

A new endemic species of *Spermacoce* L. 1753 (Equisetopsida: Gentianale: Rubiaceae) from Tamil Nadu, India: *Spermacoce Venkatesalui*

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Abstract

A new endemic species, *Spermacoce Venkatesalui*, is described from the Tropical dry deciduous forest Vellimalai sacred grove, Kanniyakumari, India. This species is closely allied to *Spermacoce hispida* L, but can be differentiated by several characters, including a pumilus herb with a terete stem and angles absent. Leaves obovate-spatulate, oblanceolate, or elliptical; apex truncate, rounded, or mucronate; base narrowly cuneate; lamina fleshy; margin serrulate-aristate; lateral veins not prominent. Stipules carnose, apex divided into two equal triangular lobes with 2–4 bristles. Bracts absent. Inflorescence terminal and axillary; flowers 6–8(–10) per axil. Calyx lobes 4–5, lanceolate; hypanthium subglobose. Petals elliptic or broadly lanceolate. Filaments 0.5–0.8 mm long. Fruit globose, densely hispidulous; capsule crustaceous; seeds oval. To facilitate the recognition and understanding of the newly described species, a comprehensive taxonomic account is provided, including a detailed morphological description, diagnostic, comparative table of allied species, distribution, ecology, phenology, distribution map, colour photographs, and line illustrations. Based on the IUCN Red List Categories and Criteria (Version 16, 2024), the new species is provisionally assessed as Critically Endangered (CR).

1 Introduction

Within Rubiaceae Juss., *Spermacoce* L. is the eighth-largest genus, established by Linnaeus in 1753 [1]. The genus comprises approximately 290 currently accepted species distributed throughout tropical and subtropical regions [2]. According to Flora of India, Vol. 14 [3], twelve species are recorded from India, including five native species, six introduced species, and one endemic species, *Spermacoce malabarica* (Sivar. & Manilal) Sivar., R.V. Nair & Kunju. Since the description of *S. malabarica* in 1987, no additional species of *Spermacoce* have been reported from India for nearly four decades.

The species *Spermacoce* is commonly found in a wide range of habitats, including grasslands, forest margins, open woodlands, rocky outcrops, wetlands, coastal areas, agricultural lands and disturbed sites [4]. The genus is characterised by opposite leaves with interpetiolar stipules, axillary or terminal glomerulate inflorescences, sympetalous corolla, an inferior bicarpellate ovary, and a capsular fruit that usually dehisces transversely or longitudinally [5]. Owing to considerable morphological variation with closely related genera, the circumscription and taxonomy of *Spermacoce* have been the subject of extensive revision [6]. Recent taxonomic studies have improved species delimitation and clarified relationships within the tribe *Spermacoceae* L. [7].

Botanical exploration was conducted between December 2024 and March 2026 to document the diversity and ecology of the unreserved tropical dry deciduous forests of Vellimalai Hill, Kanniyakumari District, Tamil Nadu, India (Fig. 1). During the survey, the first author encountered an unusual species of *Spermacoce* L. growing on rocky outcrops and exhibiting a pumilus habit. The collected specimens were critically examined using regional floras and relevant taxonomic literature [8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22], but could not be assigned to any previously described species. Detailed comparisons were subsequently undertaken with digitised herbarium specimens housed at the Madras

Herbarium (MH), Central National Herbarium (CAL), Botanical Survey of India (BSI), Assam Herbarium (ASSAM), Arunachal Pradesh Herbarium (ARUN), Botanical Survey Herbarium, Central Circle (BSHC), Dehradun Herbarium (BSD), Calicut University Herbarium (CALI), Forest Research Institute Herbarium (DD), National Botanical Research Institute Herbarium (LWG), Blatter Herbarium (BLAT), JCB Herbarium (JCB), Sri Krishnadevaraya University Herbarium (SKU), Panjab University Herbarium (PU), Gauhati University Herbarium (GUH), Kerala Forest Research Institute Herbarium (KFRI), and Rapinat Herbarium (RHT). No matching specimens were located, and the taxon is therefore recognised here as a species new to science.

The new species was further compared with morphologically similar species of *Spermacoce hispida* L. based on live material and a literature survey of Flora of India, Vol. 14 [3]; Flora of China Vol. 19 [23]; FloraBase—The Western Australian Flora <https://florabase.dbca.wa.gov.au/> [24]; Species Plantarum Vol. 1 [25]; The Flora of British India Vol. 3 [26]; The Flora of the Malay Peninsula, Vol. 2 [27]; Flore Générale de l'Indo-Chine, Vol. 3 [28]; A Revised Handbook to the Flora of Ceylon, Vol. 12 [29]; Rubiaceae of Thailand: A Pictorial Guide to Indigenous and Cultivated Genera [30]; Flora of Singapore, Vol. 13 [31] and World Flora Online (<http://www.worldfloraonline.org>) [32]. A detailed morphological description, a comparative table highlighting the diagnostic characters (Table 1; Fig. 4), a distribution map of the study area, a conservation assessment, colour photographs, and detailed botanical illustrations are provided to facilitate accurate identification and recognition of the new species.

2 Materials and methods

Live specimens and plant parts of the new species were collected from the study area, and GPS coordinates and elevation data were recorded. Phenological observations were carried out between January 2025 and February 2026. Morphological characters were examined through dissection under a stereomicroscope, and minute indumentum features were studied using an OLYMPUS CX31 light microscope fitted with an OPTIKA camera. High-resolution images captured with a Nikon D5300 camera were used to prepare a Lankester Composite Dissection Plate (LCDP). Study area and distribution maps were generated using Quantum Geographic Information System (QGIS) (<https://www.qgis.org>), while extent of occurrence (EOO) and area of occupancy (AOO) were estimated using Geospatial Conservation Assessment Tool (GeoCAT) (<https://geocat.iucnredlist.org/>). Conservation assessment followed the IUCN Red List Categories and Criteria Version 16, 2024 (<https://www.iucnredlist.org/>) [33].

2.1 Herbarium preparation

Voucher specimens were prepared using standard herbarium techniques for deposition in indexed herbaria, following the protocols practised at the Southern Regional Centre of the Botanical Survey of India (BSI). Healthy plant material bearing flowers and fruits was collected and initially fixed in 40% formaldehyde. To prevent decay and insect infestation, the specimens were subsequently poisoned by dipping the entire plant in a saturated solution of mercuric chloride in ethyl alcohol. The specimens were then carefully arranged and pressed between newspapers to preserve their natural morphology. Drying

was carried out by replacing the blotting papers daily until the specimens were completely dehydrated and well preserved. Finally, the dried specimens were mounted on standard herbarium sheets (42 × 28 cm) using suitable adhesive, ensuring all diagnostic characters are clearly visible.

3 Results

3.1 Taxonomic treatment

Spermacoce Venkatesalui S. Akash, K. Manikandan & A. Rajesh **sp. nov.**

Figures 1, 2, 3, 4, 5; Table 1.

Type. INDIA, Tamil Nadu, Kanniyakumari District, Vellimalai Hill, Sacred Grove, Tropical dry forest, 8°10'11.2"N 77°19'38.2"E; 56 m elev., 19 February 2025, S. Akash, K. Manikandan & A. Rajesh 602 (holotype MH! & isotype RHT!)

3.2 Diagnosis

A pumilus herb with a terete stem and angles absent. Leaves obovate-spatulate, oblanceolate, or elliptical; apex truncate, rounded, or mucronate; base narrowly cuneate; lamina fleshy; margin serrulate-aristate; lateral veins not prominent. Stipules carnose, apex divided into two equal triangular lobes with 2–4 bristles. Bracts absent. Inflorescence terminal and axillary; flowers 6–8(–10) per axil. Calyx lobes 4–5, lanceolate; hypanthium subglobose. Petals elliptic or broadly lanceolate. Filaments 0.5–0.8 mm long. Fruit globose, densely hispidulous; capsule crustaceous; seeds oval (Table 1; Fig. 4).

Table 1

Diagnostic morphological characters of *Spermacoce Venkatesalui* sp. nov. with *Spermacoce hispida* L.

Characters	<i>Spermacoce Venkatesalui</i>	<i>Spermacoce hispida</i>
Habit	Pumilus herb	Robust subshrub
Stem	Terete, angles absent	Subterete to quadrate, angles cartilaginous to winged
Leaves	Obovate-spatulate, oblanceolate or elliptical	Oblong-elliptic, obovate, or spatulate
Leaf apex	Truncate, rounded or mucronate	Acute, obtuse, or rounded
Leaf base	Narrowly cuneate	Cuneate to obtuse and usually long decurrent,
Lamina	Fleshy	Drying, papery to leathery
Leaf margin	Serrulate-aristate	Scaberulous or ciliolate and often revolute
Venation	Lateral veins not prominent	Lateral veins 2 or 3(or 4) pairs
Stipule	Carnose, apex divided into two equal triangular lobes with 2–4 bristles	Membranous sheaths with 8–10 bristles
Bract	Absent	Linear or infrequently stipuliform
Inflorescence	Terminal and axillary	Axillary
Flowers	6–8(–10) per axil	1–6 per axil
Calyx	Lobes 4–5, lanceolate	Lobes strictly 4, linear-lanceolate to narrowly triangular
Hypanthium	Subglobose	Ellipsoid
Petal	Elliptic or broadly lanceolate	Elliptic-oblong, lanceolate, or triangular
Filament size	0.5–0.8 mm long	1.5–2 mm long
Fruit	Globose, densely hispidulous	Ellipsoid to subglobose or flattened perpendicular to septum, sparsely hirsute
Capsule	Crustaceous	Chartaceous
Seed shape	Oval	Elliptic to elliptic-oblong

3.3 Description

Perennial pumilus herb, suberect or prostrate, 15–25 cm tall, with few or many branches arising from the basal portion of the stem. Stem fleshy, terete, 1–3 mm in diameter near the base, green or reddish in colour, sparsely covered with puberulous hairs; internodes 1–2.5 cm long. Leaves arranged in opposite

decussate pairs; lamina obovate-spatulate, oblanceolate, or elliptical, 1.5–2 × 1–1.5 cm; apex truncate, rounded, or mucronate; base narrowly cuneate; margins serrulate and fimbriate; lamina fleshy, scaberulous; midvein prominent on both surfaces, lateral veins not prominent; petiole short or subsessile, 2–3 mm long. Stipules 2, interpetiolar, carnosae, 1.5–2 × 2.8–3 mm; apex divided into two equal triangular lobes, each lobe 0.8–1 mm long, with 2–4 bristles, unequal in size, green, and moderately pilose. Bracts absent. Inflorescence axillary and terminal, few- or many-flowered, 1–1.6 cm in diameter. Flowers 6–8(–10), hermaphrodite, actinomorphic, complete, and epigynous; pedicel subsessile, 1–1.5 mm long, green, puberulous. Calyx persistent, green, valvate aestivation, hirsute; sepals 4–5, gamosepalous, lanceolate, 2–2.5 × 0.8–1 mm; apex acute; margins ciliate; hypanthium portion subglobose, 1–1.2 × 0.8–1 mm. Corolla gamopetalous, infundibuliform, 0.6–0.8 cm long, valvate aestivation, pale pink to pinkish white, glabrous, deciduous; petals 4, broadly lanceolate or elliptic-oblong, 3–4 × 2–3 mm; apex acute. Androecium consisting of 4 epipetalous stamens, didynamous, inserted, alternipetalous; filaments subsessile or short, 0.8–1.2 mm long, glabrous; anthers dorsifixed, dithecous, elliptic, yellow, introrse, dehiscent longitudinally. Gynoecium bicarpellary, syncarpous; ovary inferior, 2-locular, globose to subglobose; ovule 1 in each locule; style 2–3 mm long, glabrous; stigma bifid. Nectary disc present at the apex of the ovary. Fruit a 2-valved capsule, globose, 2–2.5 × 2–2.5 mm, golden yellow to brown when mature, densely hispidulous; capsule crustaceous; calyx persistent. Seeds 2 per capsule, ovate in outline, 1.5–1.8 × 1–1.2 mm, obtuse at both ends, dark brown, and glabrous.

3.4 Distribution and ecology

The species is currently known only from its type locality in the Sacred Grove of Vellimalai Hill, Kanniyakumari District, Tamil Nadu, India. It occurs at an elevation of approximately 55 m above sea level, growing on rocky substrates with accumulations of humus and sandy soil in tropical dry deciduous forest. According to Raunkiaer's life-form classification [34], the species is a phanerophyte. Its fleshy leaves represent an adaptation for water storage and reduced transpiration, enabling the species to persist throughout the year under the seasonally dry conditions of its habitat. The plant is growing in association with *Indigofera uniflora* Buch.-Ham. ex Roxb., *Tephrosia pumila* (Lam.) Pers., *Leucas aspera* (Willd.) Link, *Senegalia catechu* (L.f.) P.J.H. Hurter & Mabb., *Flueggea leucopyrus* Willd., *Catunaregam spinosa* (Thunb.) Tirveng (Fig. 6).

3.5 Phenology

The species exhibits two flowering and fruiting periods annually, the first from May to August and the second from September to December. Following anthesis, the flowers develop into mature, seed-bearing capsules within approximately 20–25 days.

3.6 Etymology

The specific epithet *Venkatesalui* honours Dr Venugopalan Venkatesalu, former Professor and Head of the Department of Botany and Director of the Directorate of Academic Research at Annamalai University, Chidambaram, Tamil Nadu, India, in recognition of his outstanding contributions to the department and the university.

3.7 Preliminary IUCN conservation assessment

According to the IUCN Red List Categories and Criteria (Version 16, 2024), the species is assessed as Critically Endangered (CR). It is currently known from a single locality with an estimated area of occupancy (AOO) of 8.000 km² and an extent of occurrence (EOO) of 0.028 km². The total population comprises approximately 480 mature individuals. The species occurs within a sacred grove, where increasing anthropogenic disturbance associated with temple visitation poses a significant threat to its habitat and population. Owing to its highly restricted distribution, small population size, and continuing habitat disturbance, the species is considered to face an extremely high risk of extinction in the wild (Fig. 6).

4 Discussion

In India, *Spermacoce* L. is represented by relatively few species compared with other tropical regions. Following the revision of the genus, only limited nomenclatural and distributional updates have been reported, and no new species has been described from the country since the publication of *Spermacoce malabarica* [24]. The description of new species therefore represents the second new species of *Spermacoce* L. described from India after *S. malabarica*, and the genus now includes 13 species up from 12. This discovery highlights the continued importance of systematic botanical exploration in underexplored habitats and emphasises the need for further floristic surveys to document the country's plant diversity.

The occurrence of *Spermacoce venkatesalui* on rocky outcrops in tropical dry deciduous forest is ecologically noteworthy. Most species of *Spermacoce* L. are associated with open grasslands, disturbed habitats, agricultural fields, forest margins, or seasonally moist environments [4], whereas adaptation to exposed rocky substrates is comparatively uncommon. The perennial succulent habit observed in the new species appears to represent an adaptation to the prolonged seasonal drought characteristic of the study area, enabling survival under conditions of limited soil moisture and high solar radiation.

The discovery of new taxa further highlights the conservation value of the sacred groves, which represent important refugia for endemic and habitat-specialist flora. Despite their ecological significance, these remnant forest ecosystems are increasingly threatened by anthropogenic activities like illegal poaching of forest fuel wood, grazing and clearing of the forest and the tree species are cut down for fodder purposes. The narrow distribution, limited population size, and ongoing habitat disturbances affecting *Spermacoce venkatesalui* emphasise the need for continued botanical exploration, regular population monitoring, and effective conservation strategies to safeguard the species in its natural habitat.

Declarations

Acknowledgement

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Author contribution

Sugaseelan Akash: Conceptualisation, field investigation, data collection, species identification, methodology, specimen documentation, photographic plate preparation, original draft preparation, writing, and manuscript finalisation. Anbudass Sasi Bharathi: Conceptualisation, methodology, writing, review, and manuscript finalisation. Kathavarayan Manikandan: Photography, line illustrations, plate preparation, manuscript review, editing and manuscript finalisation. Selvam Srikanth: Photography, line illustrations, plate preparation, manuscript review, editing and manuscript finalisation. Authinarayanan Rajesh: Supervision, manuscript review, and finalisation.

Funding

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Data availability

The authors did not compile or process any datasets.

Ethics approval

All plant materials were legally obtained under local and national regulations. So, no additional permits were required.

Consent to participate:

Not applicable.

Consent to publication:

Not applicable.

Competing interest:

The authors declare that they have no conflicts of interest.

Clinical trial number:

Not applicable.

Plant reproducibility

Plants of taxonomic interest were documented in the field through detailed observations and photographic records. Representative voucher specimens of the new species were collected following

standard botanical collection procedures and processed using conventional herbarium techniques. The specimens were identified using regional floras, relevant taxonomic literature, authenticated herbarium specimens, and digital taxonomic resources. Species identification was further confirmed through detailed morphological examination by the first author. Voucher specimen No. 602 has been deposited in the recognised indexed herbaria, the Madras Herbarium (MH) and the Rapinat Herbarium (RHT), together with complete collection data to facilitate future verification and ensure the reproducibility of the taxonomic study.

Permission to collect plant/ plant parts

This study was conducted for taxonomic documentation using observational methods and minimal, non-destructive plant sampling. The study site is a sacred grove and is not a legally designated protected area; therefore, no official collection permit was required. Fieldwork was conducted with the knowledge and approval of the local authorities and community, and no legally protected or restricted plant species were collected. Voucher specimens required for the formal taxonomic description of the new species were collected following standard botanical practices, with sampling restricted to the minimum amount of material necessary to avoid any significant impact on the natural population.

Plant guidelines

All plant collection and documentation were carried out in accordance with institutional, national, and internationally accepted guidelines for biodiversity research. The conservation status of the collected taxa was verified using the IUCN Red List, and particular care was taken to avoid unnecessary collection of rare, threatened, or vulnerable species. Field investigations complied with the biodiversity regulations and applicable guidelines of the Government of Tamil Nadu. Plant collection was restricted to the minimum amount of material required for scientific and taxonomic study to avoid adverse impacts on natural populations. Voucher specimens were prepared using standard herbarium techniques and deposited in publicly accessible, recognised herbaria to facilitate future taxonomic verification and ensure the reproducibility of the study

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Figures

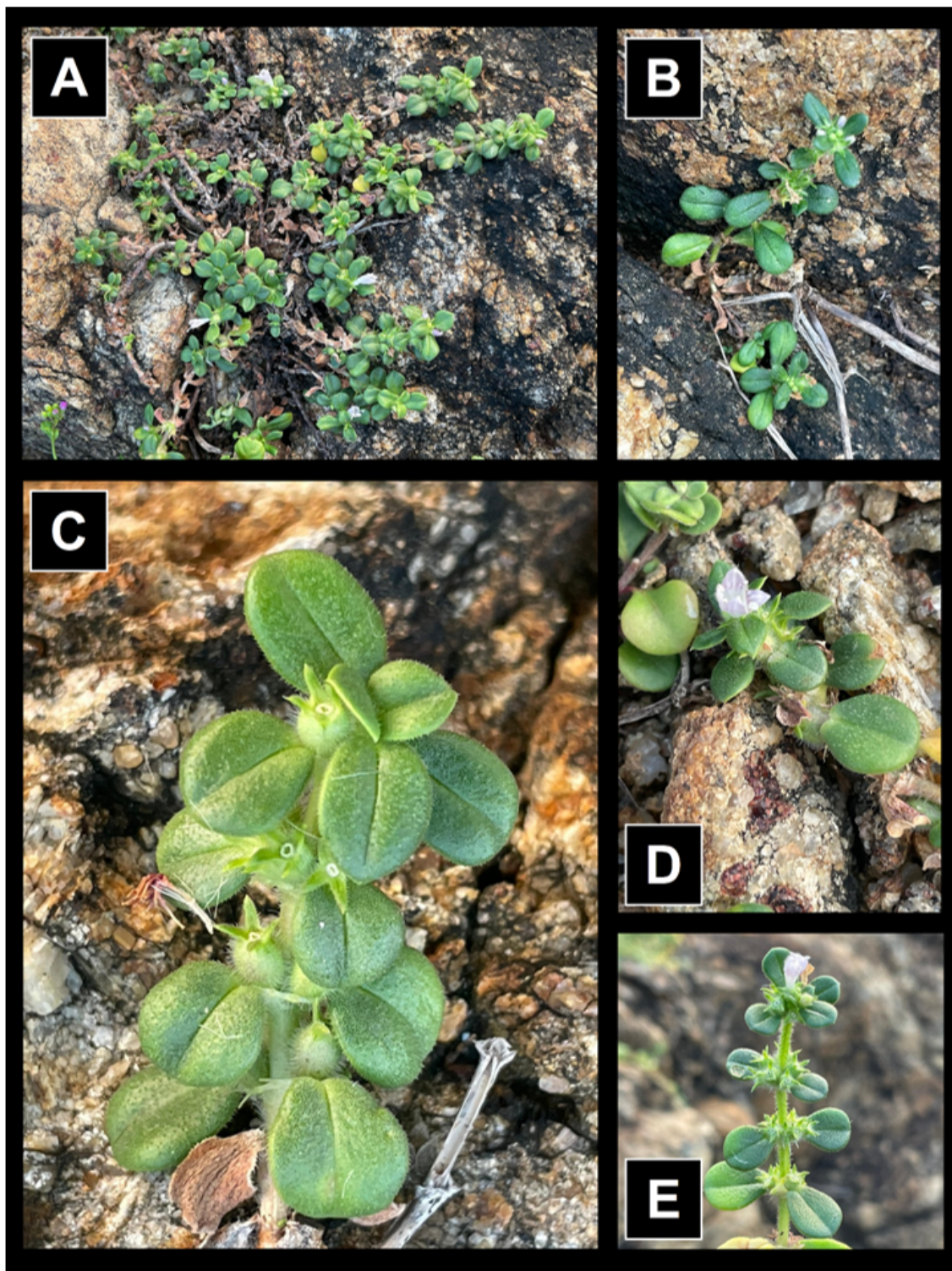


Figure 1

[A, B, C, D, E] - Habit and habitat of *Spermacoce Venkatesalui* sp. nov. (Photo credit: Sugaseelan Akash).

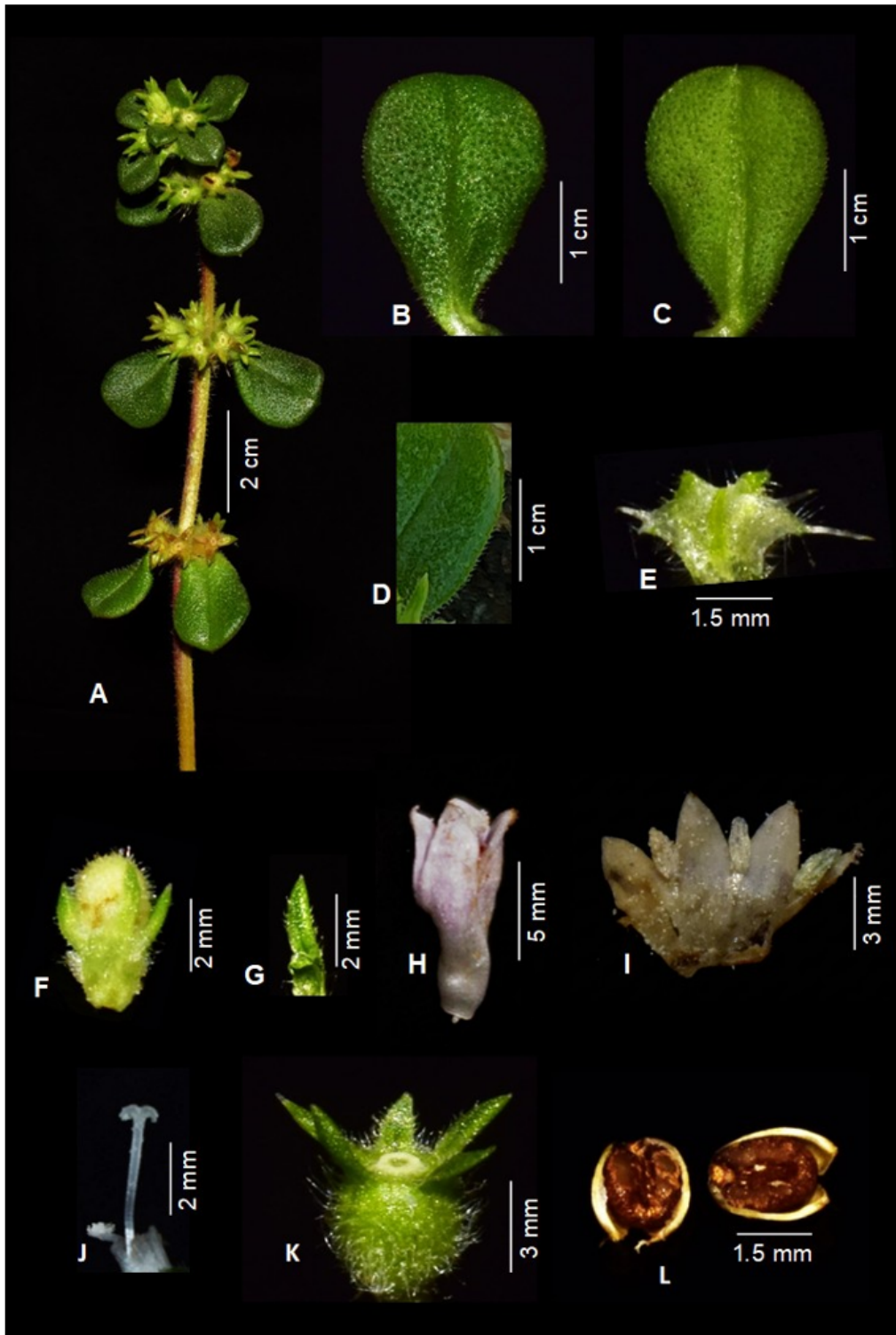


Figure 2

Lankester Composite Dissection Plate (LCDP) of *Spermacoce venkatesalui* sp. nov. **A** mature twig, **B** adaxial surface of a leaf, **C** abaxial surface of a leaf, **D** leaf margin, **E** stipule, **F** immature bud, **G** sepal, **H** corolla, **I** petal, **J** stigma and style, **K** fruit, **L** seed. (Photo Credit: Kathavarayan Manikandan & Sugaseelan Akash).

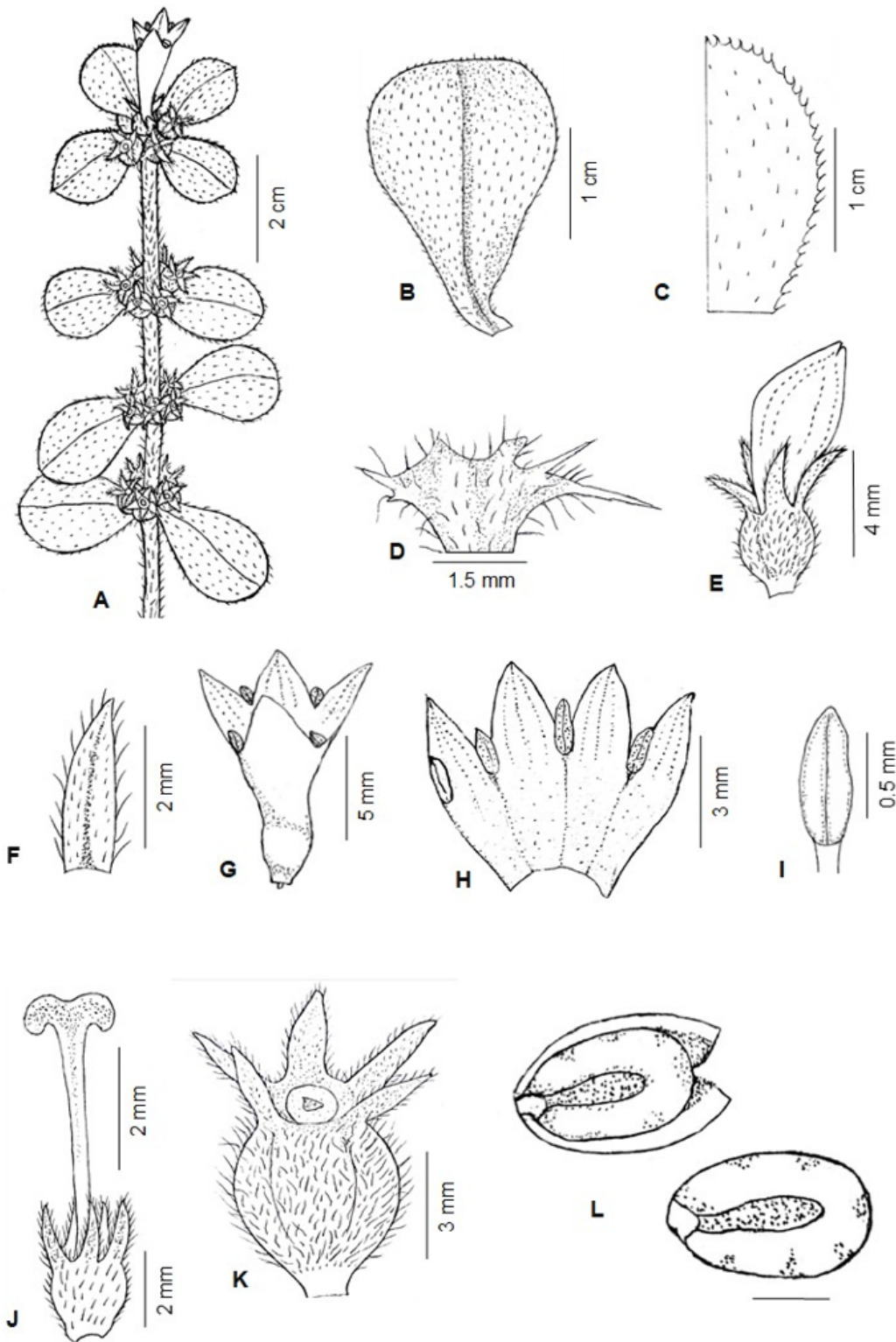


Figure 3

Illustration of *Spermacoce venkatesalui* sp. nov. **A** mature twig, **B** leaf, **C** leaf margin, **D** stipule, **E** mature bud, **F** sepal, **G** corolla, **H** petal with androecium, **I** anther, **J** gynoecium, **K** fruit, **L** seed. (Photo Credit: Selvam Srikanth & Sugaseelan Akash).

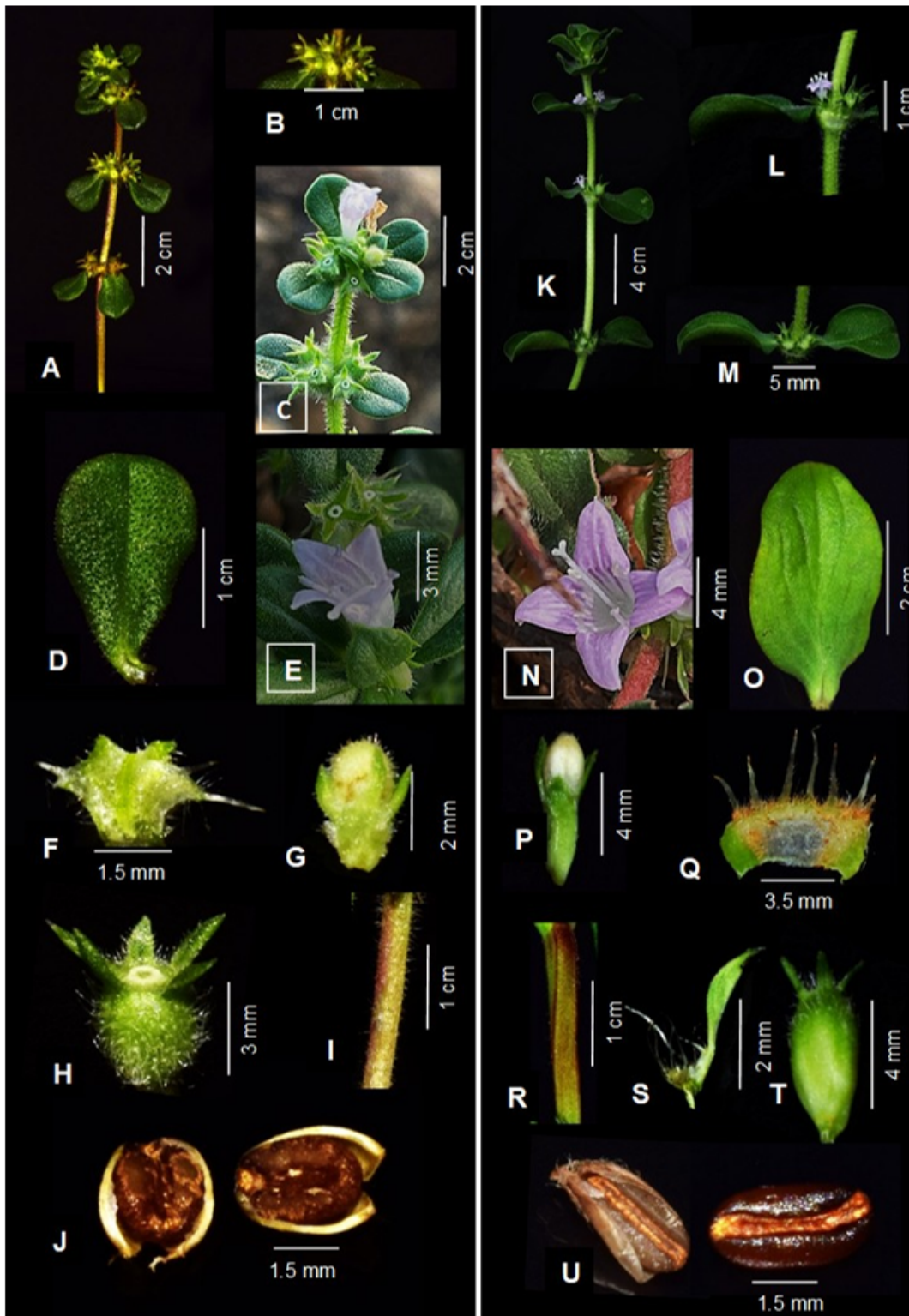


Figure 4

Comparison of the diagnostic character images of *Spermacoce venkatesalui* [A–J] with the closely allied species of *Spermacoce hispida* [K–U]. A & K mature twig, B & M cluster of fruit, C & L inflorescence, D & O leaf, E & N flower, F & Q stipule, S Bract, G & P bud, H & T fruit, I & R stem, J & U seed. (Photo Credit: Kathavarayan Manikandan & Sugaseelan Akash).

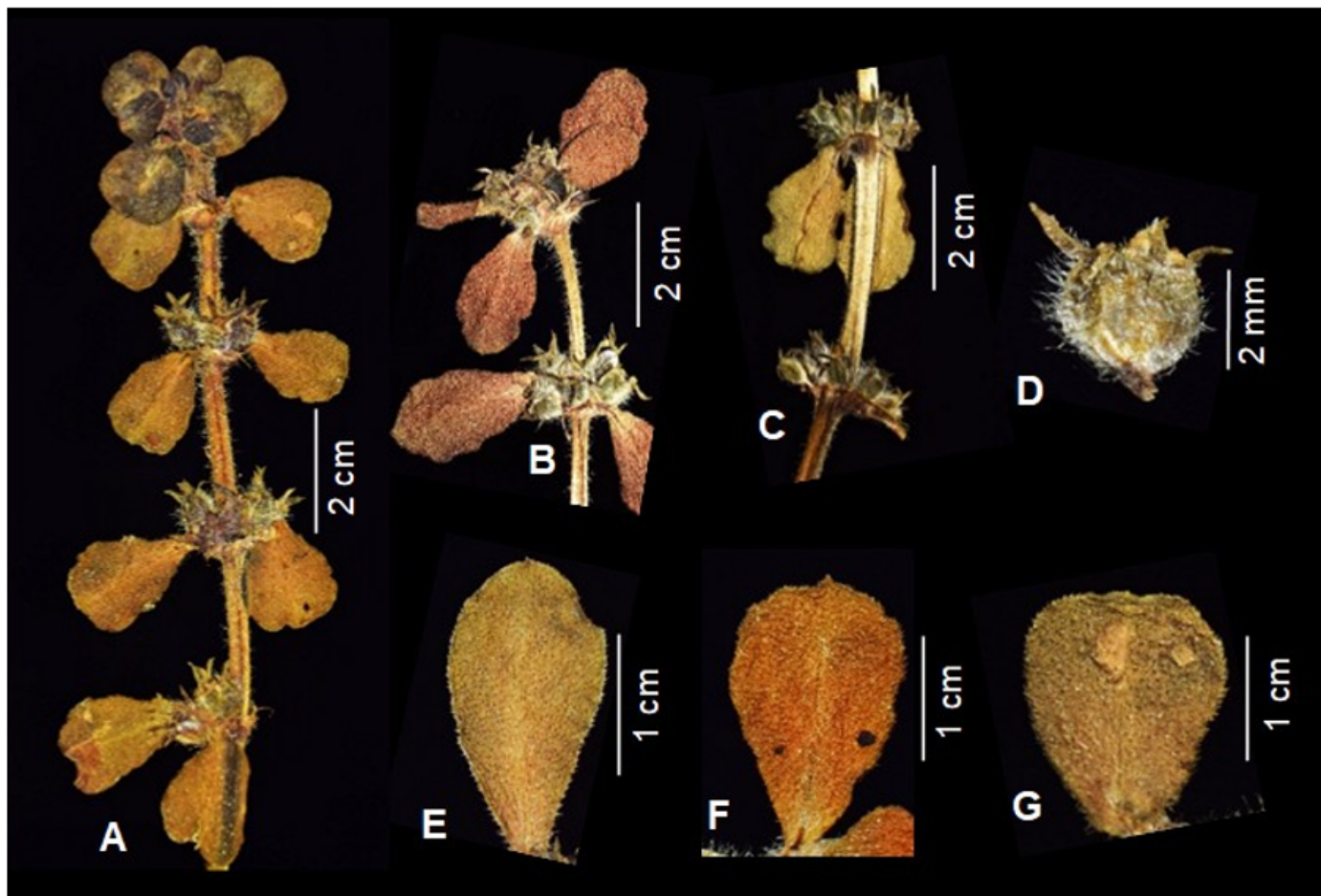


Figure 5

Preserved herbarium specimens of *Spermacoce venkatesalui* sp. nov.: **A**, mature flowering twig; **B**, terminal inflorescence; **C**, axillary inflorescence; **D**, fruit; **E–G**, leaves. (Photo Credit: Kathavarayan Manikandan & Sugaseelan Akash)

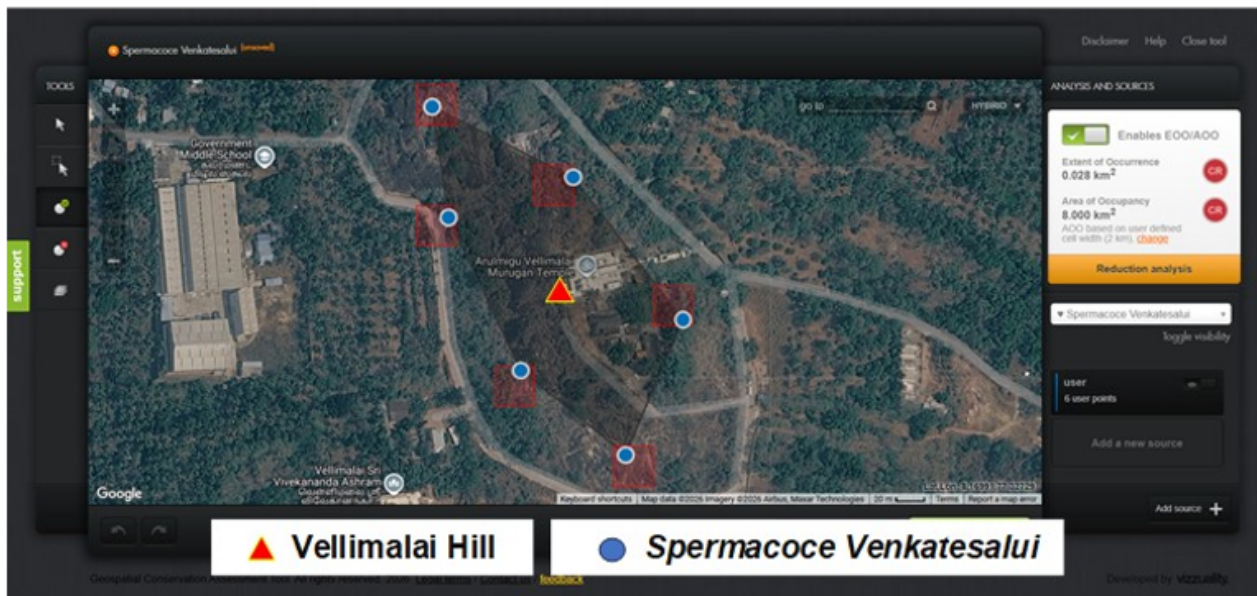
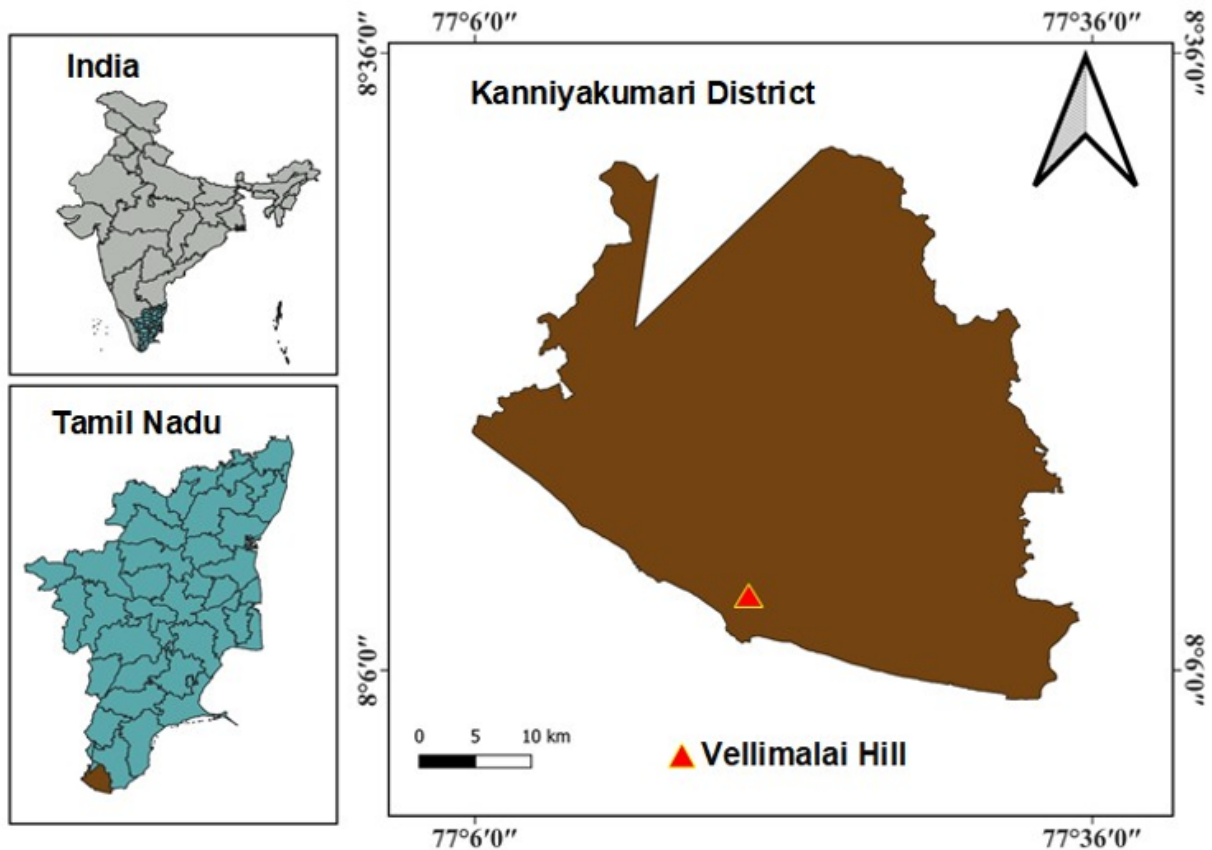


Figure 6

Study area and distributional map of *Spermacoce Venkatesalui* sp. nov. The red-coloured grid cells indicate the Area of Occupancy (AOO) and Extent of Occurrence (EOO). (Photo credit: Sugaseelan Akash).

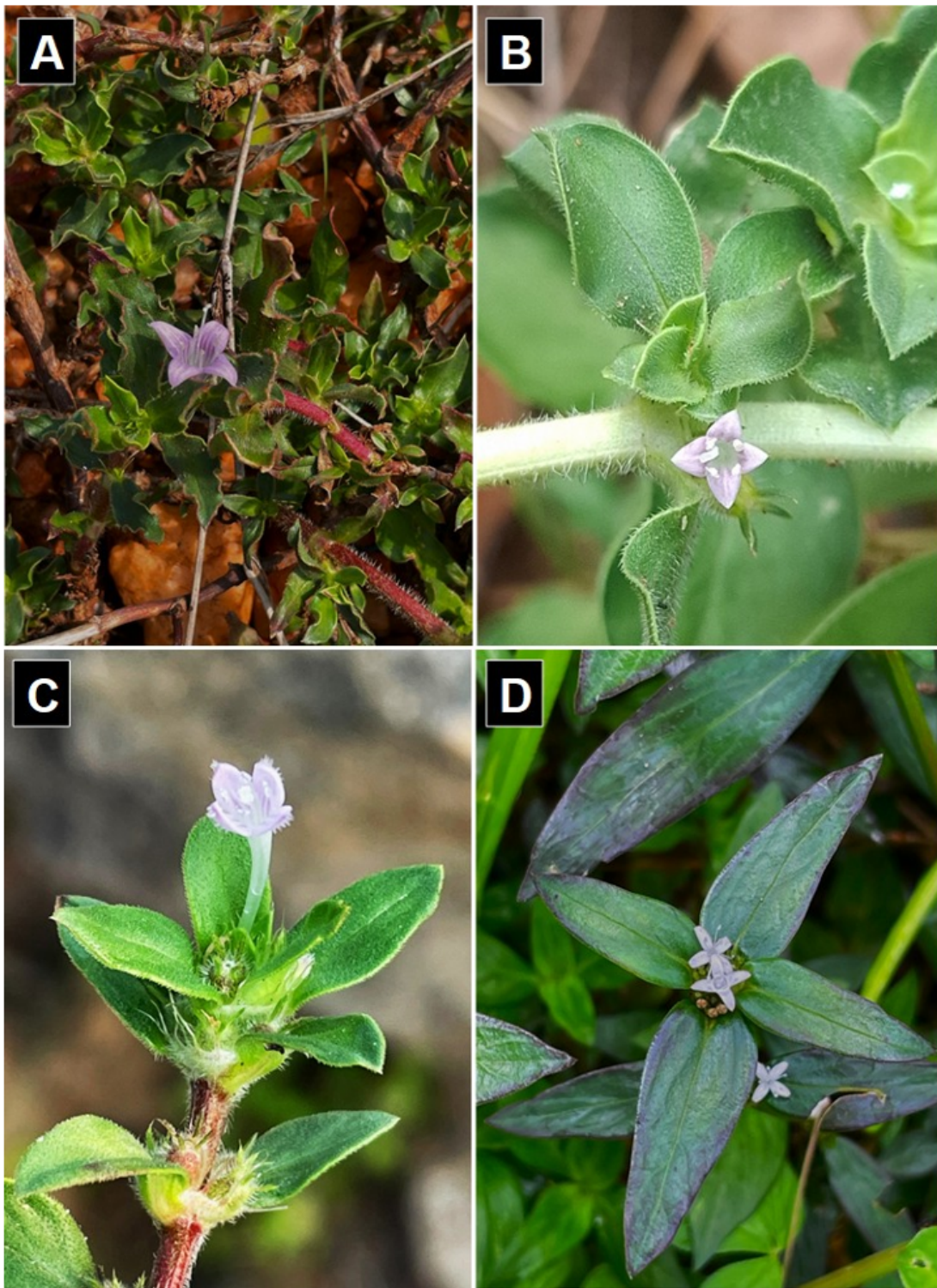


Figure 7

Commonly found *Spermacoce* L. species in Tamil Nadu; **A** *Spermacoce hispida* L. in a dune habitat, **B** *Spermacoce hispida* L. in agricultural land, **C** *Spermacoce articularis* L.f., **D** *Spermacoce remota* Lam. (Photo Credit: Sugaseelan Akash).