganur, 20.01.1979, *S.B. Manohar* KFP5923 (CAL); Hasanur reserve forest, Kollegal, 11.02.1924, *K.C. Jacob* 17311 (MH [MH00110012, MH00110013, MH00110014, MH00110015]); Ramapuram, 21.11.2008, *MVS & VSR* 33010 (SKU); without specific locality, June 1857, *G. Bhide s.n.* (MH [MH00110088]); *s.loc.*, *s.d.*, *K. Drew s.n.* (E [E01024276] digital image). **Tamil Nadu**, Dharmapuri district, Thippampatti village, N 12°14'54.3", E 78°16'31.8", 387 m, 25.09.2021, *A.F.J. King* 12808; *Ibid.*, 06.01.2022, *G. Gnanasekaran & A.F.J. King* 12851; *Ibid.*, 26.11.2022, *A.F.J. King* 12976 (Madras Christian College Herbarium, Chennai).

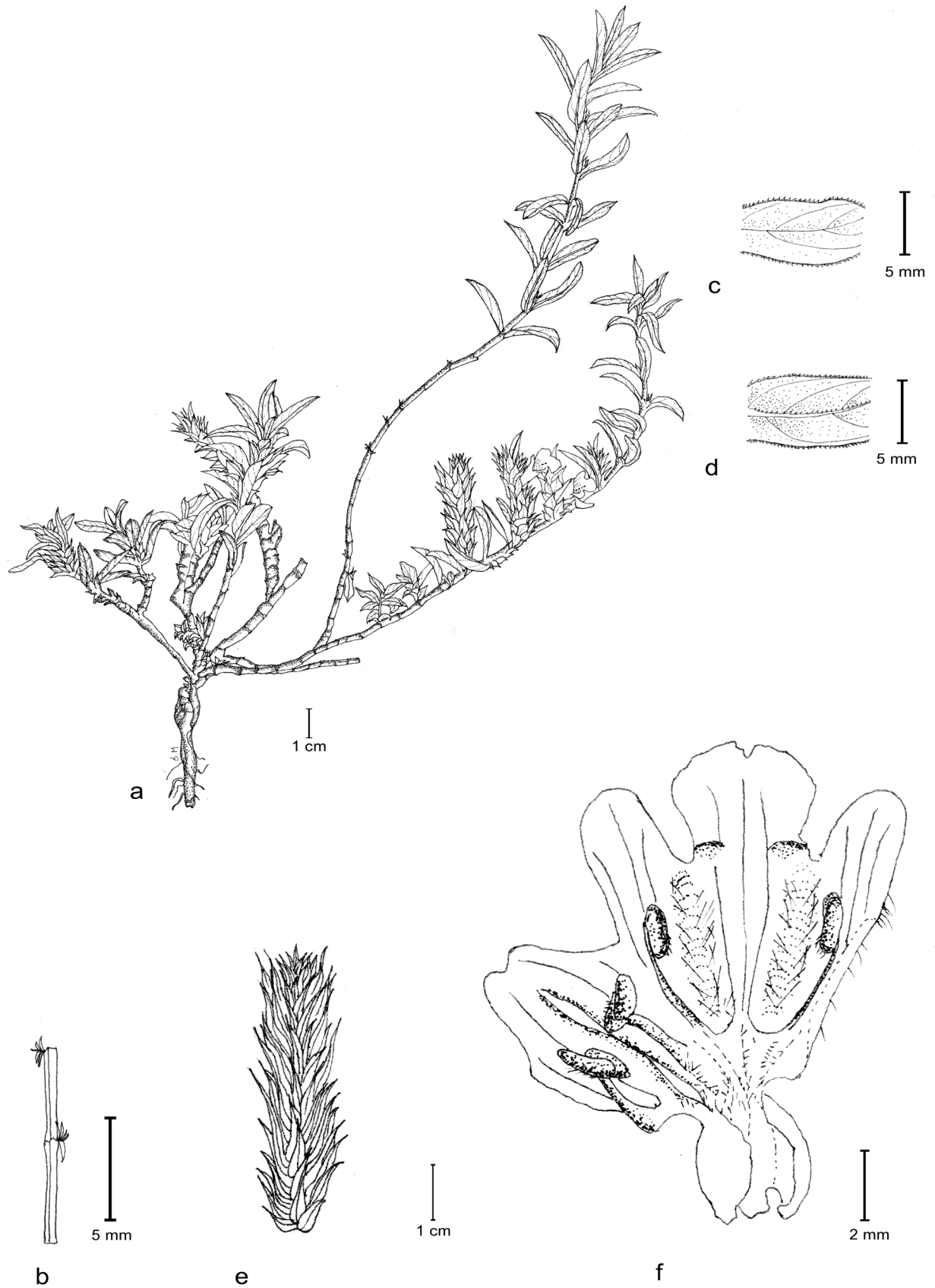


Fig. 1. *Lepidagathis diffusa* C.B. Clarke: a. Habit; b. Portion of stem; c. Leaf upper surface; d. Leaf lower surface; e. Old (dried or charred) inflorescence; f. Dissected corolla with androecium (from G. Gnanasekaran & A.F.J. King 12851, Chennai; drawn by S. Madhura).

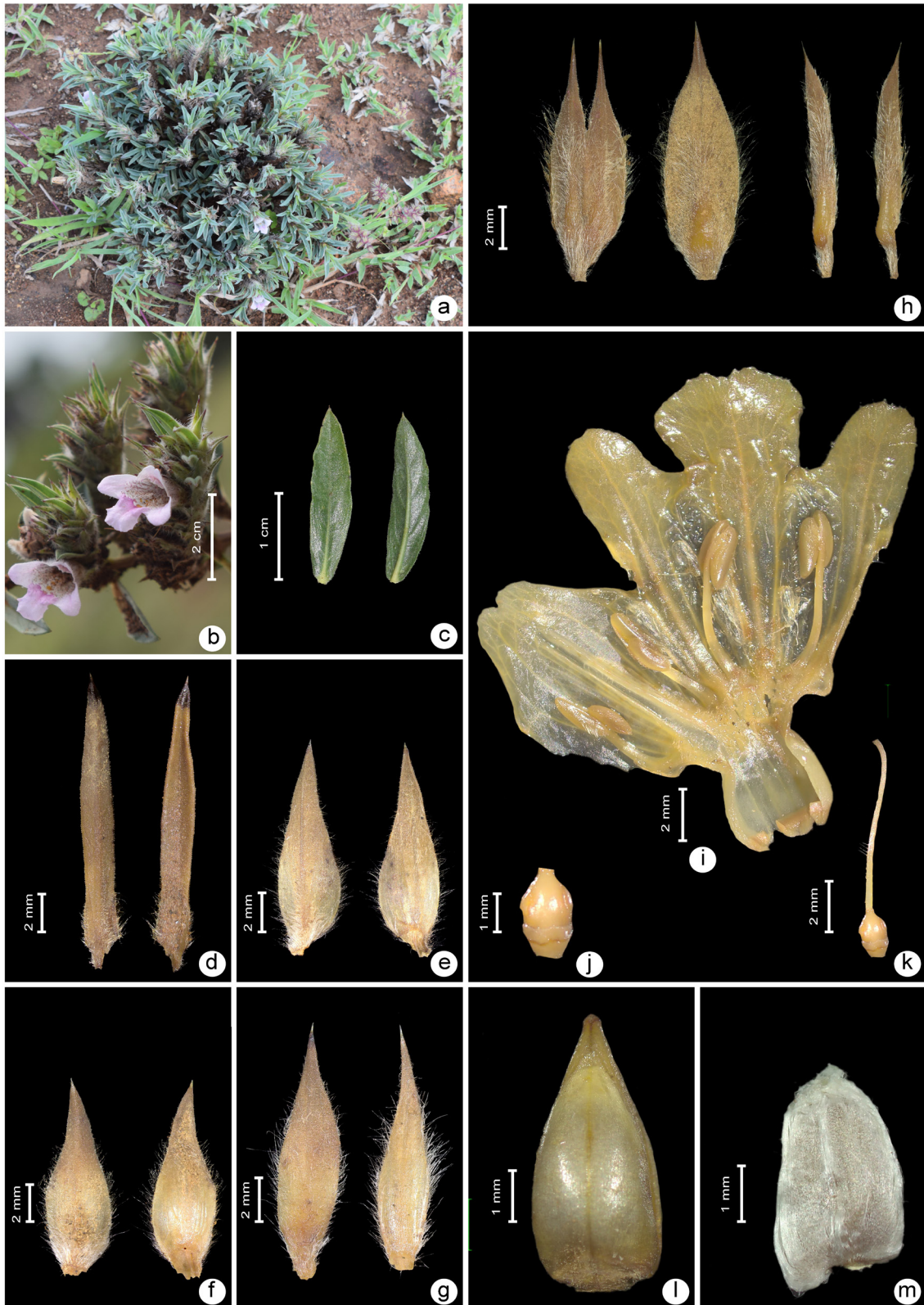


Fig. 2. *Lepidagathis diffusa* C.B.Clarke: **a.** Habit; **b.** Inflorescence close-up; **c.** Leaf upper (left) and lower (right) surfaces; **d.** Leaves at the base of inflorescence upper (left) and lower (right) surfaces; **e.** Sterile bract outer (left) and inner (right) surfaces; **f.** Fertile bract outer (left) and inner (right) surfaces; **g.** Bracteole outer (left) and inner (right) surfaces; **h.** calyx lobes outer surfaces; **i.** Dissected corolla with androecium; **j.** Ovary; **k.** Pistil; **l.** Capsule; **m.** Seed covered with hygroscopic hairs (a–c from *G. Gnanasekaran & A.F.J. King* 12851 and d–m from *A.F.J. King* 12976; photos a, b, d–m by A.F.J. King, c by G. Gnanasekaran).

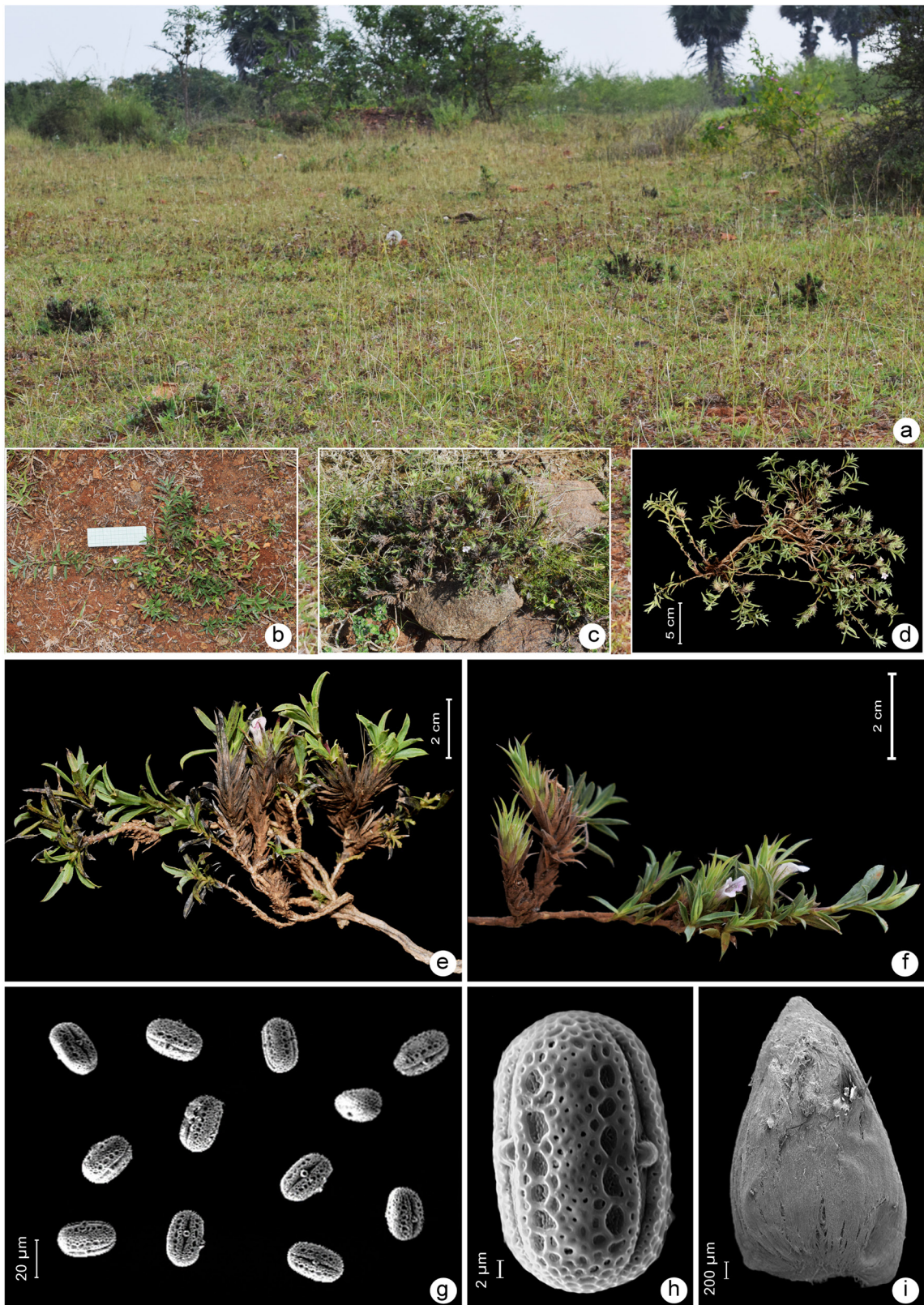


Fig. 3. *Lepidagathis diffusa* C.B. Clarke: **a.** Habitat; **b–d.** Different types of habits as an inset in the habitat; **e & f.** Flowering twigs with fresh and old (dried or charred) inflorescences; **g.** SEM micrograph of pollen grains; **h.** SEM micrograph of pollen grain close-up (mesocolpial view); **i.** SEM micrograph of seed (a–c, g–i from *G. Gnanasekaran & A.F.J. King* 12851 and d–f *A.F.J. King* 12976; photos a, d, f–i by *G. Gnanasekaran*; b, c, e by *A.F.J. King*).

Table 1. Characteristics for *Lepidagathis diffusa* and *L. decumbens* as given by Dhatchanamoorthy et al. (2022), compared with present observations.

Characters	<i>L. diffusa</i> C.B. Clarke	<i>L. decumbens</i> Dhatchan. & Soosairaj	Present observations
Plant	Prostrate	Erect or decumbent	Prostrate plants are also seen in the type locality of <i>L. decumbens</i> (Fig. 3b).
Stem	Leaf scars indistinct, internodes long, up to 3 cm	Leaf scars prominent, internodes short, up to 1 cm	The leaf scars on stem are highly variable trivial. The internodal distance ranges from 8 to 25 mm.
Leaf	Elliptic-lanceolate, nerves prominent on both surfaces, grooved along the lateral nerves on the adaxial surface	Linear-oblong to lanceolate, nerves prominent on abaxial surface and indistinct on adaxial surface	The leaf shape varies from elliptic-lanceolate to linear-oblong or oblanceolate to obovate and veins are prominent on both surfaces.
Inflorescence	Spikes sometimes aggregated at base, globose-ovoid, up to 2 cm long	Spikes not aggregated at base, oblong, 3–6 cm long	The spikes are distributed densely on the lower nodes and sparsely in the axils of leaves in the branches. The spikes at the basal nodes are often from the previous year's growth, with dried up floral structures up to 4 cm long, whereas the fresh spikes are 1–3 cm long and always at the tip of the perennial dried-up spike. The small-sized (1.5–2.5 cm) spikes on the axillary and at the tip of the old and dried spikes are also seen in the type locality of <i>L. decumbens</i> (Fig. 3d–f).
Calyx	7 × 3 mm, anterior sepals united 1/4 of the way	9 × 4 mm, anterior sepals united 1/2 of the way	The size of anticus calyx lobes is 8.5–12 × 3–4 mm, and the lobes are united about half or more than half of their total length (Fig. 2h).
Pollen	34.66 × 23.60 μm, exine thick, c. 4.14 μm	41.81 × 28.22 μm, exine thin, c. 3.52 μm	The size of the pollen grains (collected from the type locality of <i>L. decumbens</i>) ranges from 30.63–32.25 × 18.66–20.27 μm (Fig. 3g, h).
Capsule	6 × 2 mm	6 × 4 mm	The capsule size is 5.5–7 × 2.2–3 mm.
Seeds	Oblong, 3 × 1.5 mm	Ovoid-suborbicular, 3.5 × 3 mm	The seed shape is always ovoid and the size is 3–4.5 × 2–3 mm.

Conservation status: The estimated Extent of Occurrence (EOO) and Area of Occupancy (AOO) for this species are 82,908.8 km² and 48 km², respectively. Although the AOO of this species fits

the Endangered [EN] category, the species is known to occur in many localities across three southern Indian states. Therefore, this species is provisionally assessed here as 'Least Concern' [LC].

Case Study II

Lepidagathis fasciculata (Retz.) Nees versus *Lepidagathis rajasekharae* K.Prasad & A.M.Reddy

Lepidagathis fasciculata (Retz.) Nees was originally described as *Ruellia fasciculata* by Retzius (1786) based on the collection of König (LD [LD1801295]) from “*Habitat in nemorolis prope Thermas Trinquemallenses Zeylonæ*” (Trincomalee), Sri Lanka. Nees von Esenbeck (1832) divided the species into two unnamed varieties α (*foliis grosse dentatis*) and β (*foliorum dentibus minoribus*). The α (alpha) variety represents the typical plant based on multiple citations of earlier literature with two collections, Wall. Numer. List: n. 2394a and 2406. The β (beta) variety was based on a *nomen nudum*, *Ruellia viscosula* Wall. (Numer. List: n. 2394c). Subsequently, Nees von Esenbeck (1847) proposed another variety α^* (*minor et laxior*) based on his species, *Lepidagathis hirta* Nees (1841), described on the basis of Walkers collections from Sri Lanka.

Lepidagathis goensis Dalzell was described by Dalzell (1850) based on the collections of Stocks and Dalzell (K [K001392436, K001392438, K001392442]) from the foothills of Syhadree (Sahyadri) mountains and differentiated it from *L. ceylanica* Nees in its small hairy leaves. Later it was reduced to the synonymy of *L. fasciculata* by Anderson (1867). This treatment was followed by Clarke (1885), Cooke (1905), Almeida (2003), Karthikeyan *et al.* (2009) and POWO (2023). However, Brahmadande and Nandikar (2023) did not notice these earlier treatments reporting that they had reduced it to the synonymy for the first time. In most of the published state (Rao, 1986; Moorthy, 2001), regional (Nayar *et al.*, 2014) and national (Arisdason *et al.*, 2020) checklists and floras, *L. goensis* has neither been cited as a synonym nor as an accepted taxon.

Prasad and Reddy (2020) described *Lepidagathis rajasekharae*, based on specimens collected from Talakona in the Sesachalam hills of Kadapa district, Andhra Pradesh. They compared it with *L. fasciculata*, a widely distributed species on the Indian subcontinent and in Southeast Asia. Our studies suggest that all diagnostic characters used to differentiate the new species from *L. fasciculata* are either clinal, variable, or erroneous observations. Therefore, *L. rajasekharae* is treated here as conspecific to *L. fasciculata*. A comparison of diagnostic characters with critical notes based on

our present observations are presented in Table 2.

***Lepidagathis fasciculata* (Retz.) Nees** in Wall., Pl. Asiat. Rar. 3: 95. 1832. *Ruellia fasciculata* Retz., Observ. Bot. 4: 38. 1786. *Lepidagathis fasciculata* (Retz.) Nees var. α (alpha) Nees in Wall., Pl. Asiat. Rar. 3: 95. 1832. *Lectotype* or perhaps holotype (designated by Fischer, 1932): SRI LANKA, Thermas Tranquemallenses (Trincomalee), *s.d.*, König *s.n.* (LD [LD1801295, digital image!]).

Lepidagathis fasciculata (Retz.) Nees var. β (beta) Nees in Wall., Pl. Asiat. Rar. 3: 95. 1832. *Ruellia viscosula* Wall., Numer. List: n. 2394, 1830, *nom. nud.* *Lectotype* (designated here) or perhaps holotype: MYANMAR, Ataran (Atran) and Salween (Selum), 1827, *s.coll.*, *s.n.* (Wall., Numer. List: n. 2394c, K [K001115849, digital image!]).

Lepidagathis hirta Nees, *Lepidagath.* Illustr. Monogr.: 53. 1841. *Lepidagathis fasciculata* var. α^* (*alpha star*) Nees in DC., Prodr. 11: 260. 1847. *Lectotype* (designated here): SRI LANKA, (Ceylon), Walker *s.n.* (K [specimen at the bottom of the sheet], digital image!).

Lepidagathis goensis Dalzell, Hookers J. Bot. Kew Gard. Misc. 2: 340. 1850. *Lectotype* (designated by Brahmadande & Nandikar, 2023): INDIA, Goa, Dalzell *s.n.* (K [K001392436, digital image!]).

Lepidagathis rajasekharae K.Prasad & A.M.Reddy, Phytotaxa 470(1): 112. 2020, *syn. nov.* *Type*: INDIA, **Andhra Pradesh**, Kadapa district, Sesachalam hills, way to Mogalipenta from Talakona top, 25.03.2017, K. Prasad 5208 (holo: BSID; iso: CAL [CAL0000213067!], BSID). **Figs. 5–10**

Decumbent to erect perennial herbs; stems 0.5–1 m long, rooting at lower nodes, greenish, well-branched, 4-angled, glandular-hairy throughout, internodal distance 2–4 cm. Leaves subsessile, opposite-decussate, lance-ovate to elliptic, (1–)4–18 × (0.5–)2–6 cm, base attenuate to decurrent, margins vary from entire, crenate to serrate or dentate and undulate, apex acuminate, sparsely pubescent intermixed with glandular hairs; lateral veins 3–8 pairs. Inflorescence a spike, axillary and terminal, 1–2 cm long; peduncles 1–2 cm long. Bracts: sterile bracts 2, foliaceous, at base of each spike, lance-ovate to elliptic, 10–12 × 3–6 mm, apex acute, tomentose with glandular hairs throughout; fertile bract 1 per flower, oblong-elliptic, 6.3–9.4 × 2.5–4 mm, otherwise as sterile bracts. Bracteoles 2,

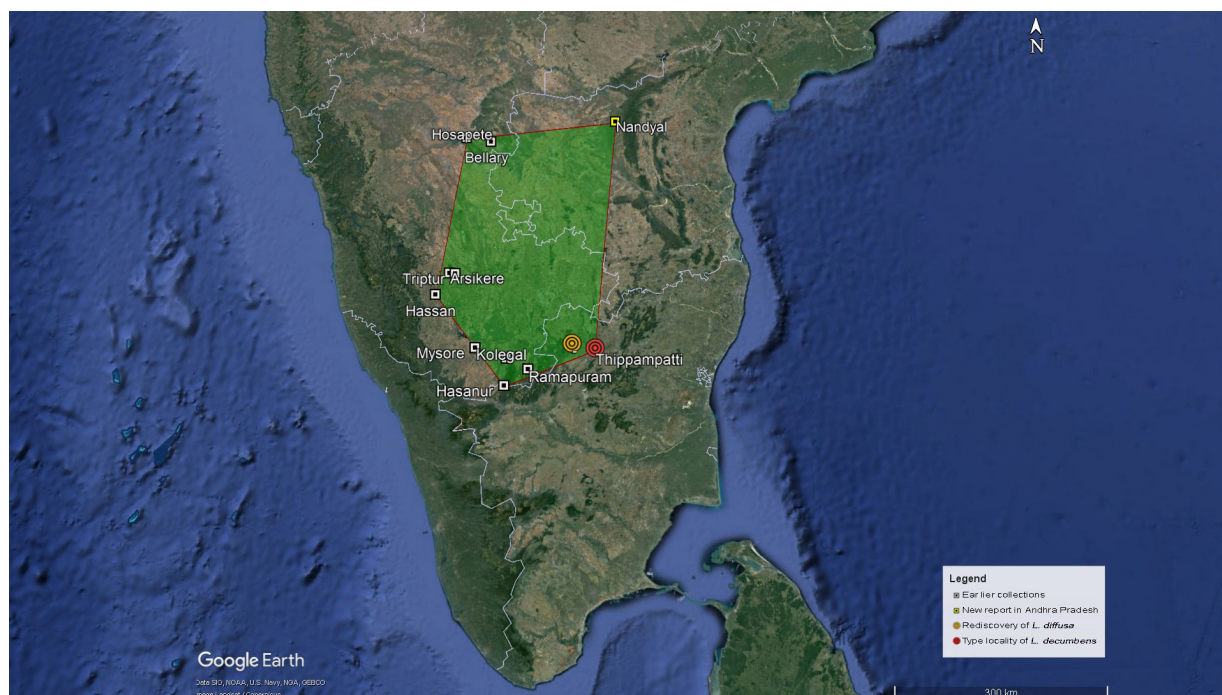


Fig. 4. Geographical distribution of *Lepidagathis diffusa* C.B. Clarke. Produced using Google Earth Pro version 7.3.

dimorphic, linear to narrowly oblong and oblong to elliptic, $4.2\text{--}7 \times 1\text{--}2.8$ mm, otherwise as bracts. Calyx 5-lobed; lobes heteromorphic, tomentose with glandular hairs throughout; anticous lobes 2, equal, linear-oblong, $5\text{--}7.5 \times 1\text{--}2$ mm, connate at base (less than a quarter of their total length, *i.e.*, 1–2 mm); posticous lobe oblong-elliptic, $5.5\text{--}7.5 \times 1.3\text{--}2.2$ mm; lateral lobes 2, linear, $4.2\text{--}6 \times 0.4\text{--}0.8$ mm. Corolla 8–9 mm long, white (faintly yellowish at maturity) with pale purplish markings on expanded portion of tube inside throughout and yellow on palate; tube 5–6 mm long, cylindric below for 3–3.8 mm long, abruptly expanded above for 1.7–2.2 mm long, glabrous inside, retrorsely hairy outside; upper lip arcuate, $1.6\text{--}2 \times 2.4\text{--}3$ mm, margins entire, minutely 2-lobed (0.2–0.5 mm long) at apex, each lobe 3-veined; lower lip 3-lobed, 3–3.4 mm long including lobes, middle lobe broader than the lateral lobes, suborbicular, $2\text{--}2.2 \times 2\text{--}2.7$ mm, entire, 3-veined, lateral lobes oblong, $1.7\text{--}2 \times 1.3\text{--}1.6$ mm, 3-veined. Stamens 4, didynamous; filaments white with purple spots, adnate at the base of expanded corolla tube, glabrous, anticous filaments 1.8–2.2 mm long, posticous filaments 0.8–1.3 mm long; anthers bitheous, oblong, divergent, 0.7–1 mm long, white to purple, sparsely hairy at base of suture and at connectives, dehiscing longitudinally. Pollen grains prolate, $28.1\text{--}29.7 \times 16.3\text{--}19.3$ μm ,

tricolporate; tectum reticulate, more open in area adjacent to apertures. Ovary sub-globose, $1.2\text{--}1.5 \times 1\text{--}1.2$ mm, minutely hairy at apex, 2-loculed; ovules 2 in each locule; nectary disk cupulate; style 4.5–5.5 mm long, bristled-glandular-hairy; stigma bi-lobed. Capsules lance-ovoid, $5\text{--}6.2 \times 1.4\text{--}2$ mm, minutely hairy towards apex, yellowish-brown; seeds 4, lower 2 ovoid, upper 2 sub-globose, $1\text{--}2 \times 1\text{--}1.7$ mm, sparsely covered with short hygroscopic hairs throughout.

Flowering & fruiting: Flowering from January to February and fruiting from February to May.

Habitat: In shady areas of dry evergreen forests and on open slopes of the Ghats, at elevations ranging from 100 to 1000 m.

Distribution: Bangladesh, China, India, Myanmar, Pakistan, Sri Lanka and Thailand.

Specimens examined: INDIA, **Andhra Pradesh**, Godavari district, Sukuwana hill, February 1885, *J.S. Gamble* 15967 (MH [MH00110399]); Vatangi, 06.02.1916, *C.A. Barber* 12686 (MH [MH00110370, MH00110371, MH00110372]); Mareduhilli, near tiger camp, 600 m, 18.02.1994, *M. Mohanan* 101277 (BSID [BSID0005360, digital image], MH [MH00110373, MH00110374]); Kadapa district, Sesachalam hills, on the way to Talakona falls, 26.02.2022, *G. Gnanasekaran & A.F.J. King* 12880,

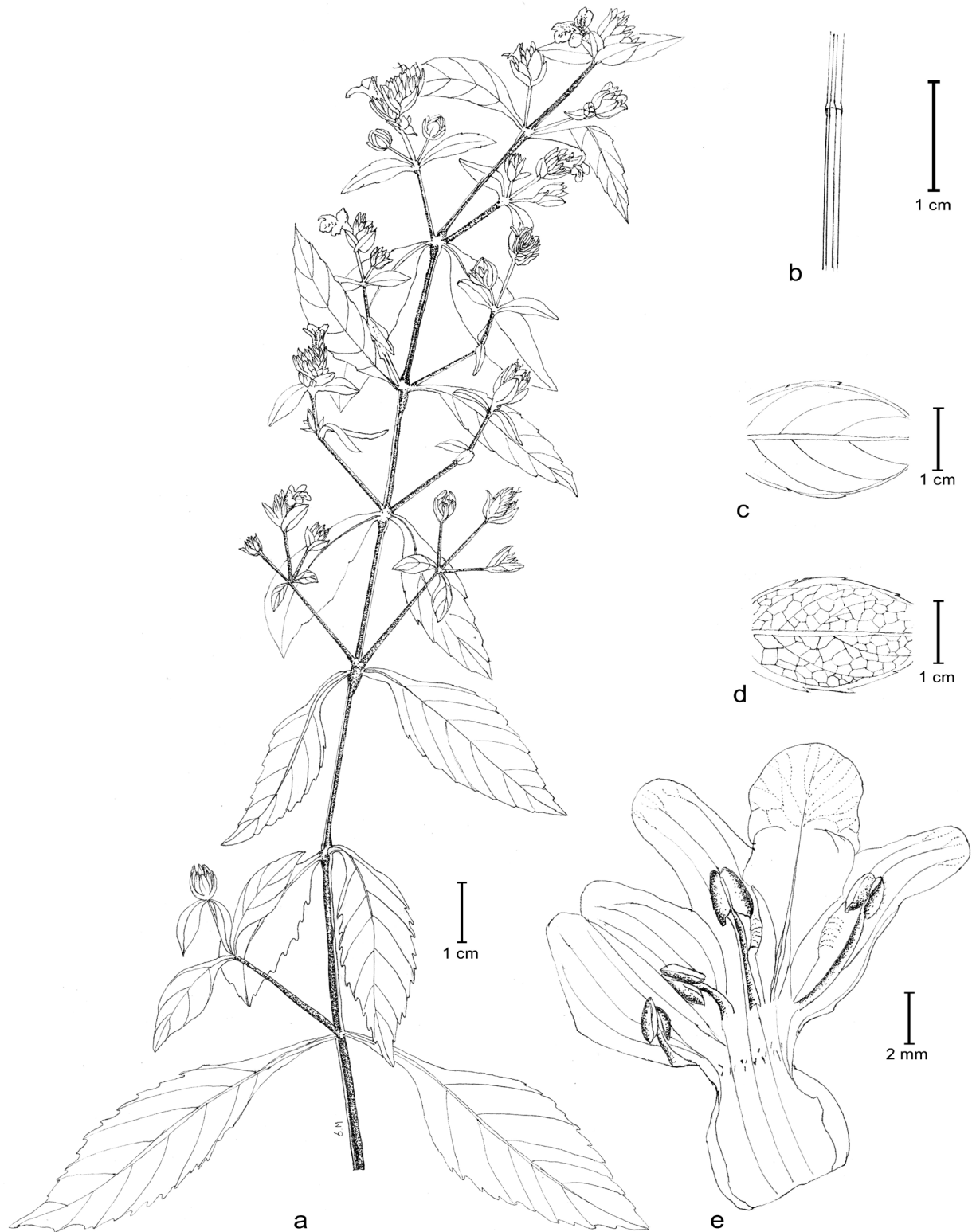


Fig. 5. *Lepidagathis fasciculata* (Retz.) Nees: a. Habit; b. Portion of stem; c. Leaf upper surface; d. Leaf lower surface; e. Dissected corolla with androecium (from G. Gnanasekaran & A.F.J. King 12880, Madras Christian College Herbarium, Chennai; drawn by S. Madhura).

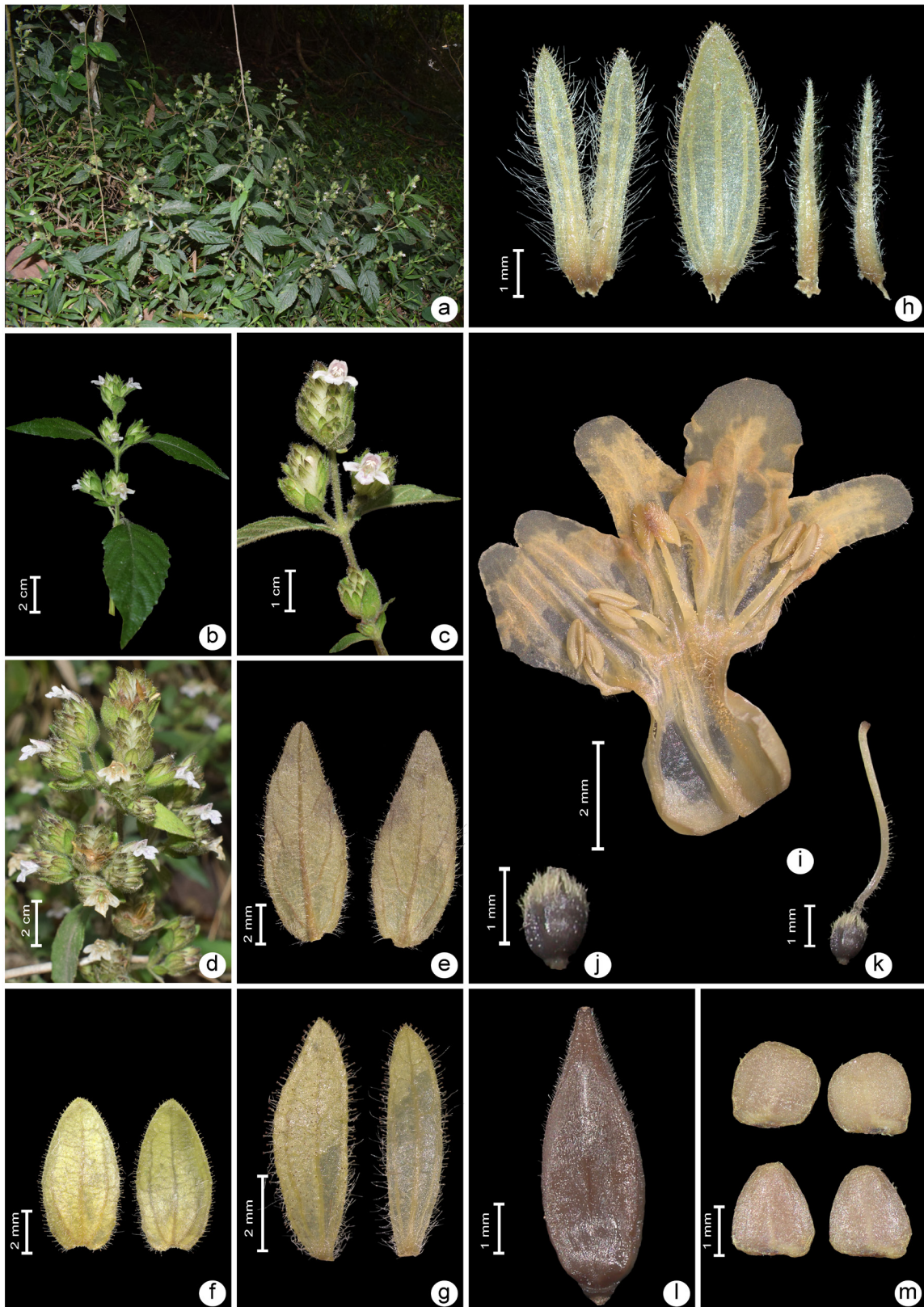


Fig. 6. *Lepidagathis fasciculata* (Retz.) Nees: **a.** Habit; **b.** Flowering twigs; **c** & **d.** Inflorescence close-up; **e.** Sterile bract outer (left) and inner (right) surface; **f.** Fertile bract outer (left) and inner (right) surface; **g.** Bracteole outer (left) and inner (right) surface; **h.** Calyx lobes outer surface; **i.** Dissected corolla with androecium; **j.** Ovary; **k.** Pistil; **l.** Capsule; **m.** Seeds (e–m from *G. Gnanasekaran & A.F.J. King* 12881 and a–d *A.F.J. King* 12994; photos by A.F.J. King).

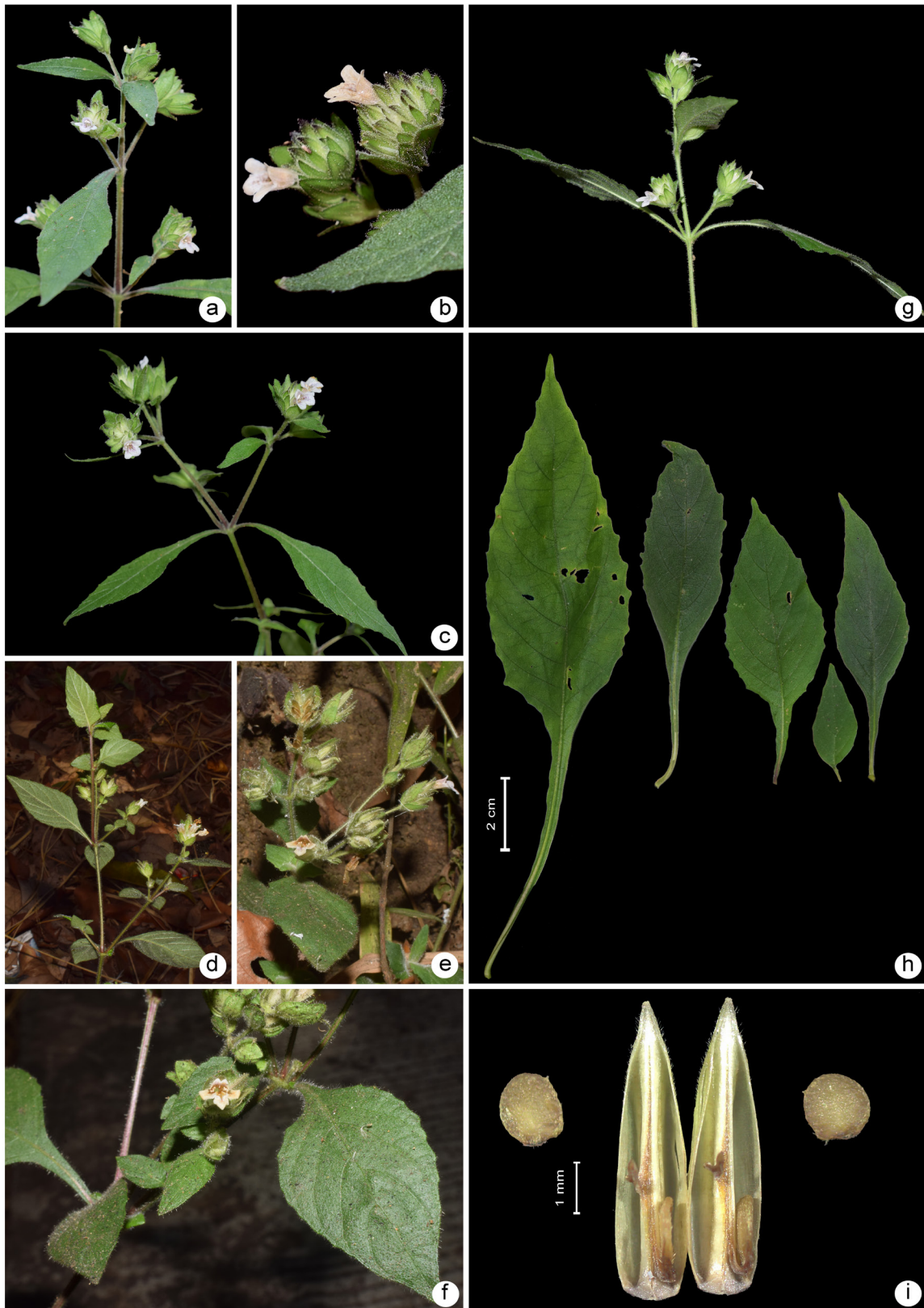


Fig. 7. *Lepidagathis fasciculata* (Retz.) Nees: **a–g.** Images of flowering twigs collected from different localities (**a–c.** Talakona, Andhra Pradesh; **d–f.** Molem, Goa; **g.** Jawadhu hills, Tamil Nadu); **h.** Variation in leaf shape observed in one individual plant from Talakona; **i.** Capsule split open showing four seeds (**a–c, h & i** from *G. Gnanasekaran & A.F.J. King* 12882, **g** from *A.F.J. King* 12994, and **d–f** from *A.F.J. King* 13003; photos **a–c & h** by *G. Gnanasekaran*; **d–g & i** by *A.F.J. King*).



Fig. 8. Lectotype or perhaps holotype of *Ruellia fasciculata* Retz. (LD [LD1801295]) [inset: annotations by the original author on back of sheet] © Lund Herbarium. Reproduced with permission.

12881, 12882, 12883 (Madras Christian College Herbarium, Chennai); Karimnagar district, way to Mukunoor, Mahdavpur, 22.02.1986, 140 m, *N. Rama Rao & T. Ravi Shankar* 83705 (MH [MH00110377, MH00110378]); Khammam district, Nellippakka forest, 250 m, 22.02.1994, *R. Chandrasekaran* 99020 (BSID [BSID0005361, digital image], MH [MH00110375, MH00110376]); Mahabubnagar district, Nilagiri view point, 800 m, 10.02.1998, *S.R. Srinivasan* 109718 (BSID [BSID0005362, digital image]); On the way to Sirivakai, March 1962, *D.C.S. Raju* 101 (E [E01024235] digital image); Visakhapatnam district, Mettur (Madgole to Minumuluru), 20.12.1967, 625 m, *G.V. Subbarao* 29563 (MH [MH00110379, MH00110380]); Punniyagiri to S. Kota, 23.12.1969, 250 m, *G.V. Subbarao* 32783 (MH [MH00110381, MH00110382]); on the way to Javapuram peak from Madugula, 09.04.1976, 400 m, *G.V. Subbarao* 47257 (MH [MH001100384]). **Goa**, Just before Butpal, 13.03.1964, *K.C. Karodia* 96231 (BSI [BSI0000068427]); Anmod Ghat, 21.04.2023, N 15°24'50.6628", E 74°16'40.458", *A.F.J. King* 13003 (Madras Christian College Herbarium, Chennai).

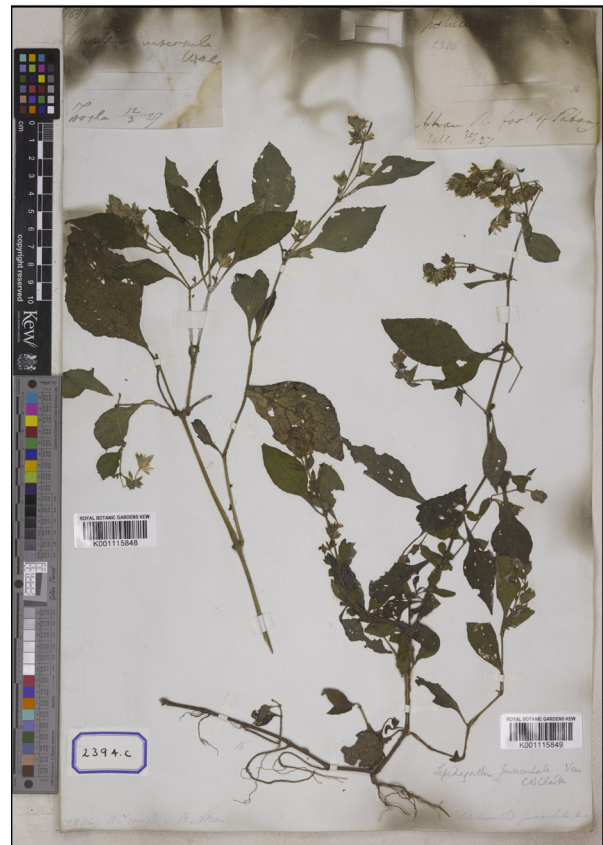


Fig. 9. Lectotype or perhaps holotype of *Lepidagathis fasciculata* var. *beta* Nees (K, K00115849) © The Board of Trustees for the Royal Botanic Gardens, Kew Herbarium. Reproduced with permission.

Karnataka, Bangalore, Nandi hills road, 20.01.1973, *B.L. Burt*, *C. Townsend*, *C. Saldanha* 18351 (C, digital image); North Canara, *s.d.*, *s.coll.* 188 (MH [MH00110402]); Chikkaballapur district, Nandi hills, 02.03.1957, *E.K. Janaki Ammal* 7392 (MH [MH00110287]); Canara & Mysore, *s.d.*, *Law s.n.* (C, digital image); Malabar Concan, *s.d.*, *Stocks Law s.n.* (C, L [U1046906], BM [BM013860496], G [G00390455], NYBG [NYBG04204645] digital images); S. Concan, *s.d.*, *Ritchie* 592 (NYBG [NYBG04204644] digital image); Chikmagalur district, Bababoodan Hills, *s.die*, *Law s.n.* (L [L2837927] digital image); South Canara district, 1857, *R.H. Beddome s.n.* (MH [MH00110401, MH00110407, MH00110408]); Mudabidiri, 15.03.1915, *C.A. Barber* 11943 (MH [MH00110403, MH00110404, MH00110405, MH00110406]); Someshwar, 14.02.1940, *S.R. Raju* 85494 (MH [MH00110398, MH00110400]); Shivamoga district, Agumbe, 29.05.1958, *S.D. Mahajan* 34335 (BSI [BSI0000068431, BSI0000068432, BSI0000068433]); Udupi district, Mookambika WLS, Madur forest, 19.03.2007, *P.G. Diwakar & R.K. Singh* 184258 (BSI [BSI0000068428, BSI0000068429, BSI0000068430]).

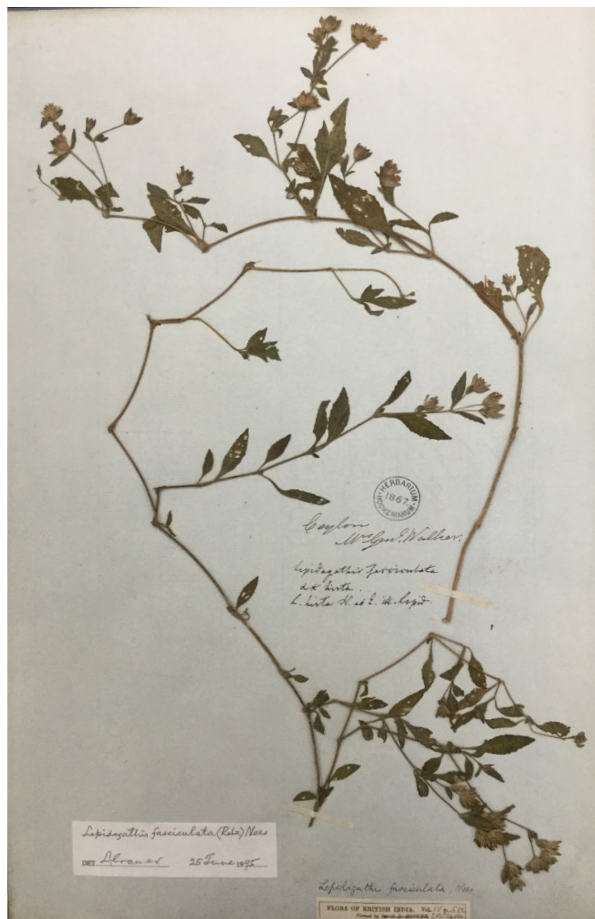


Fig. 10. Lectotype of *Lepidagathis hirta* Nees (K [specimen at the bottom]). © The Board of Trustees for the Royal Botanic Gardens, Kew Herbarium. Reproduced with permission.

Kerala, Kannur district, Kannothe Reserve Forest, 125 m, 19.04.1980, V.S. Ramachandran 66911 (MH [MH00110388, MH00110391]). **Madhya Pradesh**, Bastar district, way to Thirathgarh falls, 09.02.1961, 540 m, N.P. Balakrishnan & A.N. Henry 11892 (L [L2837906] digital image); Hoshangabad district, Churna, 413 m, 26.04.1961, J. Joseph 12423 (MH [MH00110394, MH00110395]); Bori Reserve Forest, 550 m, 01.05.1961, J. Joseph 12482 (MH [MH00110383]). **Maharashtra**, Ratnagiri district, Narur, 25 km from Sawantwadi, 17.04.1971, B.G. Kulkarni 128770 (BSI [BSI0000068422]); Wasul Rai, 40 km from Sawantwadi, 18.04.1971, B.G. Kulkarni 128803 (BSI [BSI0000068423]); Ram Ghat, 24 km from Amboli, 27.04.1971, B.G. Kulkarni 129341 (BSI0000068426); Bhedshi, 02.05.1971, B.G. Kulkarni 129474 (BSI [BSI0000068424]); Hewale, Bhedshi, 28.05.1970, B.G. Kulkarni 120925 (BSI [BSI0000068425]); Sindhudurg district, Amboli, 15.04.2017, J.V. Dalavi & M. Lekhak JVD-505 (SUK); Chorla Ghat, s.d., N.V. Malpure NVM2887 (SUK);

Nagergali, 23.02.2008, N.V. Malpure NVM2887 (SUK); Satara district, Khandala, Forbay to Saddle, 15.03.1952, H. Santapau, S.J. 14101, 14102, 14103, 14104, 14105, 14106, 14107, 14108, 14109, 14110, 14111 (BLAT); Koyna, 11.02.1979, R.K. Kochhar 158315 (BSI [BSI0000068451]). **Odisha**, Niasangiri, Kalahandi, 30.04.1986, S.K. Mukherjee 4138 (BM [BM013860497] digital image); Balasore district, Kuldiha forest, 24.01.1986, 80 ft, Geetha, P. 6732 (CALI [CALI129493]); *Ibid.*, Karthiayani, K.P. 6344 (CALI [CALI139494]); *Ibid.*, Jeeja Majeed 8338 (CALI [CALI129495]); *Ibid.*, A.K. Valsa 7034 (CALI [CALI129496]); Tulka, N 20°36'53.1", E 84°57'35.0", 307 m, 04.02.2015, K.C. Mohan 6513 (BSID [BSID0010883] digital image); Ganjam district, Hijilly, Dec. 1883, J.S. Gamble 13618 (MH [MH00110356]); Linepada to Koinjur, 25.01.1900, C.A. Barber 1244 (MH [MH00110385, MH00110386]); Durgaprasad, December 1906, s.coll. s.n. (MH [MH00110387]). **Tamil Nadu**, Dharmapuri district, Denkanikotta taluk, Thalli, Devarbetta reserve forest, 11.02.1960, 950 m, T.S. Jayaseelan 26386 (RHT [RHT047306]); *Ibid.*, 14.11.1979, 900 m, K.M. Matthew 24588 (RHT [RHT047305]); Krishnagiri district, Sembiaru, Singarapettai hills, 05.04.1987, M.B. Viswanathan 1412 (MH [MH00110390]); Tiruchirappalli district, Chengattupatti, 800 m, 20.03.1959, K.M. Sebastine 7916 (MH [MH00110392, MH00110393]); Thuraiyur, Pachamalais, Karuppankadu Thittu, 17.03.1978, 1000 m, K.M. Matthew 12357 (L [L3720654] digital image); Tirupathur district, Yelagiri hills, on the way to Swamimalai, 28.03.1987, M.B. Viswanathan 1376 (MH [MH00110389]); Tiruvannamalai district, Jawadhu hillslopes, N 12°24'15.6", E 78°40'26.6", 26.03.2023, A.F.J. King 12994 (Madras Christian College Herbarium, Chennai). *Sine data* (C [C10005034, C10005035], LINN [LINN-HS 1093-12], digital images); *Sine data* (BM [BM014117825, BM013860495] digital images); *S.loc., s.d., Roxburgh s.n.* (BM [BM013860499] digital image); *S.loc., s.d., R.H. Beddome s.n.* (BM [BM013860499] digital image). SRI LANKA, Naula to Elahera road, 18.06.1932, s.coll. 9826 (BM [BM013860500] digital image); Without exact locality, July 1981, (BM [BM013860498] digital image); without exact locality, in Herb. Madrasp. (Wall., Numer. List: n. 2394a), *sine data* K ([K001115846 (specimen on left, annotated as a), CAL [CAL0000020058, digital images!]); in Herb. Roxb. (Wall., Numer. List: n. 2406), *Sine data* (K [K001115870, digital image!]).

Table 2. Characteristics for *L. fasciculata* and *L. rajasekharae* as given by Prasad and Reddy (2020) compared with present observations.

Characters	<i>L. fasciculata</i> (Retz.) Nees	<i>L. rajasekharae</i> K. Prasad & A.M. Reddy	Present observations
Leaf margins	Crenulate or crenulate-serrulate	Sub-entire or undulate	The leaf margins can vary from entire, crenate to serrate or dentate and undulate (Fig. 7g).
Flowers	Sessile or sub-sessile	Pedicellate	The flowers are always sessile to subsessile and never pedicellate.
Bracteoles	Unimorphic	Trimorphic	The bracts are always dimorphic (never trimorphic) and different shapes and sizes. The larger one is oblong to elliptic, and the smaller one is linear to narrowly oblong (Fig. 6g).
Corolla indumentum	Corolla glabrous inside	Corolla throat densely hairy and the tube with glandular hairs in one line	The corolla is always pubescent inside at the point of insertion of the filaments.
Capsules	4-seeded	2-seeded	The capsule is always 4-seeded with fewer seeds only by abortion (Fig. 7i).

Conservation status: The species is provisionally assessed here as 'Least Concern' [LC].

Typification: Nees von Esenbeck (1832) described *L. fasciculata* variety β (*foliorum dentibus minoribus*) with a direct citation of a *nomen nudum*, *Ruellia viscosula* Wall. with Wall. Numer. List: n. 2394c that was collected from Ataran (Atran) and Salween (Selum), Myanmar, in 1827. At K, we found two specimens with different barcodes [K001115848, K001115849] and collection localities (a [Trogla?] and b [Atran], respectively), which were mounted on a single sheet with a label, Wall., Numer. List: n. 2394c. Among the two, the specimen with K0011158489 is designated here as the lectotype (perhaps holotype) as it matches the species identity and collection locality given in the protologue.

Acknowledgements

GG and AFJK are thankful to the Science and Engineering Research Board (SERB), Government of India, for funding the Core Research Grant (File Number CRG/2020/001605) and to the Principal and Head of the Department of Botany, Madras Christian College (Autonomous), Chennai for facilities. Authors are grateful to the Curators and Directors of BLAT,

BM, BSI, BSID, C, CALI, E, G, K, L, M, MH, NY, RHT, SKU, SUK and US for granting permission to access the digital images or to consult the specimens personally. The authors are also thankful to Dr. Rane Om Prakash, Senior Curator, Natural History Museum, UK for sending us the digital images of type specimens and to Miss S. Madhura, for line drawings.

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