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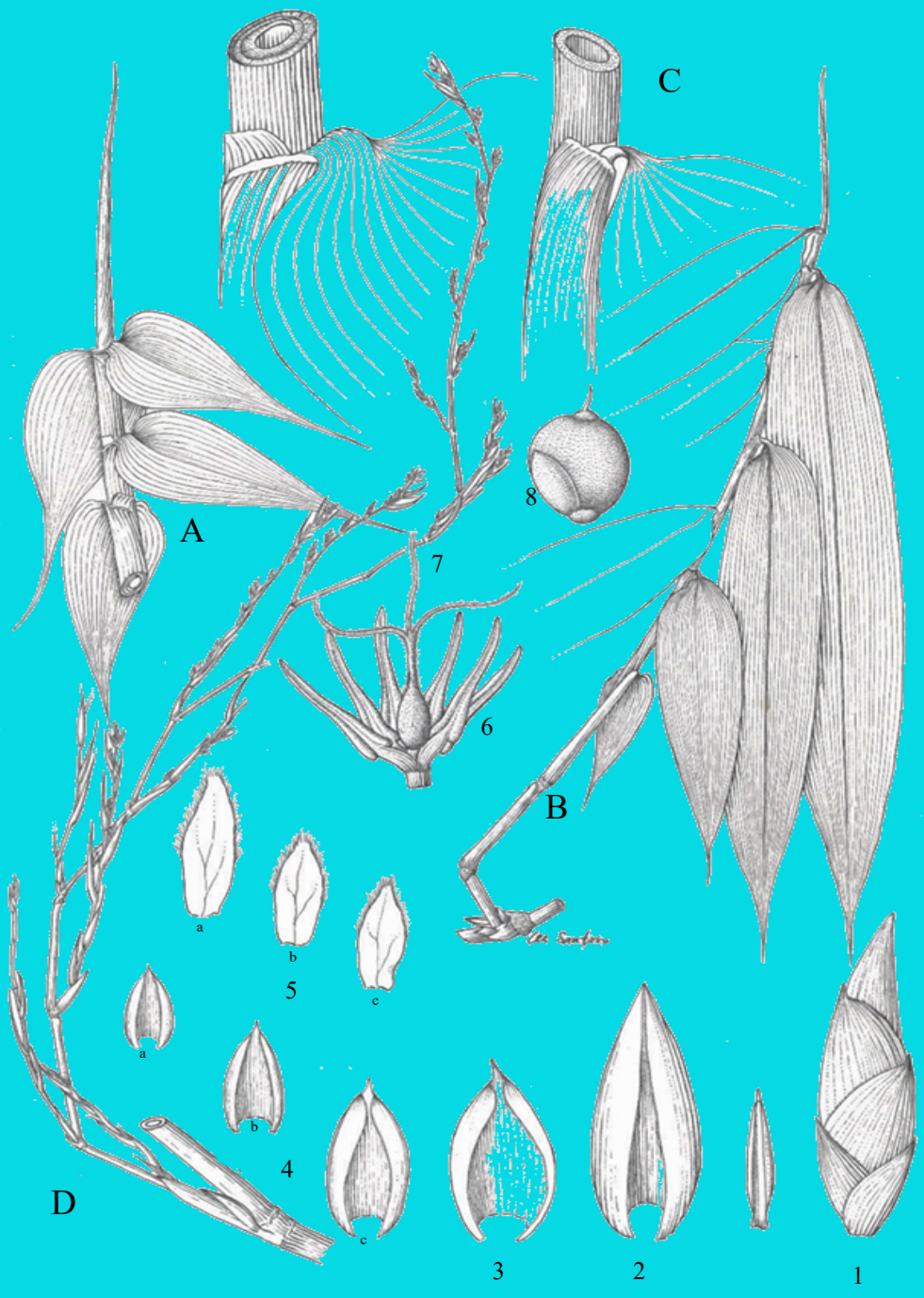

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TRICHODESMA KUMAREUM (BORAGINACEAE), A NEW SPECIES FROM NORTH EAST INDIA

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ABSTRACT
YUMKHAM, S. D., DEVI, N. P., KHOMDRAM, S. D. & DEVI, M. R. 2019. *Trichodesma kumareum* (Boraginaceae), a new species from North East India. Reinwardtia 18(2): 105−113. — A new species, *Trichodesma kumareum* S.D.Yumkham, N.P.Devi, S.D.Khomdram & M.R.Devi (Boraginaceae) is described and illustrated from Manipur State of North East India. It shows affinity with *T. khasianum* and *T. calycosum*, but can be differentiated from the rest by its larger size in habit, helicoid cyme, closely packed numerous flowers ranging between 120–160 in number per inflorescence, presence of eight faucal appendages at the base of corolla lobes, adpressed urn–shaped flowering calyx and 1–4 lobed ovaries. A comprehensive description, photographs, relevant notes, conservation status and key to species are incorporated.

Key words: Boraginaceae, new species, North East India, *Trichodesma.*

ABSTRAK
YUMKHAM, S. D., DEVI, N. P., KHOMDRAM, S. D. & DEVI, M. R. 2019. Satu jenis baru *Trichodesma kumareum* (Boraginaceae), dari Timur Laut India. Reinwardtia 18(2): 105−113. — Satu jenis baru, *Trichodesma kumareum* S.D.Yumkham, N.P.Devi, S.D.Khomdram & M.R.Devi (Boraginaceae) dideskripsikan dan diilustrasikan dari Manipur, sebuah Negara bagian Timur Laut India. Jenis tersebut memiliki persamaan dengan *T. khasianum* and *T. calycosum*, tetapi dapat dibedakan dengan keduannya berdasarkan ukuran yang lebih besar, perbungaan berbentuk payung menggarpu yang *helicoid*, setiap perbungaan mengandung 120–160, terdapat 8 pelengkap *faucal* pada bagian dasar tabung mahkota, kelopak menyerupai guci dan memiliki 1–4 bakal buah yang bercuping. Artikel ini menggabungkan deskripsi yang komprehensif, foto, catatan-catatan yang relevan, status konservasi dan kunci identifikasi jenis.

Kata kunci: Boraginaceae, jenis baru, Timur Laut India, *Trichodesma.*

INTRODUCTION

The genus *Trichodesma* R.Br. (Boraginaceae) consists of about 45 species and distributed in tropical to sub–tropical region of Asia, Arabian Peninsula, Africa and Australia (Weigend *et al*., 2014). New phylogenetic evidences revealed that it comes under the tribe Trichodesmeae along with the genus *Caccinia* Savi (Chacon *et al*., 2016). Main diagnostic feature of the genus includes presence of accrescent calyx, long anthers with soft hairs usually on the abaxial side and often twisted connectives produced above the thecae (Mabberley, 2008). From India, eight species are recorded and this includes *T. mudgalii* A.Kumar & K.K.Khanna, *T. indicum* (L.)Lehm., *T. decurrens* Banerjee, *T. africanum* (L.)Lehm ., *T. sedguickianum* Banerjee, *T. khasianum* C.B. Clarke, *T. calycosum* Collett et Hemsl. and *T. zeylanicum* (Burm.f.) R.Br. (Banerjee & Pramanik, 1975; Kumar & Khanna, 2002).

During a botanical exploration conducted in Manipur State of North East India, the authors came across a striking species of *Trichodesma.* A check on the available literature and critical examination of taxonomic characters revealed that the collected taxon is a new species, and hence described here as *Trichodesma kumareum*.

MATERIALS AND METHODS

The voucher specimens of the new species were collected from four localities of Kakching (Heikakpokpi Hill Range, Wairi) and Chandel

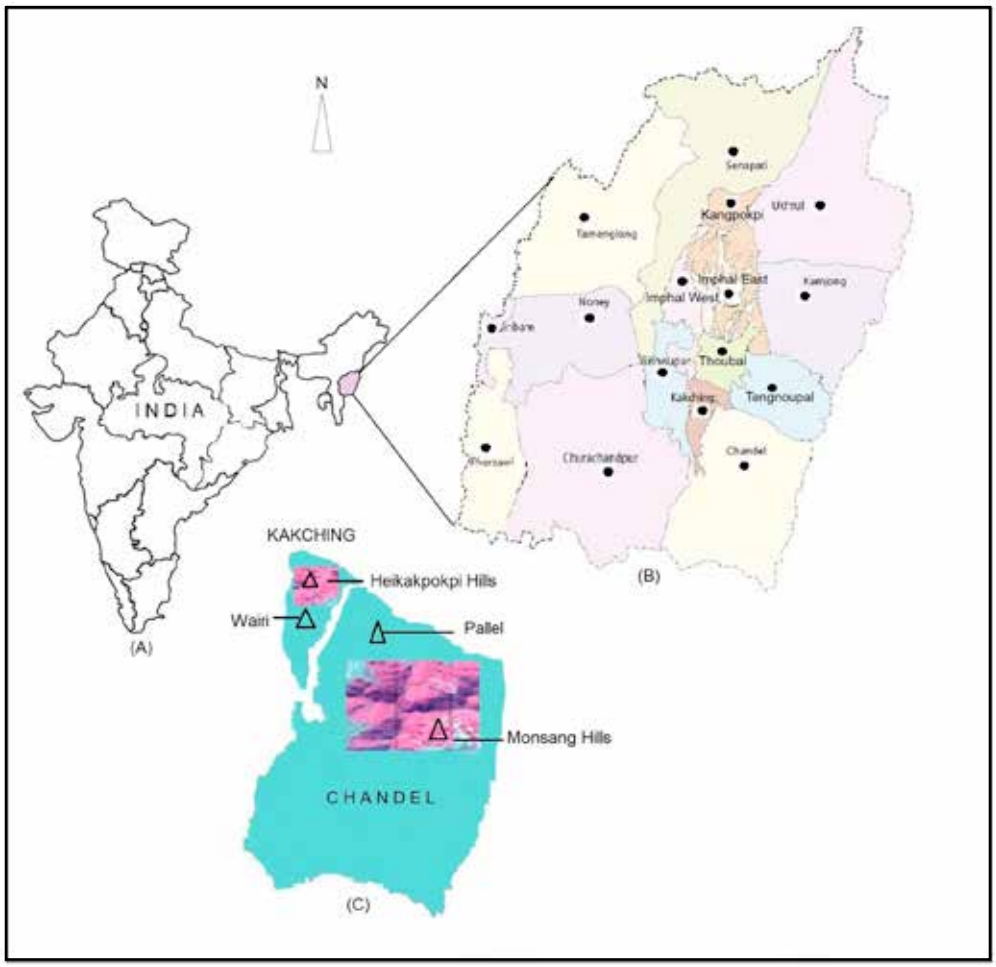

Fig. 1. A–B. Map of India showing location of Manipur State with its sixteen districts. C. Distribution of *Trichodesma kumareum* S.D.Yumkham, N.P.Devi, S.D.Khomdram & M.R.Devi, *spec. nov.* in Kakching and Chandel Districts.

(Monsang Hills, Pallel) Districts of Manipur (India) during June 2016 to March 2018 (Fig. 1A, B). It was compared with closely allied preserved specimens deposited at CAL (Botanical Survey of India, Central National Herbarium, Calcutta), ASSAM (Botanical Survey of India, Shillong), Herbarium JCB (Herbarium Joseph's College, Bangalore). Relevant literature (Kanjilal *et al.,* 1939; Al–Shehbaz, 1991; Retief & Vanwyk, 2002; Mosti & Selvi, 2007) were consulted to assess the existing species and for studying the differences in their morphological parameters. Microphotographs of palynological and anatomical characters were taken by using phase–contrast microscope (Motic BA 210), LED–USB Cooling Tech Microscope, Sony DSC–W610 and Nikon D5300. For pollen studies, mature anthers were smeared in mixture of glycerol and acetocarmine (1:1) and stain in aniline blue (1%). The size of pollen grains were calculated by taking average from 15 pollen grains and expressed as Polar axis/ Equatorial axis (P/E). Terminology by Punt *et al.* (2007) is used to describe the characters of pollens. For anatomical studies of leaves, epidermal peels were obtained both from abaxial and adaxial sides and treated with 4 % KOH solution, washed in water and mounted in glycerol. All the specimens were deposited separately at national and regional herbaria (CAL, ASSAM, MUMP–Manipur University Museum of Plants, MZUH–Mizoram University Herbarium).

RESULTS

TAXONOMIC TREATMENT

Trichodesma kumareum S. D. Yumkham, N. P. Devi, S. D. Khomdram & M. R. Devi, *spec. nov.* — Type: India, Manipur, Heikakpokpi Hills Range, Kakching District, 820–988 meters, near a small stream, ferruginous red soil, 24°29 '53.52"N, 93°58'52.54"E, 12 October 2017, *S. D. Yumkham & N. P. Devi 003585* (Holotype: CAL!, isotypes: ASSAM!, MUMP!) (Figs. 2–4).

Diagnosis. The species is morphologically

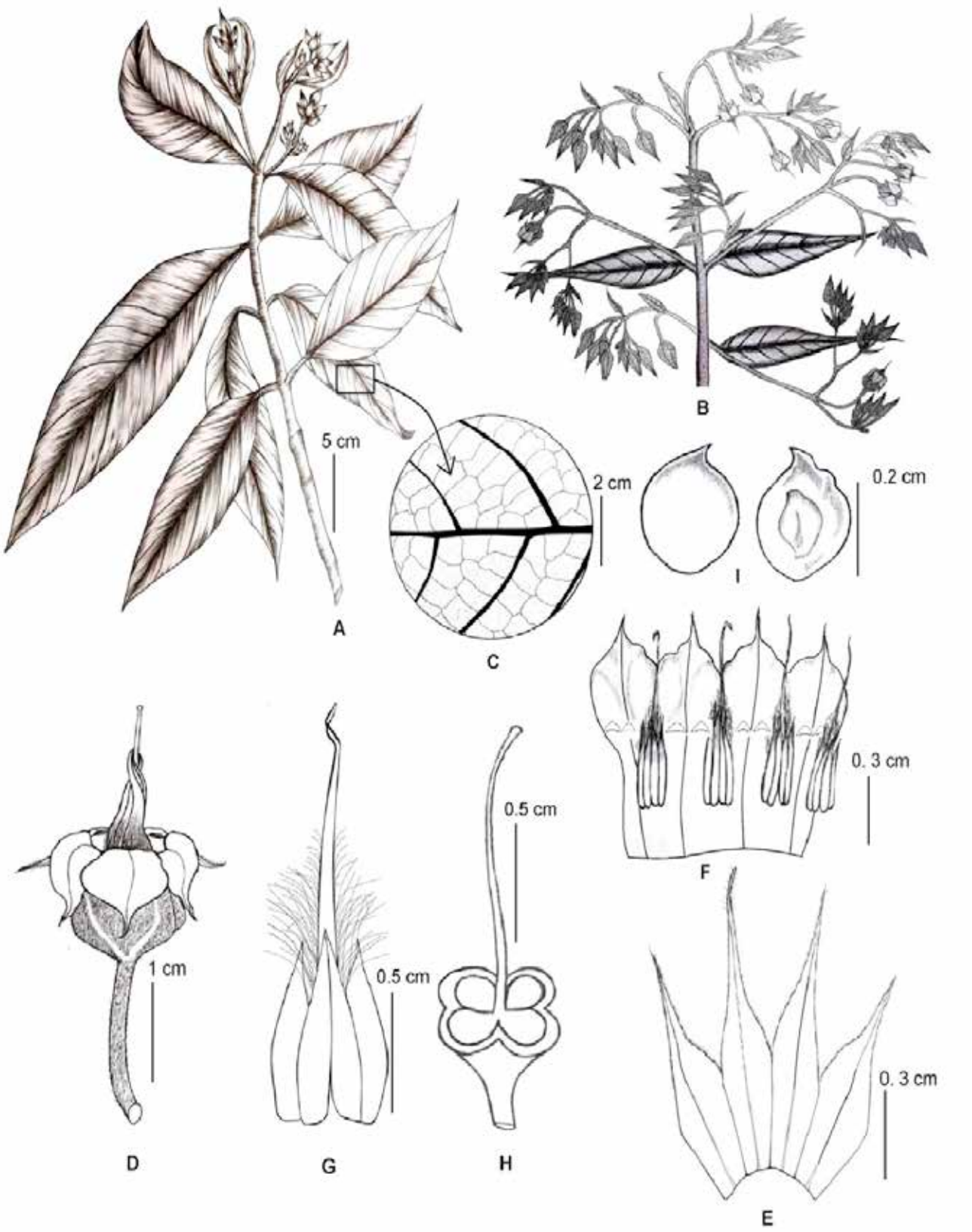

Fig. 2. *Trichodesma kumareum* S.D.Yumkham, N.P.Devi, S.D.Khomdram & M.R.Devi, *spec. nov*. A.Habit. B. Flowering twig. C. Enlarged section of leaf. D. Flower. E. Calyx opened (inner view). F. Opened corolla showing faucal appendages at the base of corolla lobes with attached stamens. G. Stamen showing hairs & twisted connective apex. H. Gynoecium with inconspicuous stigma I. Seeds showing adaxial & abaxial sides.

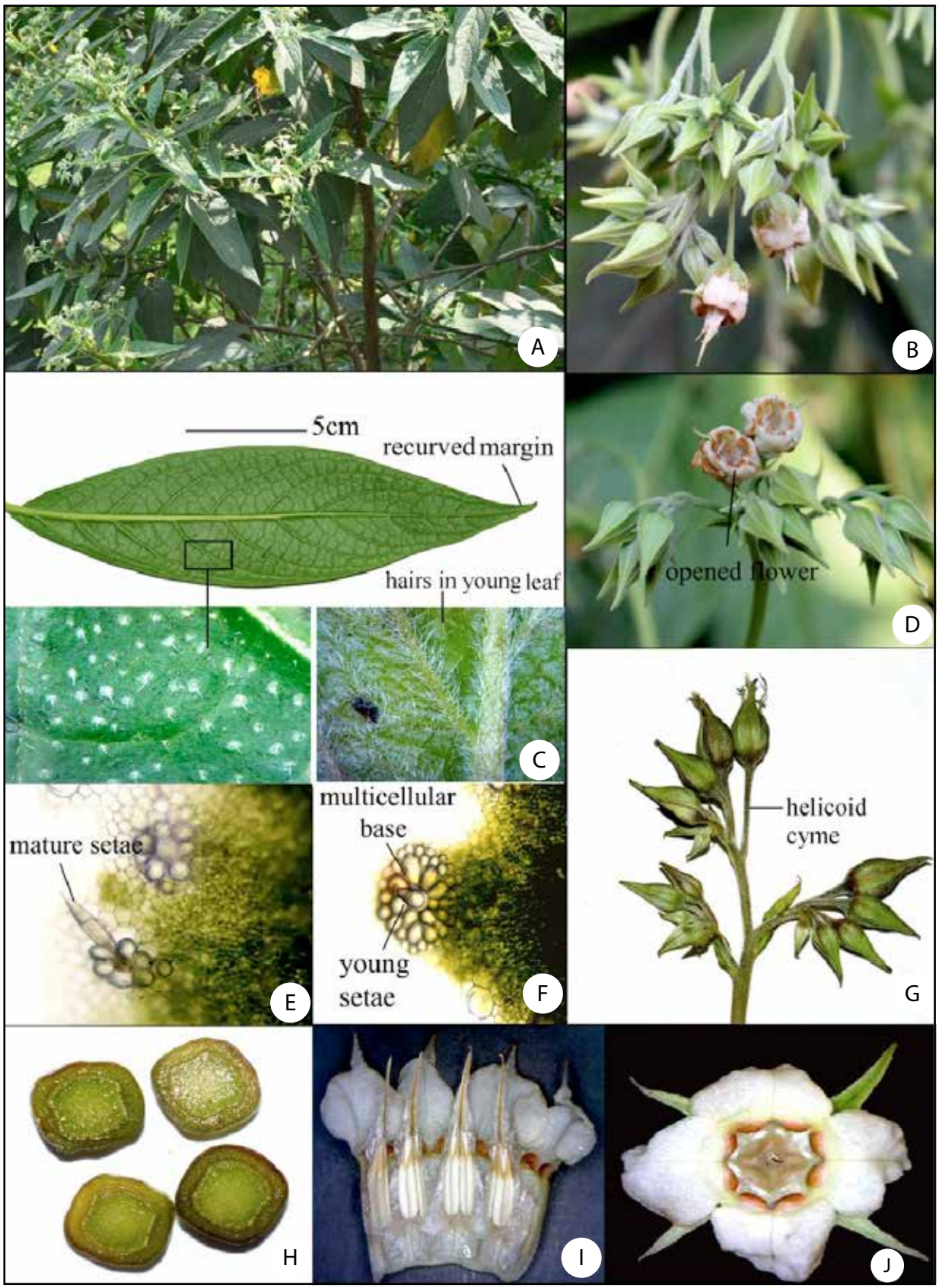

Fig. 3. *Trichodesma kumareum* S.D.Yumkham, N.P.Devi, S.D.Khomdram & M.R.Devi *spec. nov*. A. Habit. B. Inflorescence. C. Leave showing recurved apex along with portion showing trichomes on it. D. Fully opened flowers. E. Mature setae of a mature leave. F. Young developing setae with multicellular base. G. Part of inflorescence showing helicoid cyme. H. Section showing tetragonous stem. I. Dissected corolla. J. Vertical view of a flower showing radiating sepals.

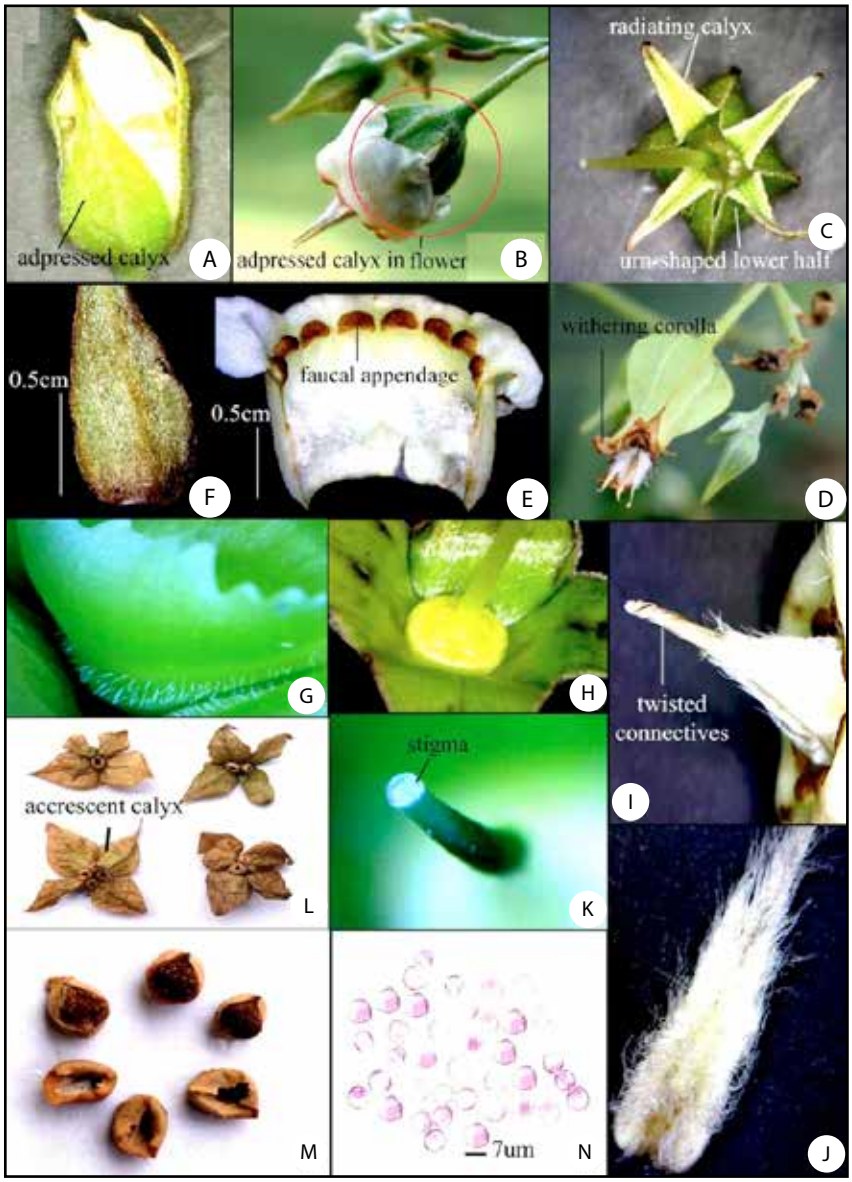

Fig. 4. Microphotographs of floral parts in *Trichodesma kumareum* S.D.Yumkham, N.P.Devi, S.D. Khomdram & M.R.Devi *spec. nov*. A–B. Stages showing adpressed calyx from budding stage to maturity. C. Urn–shaped calyx formed by lower half and radiating upper half. D. Adpressed calyx in withered corolla. E. Faucal appendages at the base of corolla lobes. F. Part of calyx covered with whitish hairs. G. Cupular nutlets with stiff trichomes. H. Gynobase four–chambered ovary. I. Spirally twisted connectives. J. Stamen ornamented with fine pilose. K. Inconspicuous stigma. L. Accrescent calyx in 1–, 2–, 3– 4–lobed ovary. M. Individual nutlets. N. Tricolporate pollen grains, 400×.

similar to *T. khasianum* C.B.Clarke and *T. calycosum* Collett et Hemsl., but can easily be distinguished from the two species by its exceedingly larger size in habit, paniculate helicoid cyme with numerous flowers (120–160) per inflorescence as against corymbose raceme in *T. khasianum* and paniculate simple cyme in *T. calycosum*, larger leaf blade size of 24 × 8 cm versus 17 × 6 cm in *T. khasianum* and 8 × 3 cm in *T. calycosum*, tetramerous flower with adpressed urn–shaped calyx versus pentamerous and lax campanulate calyx in the latter two species, presence of 8 faucal appendages at the base of corolla lobes (absent in *T. khasianum*, 10 in *T. calycosum*) and with 1–4 lobed ovary (4–lobes in *T. khasianum,* 1–3 lobes in *T. calycosum*).

Shrub to small tree, 4–4.5 m tall, erect, woody, stem tetragonous, branches pubescent. *Leaves* opposite, decussate, petiole 1–2 cm long, blade ovate–elliptic, 24 × 8 cm, apex attenuate with slightly recurved margin, base cuneate, covered with simple unbranched whitish stiff trichomes, numerous on abaxial surface, possess large setae with multicellular bases, setae outline slightly

asymmetrical, younger leaves ornamented with longer trichomes. *Inflorescence* paniculate helicoid cyme, 120–160 flowers per cyme, covered with whitish short hairs. Pedicels 1.5–2.2 cm long. *Flowers* tetramerous. *Calyx* connate, 1.3 × 0.6 cm, 4–partite, green, entire, ovate–lanceolate, apex acuminate, covered with simple short whitish hairs, tightly adpressed to corolla, half of the calyx length form urn–shaped structure with sagittate base, remaining half radiated outwards, accrescent initiated after withering of corolla, fruiting calyx 2.5–3.2 × 1.8–2 cm, papery, turning brown at maturity. *Corolla* gamopetalous, white, up to 2 cm long, 0.4–0.6 cm in diameter, ovate–lanceolate, half of the length forming corolla–tube, densely tomentose, 8 faucal appendages present at base of corolla lobes, yellowish brown in colour, slightly reniform–shaped. *Stamens* 4, *ca.* 1.7 cm long, anther bilobed, lanceolate, connective heavily pilose at abaxial, exserted from corolla, spirally twisted at apex, about 2 mm long. *Ovary* 1–4 lobed, gynobasic, 1.5–1.8 cm long, slender, glabrous, stigma inconspicuous. *Nutlets* 1–4, broadly ovoid, becoming cupular, dorsiventrally compressed, bear small stiff trichomes at base, margin irregularly sinuate to obtuse dentate. *Seeds* sub–orbicular, complanate, 0.3 × 0.2 cm. *Pollens* sub–spherical, radially symmetrical, isopolar, tricolporate, P/E= 6–8/5–7 µm. Shape of pollen in polar view is triangular with sunken apertures. From equatorial view, pollens are elliptic in shaped. The character of pollens revealed no significant differences among the species of *Trichodesma* (Brummitt, 1982).

Distribution. During our regular survey, the species is seen growing in sparse condition only in four localities of Manipur State, North East India (Heikakpokpi Hills Range & Wairi in Kakching District, Monsang Forest & Pallel in Chandel District).

Habitat. It mainly grows in ferruginous red soil or sometimes in mixed alluvial soil or with traces of small gravels and grows at an altitude between 700–1,000 m asl. Other associated species include *Tephrosia candida* D.C., *Crassocephalum crepidioides* (Benth.)S.Moore, *Osbeckia stellata* Buch.-Ham. ex Ker Gawl., *Conyza bonariensis* (L.) Cronquist, *Dichrocephala integrifolia* (L.f.) Kuntze, *Rotheca serrata* (L.) Steane & Mabb., members of Poaceae, ferns like *Christella parasitica* (L.) Holttum , *Dryopteris* Adans., *Adiantum* L. *etc*.

Conservation Status. We recorded around 106 mature plants growing in these four sites with maximum species concentration of around 45 plants confined in Monsang Forest (Fig. 1C). Due to the rough topography of the state, we cannot ascertain the occurrence of the specimen at other localities, specially the Indo–Myanmar bordering zone which is very much similar to the above four localities. As the population size is unknown at present, *Trichodesma kumareum* must be currently categorized as 'Data Deficient' (IUCN, 2017).

Etymology. The specific epithet is named in honour of Professor Potsangbam Kumar Singh (Manipur University, Canchipur, India) for his valuable contributions in Plant Resources & Genetic Diversity, Physiology and Ethnobotany.

Phenology. Flowering and fruiting from December to May.

Vernacular name. In Manipuri language, it is known as '*Ching–hawaimaton*' which literally means 'mountain pea'.

Additional specimens examined (paratypes). India, Manipur, Monsang Forest margin, along the Chakpi River, Chandel District, near the entrance of Mon Lok, 980 m asl., 05 February 2017, *S. D. Yumkham & N. P. Devi 003589* (MUMP). India, Manipur, Pallel, along the bordering area of Highway No. 2, Chandel District, left side along the mountainous terrain, ferruginous red soil, 820 m msl., 23 March 2017, *S. D. Yumkham & N. P. Devi 003591* (MUMP). India, Manipur, Monsang Forest, Chandel District, near Khunjao cave, red soil mixed with small gravels, 998 m asl., 10 January 2018, *S. D. Yumkham & S. D. Khomdram 00501* (MZUH). India, Manipur, Wairi, Kakching District, near bank of Sekmai River, along embankment slopes, alluvial soil, 738 m asl., 15 February 2018, *S. D. Yumkham & S. D. Khomdram 00502* (MZUH).

Relevant notes. Like other *Trichodesma*, the phenomenon of protandry (shedding of pollens before stigma receptivity) is observed in *T. kumareum*. Flowers are scentless, small in size and white in colour, however buzz (bee) pollination is observed. The faucal appendages mimic as nectar glands and attract the bees thus serving as a guide towards the nectar present at the basal part of the corolla tube adjoining the ovary. Moreover, the compact inflorescence with numerous flowers facilitates the mechanism of attraction.

DISCUSSION

The genus *Trichodesma* is a complex group and can be studied under six sections based on villose or non–villose, compressed or non–compressed nutlets. These sections are *Trichocaryum* Brand, *Acanthocaryum* Brand, *Friedrichsthalia* (Fenzl) A.DC., *Ommatocaryum* A.DC., *Trachycaryum* A.DC. and *Liocaryum*

Key to the species

1 a. Inflorescence corymbose raceme, faucal appendages at corolla absent, ovary always 4 lobed……..…….……. *T. khasianum*

1 b. Inflorescence paniculate cyme, faucal appendages at corolla present, ovary 1–4 lobed ……..…….……..……..……..…… 2

2 a. Herb, branches glabrous, leaves 8 × 3 cm, leaf apex straight, simple cyme, flowers per inflorescence 30–80, calyx–corolla arrangement lax, urn–shaped calyx absent, faucal appendages 10 in number. ……..…. *T. calycosum*

2 b. Shrub, branches pubescent, leaves 24 × 8 cm, leaf apex recurved upward, helicoid cyme, flowers per inflorescence 120–160, calyx–corolla arrangement adpressed, urn–shaped calyx present, faucal appendages 8 in number ……..... *T. kumareum*

Table 1. Main differential characters among the allied species (*T. khasianum, T. kumareum spec. nov.* and *T. calycosum*)

Characters	T. khasianum	T. kumareum	T. calycosum
Habit	Shrub, lower main trunk woody	Shrub to small tree, stems & branches woody	Stout herb
Mean height	2 to 3 m tall	4 to 4.5 m tall	1.5 to 2.5 m tall
Stem & branches	Cylindrical, glabrous	Tetragonous, pubescent in young branches	Cylindrical to tetragonous, sparsely glabrous
Leaf blade & apex	17 × 6 cm, straight	24 × 8 cm, recurved upward	8 × 3 cm, straight
Inflorescence	Corymbose raceme	Helicoid cyme, paniculate	Simple cyme, paniculate
Flowers per inflorescence	50–100	120–160	30–80
Nature of inflorescence	Flowers laxly arranged	Flowers closely packed (not lax)	Flowers laxly arranged,
Flower & colour	Pentamerous, light brown or pink	Tetramerous, flower always white	Pentamerous, flower yellowish–brown, pink or white
Pedicel	Up to 1.6 cm long	Up to 2.2 cm long	Up to 1.5 cm long
Calyx–corolla arrangement	Lax, rusty pubescent	Adpressed, whitish pubescent	Lax, rusty pubescent
Size of calyx	Flowering calyx 1.6 cm long Fruiting calyx 2.5 ×1.5 cm	Flowering calyx 1.3 cm long Fruiting calyx 2.5–3.2 × 1.8–2 cm	Flowering calyx 0.6 cm long Fruiting calyx 2.5 × 2 cm
Shape of flowering calyx	Campanulate	Urn–shaped	Campanulate
Faucal appendages	Absent	8	10
Shape of corolla	Linear–lanceolate	Ovate–lanceolate	Triangular–ovate
Nature of connective	Sparsely hairy	Densely hairy	Densely hairy
Nature of stigma & ovary	Inconspicuous, 4 lobed	Inconspicuous,1–4 lobed	Capitate,1–3 lobed
Margin of nutlets	Dentate with wide margined	Irregularly sinuate to obtuse dentate	Denticulate to obtuse dentate

A.DC. (Brand, 1921). The Indian species are placed under two sections–*Friedrichsthalia* (*T. khasianum*, *T. calycosum*, *T. africanum*) and *Leiocaryum* (*T. indicum*, *T. decurrens*, *T. sedguickianum*, *T. zeylanicum*). Earlier, the genus *Lacaitaea* was created for *T. calycosum* because this is considered as the only species under the genus having faucal appendages (10 in number). However, it was retained to *Trichodesma* as it resembles the said genus in all other characters, and erecting a separate genus on the basis of a single character (faucal appendage) is unnatural (Johnston, 1952). The new species, *T. kumareum* is taxonomically distinct from the rest of the species reported so far. Superficially, it shows resemblance with *T. khasianum* and *T. calycosum*, but differs a lot in habit (shrub to small tree), inflorescence (helicoid cyme, high number of flowers per inflorescence, upto 120–160 in number, leaves (apex recurved upward), nature of flower (always tetramerous, no pentamerous recorded) and ovary (1–4 lobed). A unique character recorded is the height of *T. kumareum* (*ca*. 4 to 4.5 m) which is exceedingly higher than the latter two species. So far, *T. scottii* Balf.f. of Socotra (Yemen) is considered as the largest species of the genus and grows up to 4 meters. The stems and branches are ornamented with fine whitish hairs in *T. kumareum*. The other two species possess glabrous stem/branches (Banerjee & Prammanik, 1975; Ge-ling *et al*., 1995). Leaves 24 × 8 cm are also exclusively larger as against 17 × 6 cm in *T. khasianum* and 8 × 3 cm in *T. calycosum*. We compared various herbaria and images of both *T. khasianum* and *T. calycosum* with our species, and found that there are great differences in the nature of calyx. In our species, the calyx remain tightly adpressed to the corolla right from budding to the stage of maturity, and even continue upto the withering stage of corolla. The lower half joined together to form a unique urn–shaped structure, while the other half radiates out from the constricting point. After the corolla withers completely, the urn–shaped structure dissociates with the opening of the sepals and their accretion also initiates simultaneously. However, in *T. khasianum* and *T. calycosum*, the calyces remain adpressed to the corolla only during the budding stage. In them, the floral parts like calyx and corolla are arranged in a highly lax manner, and calyces are campunulate in shape. Among the three species, flowers of *T. calycosum* and *T. kumareum* resembled one another to some extent due to the presence of faucal appendages. This also shows that there is every possibility of further existence of allied species with faucal appendages. However, the two species greatly differ from one another in their habit, plant height, number/nature of flowers in inflorescence, number of sepals/petals and variation in abortive ovary (Table 1). All the three species mentioned above are distinct and easily identifiable from one another. For better clarity and understanding, a key to species is also provided.

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