



Pentasacme banaense, a new species of Apocynaceae (Asclepiadoideae: Ceropegieae) from Vietnam

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ABSTRACT: *Pentasacme banaense* Bo Li & T.S. Hoang, a new species of Apocynaceae discovered from Ba Na Nui Chua Nature Reserve of Danang City, Central Vietnam, is here described and illustrated. The new species is morphologically most similar to *P. malipoense*, but could be readily distinguished from the latter by the shape of leaves and corolla, the color of calyx, corolla and corolline corona, as well as the structure of staminal corona and style-head. Morphological description, high-resolution photographs, and habitat information of *P. banaense* plus a diagnostic key for all seven currently known species within the genus *Pentasacme* are provided.

KEY WORDS: Ba Na Nui Chua Nature Reserve, Danang, morphology, *Pentasacme malipoense*, Vietnam.

INTRODUCTION

Pentasacme Wall. ex Wight is an endemic genus in Asia, primarily distributed across southern China, the Pan-Himalayan region, and south Asia (Rahman and Wilcock, 1992; Li *et al.*, 1995; Surveswaran *et al.*, 2014; Tobgay *et al.*, 2019; Liu *et al.*, 2022). The genus was first formally described by Robert Wight (1796–1872) based on specimens collected by Nathaniel Wallich (1786–1854) from Bangladesh, originally including two species: *P. caudatum* Wall. ex Wight and *P. wallichii* Wight (Wight, 1834). *Pentasacme* is characterized by its rheophytic habitat, lanceolate or elliptic leaves, lateral cymes with nearly absent peduncles and long pedicels, and pollinia with a beak-like structure at the apex (germination crest). It has traditionally been placed in the Asclepiadaceae (Hook, 1885; Tsiang and Li, 1977; Rahman and Wilcock, 1991; Li *et al.*, 1995), which is now part of Apocynaceae as subfamily Asclepiadoideae (Endress and Bruyns, 2000). Actually, Asclepiadoideae were subdivided into five tribes: Fockeeae, Eustegieae, Marsdenieae, Ceropegieae, and Asclepiadeae (cf. Endress *et al.* (2018)). Within the tribe Ceropegieae, *Pentasacme* and three further genera - *Conomitra* Fenzl, *Leptadenia* R. Br., and *Orphanthera* Wight - constitute the subtribe Leptadeniinae which is one of the four subtribes proposed by Meve & Liede (2004) and characterized by having solitary mericarps.

Within *Pentasacme*, Rahman and Wilcock (1991) have proposed an infrageneric classification with two sections based on leaf shape and flower size: sect. *Pentasacme* (including *P. caudatum* and *P. shanense* R.W. MacGregor & W.W. Sm.) has linear or linear-lanceolate leaves and small flowers, whereas sect.

Wallichiana (including *P. wallichii* and *P. pulcherrima* Grierson & D.G. Long) bears elliptic-ovate or elliptic leaves and larger flowers. However, the two recently described species, *P. tubulosum* C. Liu, X.J. Hu & Y.H. Tan and *P. malipoense* C. Liu & Y.H. Tan, found in Yunnan Province, southern China, do not fit neatly into this infrageneric classification (Liu *et al.*, 2022), as both species have lanceolate leaves but large flowers. Further molecular phylogenetic analyses, based on a comprehensive sampling, are needed to clarify the infrageneric classification of *Pentasacme*.

In 2024, during a field survey in the Danang City of Central Vietnam, we discovered populations of an unknown *Pentasacme* species in the Ba Na Nui Chua Nature Reserve. Upon examination, we noted that this element possesses lanceolate leaves and large flowers (Fig. 1B, D, E, F; Fig. 2A, B, D), which is superficially similar to *P. malipoense*, but its floral characteristics, particularly the shape of corolline corona and style-head, are different from other known species in the genus. After morphological analysis, trait measurements, plus a review of the relevant literature, we confirmed that these plants from Ba Na Nui Chua represent an undescribed new species, namely *Pentasacme banaense* Bo Li & Thanh Son Hoang, and formally reported here.

MATERIAL AND METHODS

Field surveys were conducted in the Ba Na Nui Chua Nature Reserve, Danang City, Central Vietnam, from March to May, 2024. Morphological observations and trait measurements of the putative new species were carried out on living plants and herbarium specimens

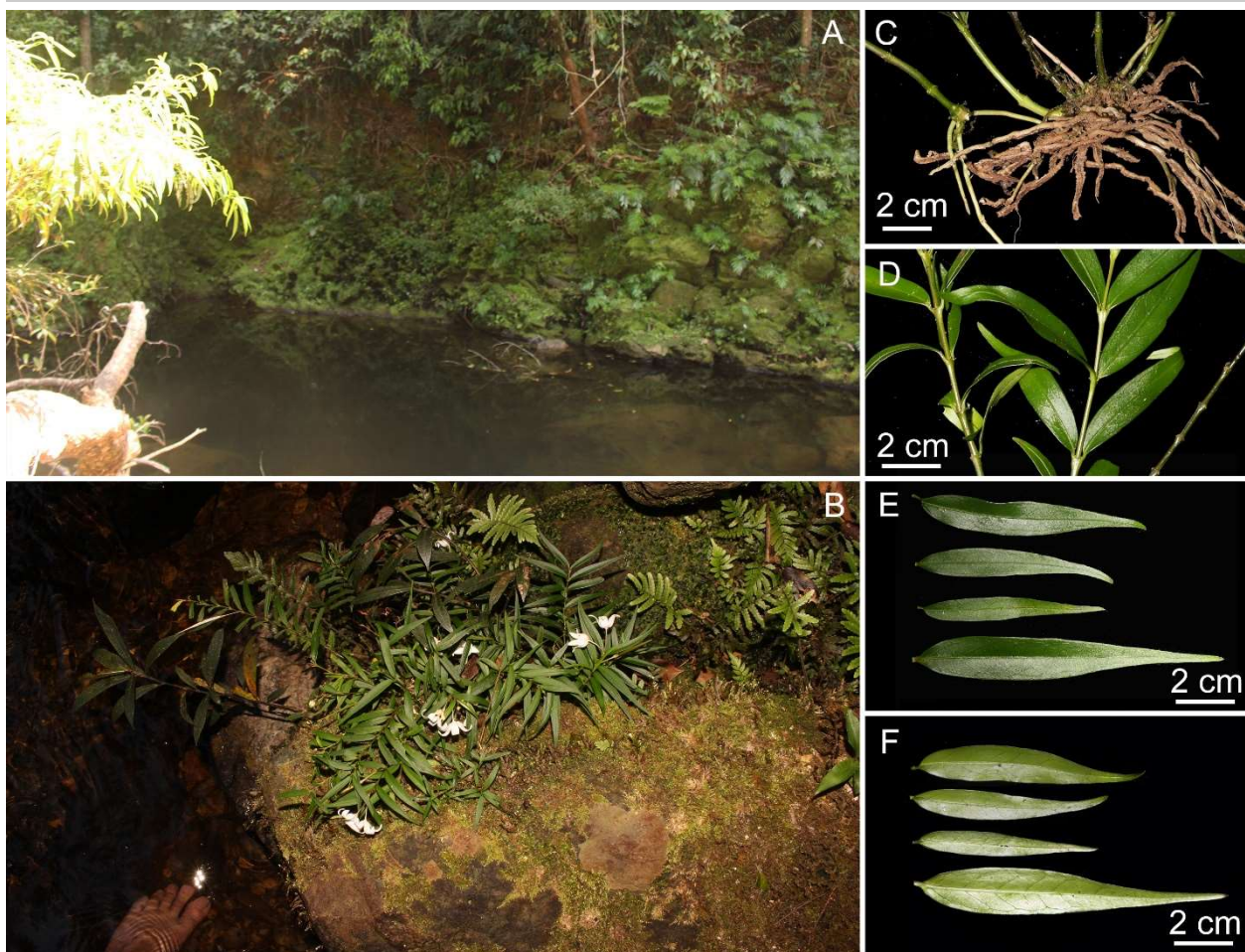


Fig. 1. Habitat and morphology of *Pentasacme banaense* sp. nov. **A & B.** Habitat. **C.** Roots. **D.** Stem and leaf base. **E.** Leaf blades, adaxial view. **F.** Leaf blades, abaxial view.

collected from the reserve. The morphological variations were measured using a ruler. High-resolution images of *Pentasacme* species were consulted via JSTOR Plant Science (<http://plants.jstor.org>) and Chinese Virtual Herbarium (<https://www.cvh.ac.cn/>). Relevant herbarium specimens from CSF, HITBC, IBSC, KUN, and PE were also examined (acronyms following Thiers 2020+). All morphological characteristics are described using the terminology from Rahman and Wilcock (1991), Li *et al.* (1995), and Liu *et al.* (2022).

TAXONOMIC TREATMENTS

Pentasacme banaense Bo Li & T.S. Hoang, *sp. nov.*

Figs. 1 & 2

Diagnosis: *P. banaense* is morphologically similar to *P. malipoense* in its lanceolate leaf blades, large flowers over 2 cm in length, and deeply lobed corollas. However, it can be readily distinguished from the latter by several characteristics: equally wide in the middle and lower part of the leaf blades (*vs.* noticeably widest at about one-third of the distance from the leaf base in *P. malipoense*), calyx

flavescent (*vs.* reddish), corolla pure white with densely short pubescence (*vs.* corolla reddish at base and glabrous), corolla lobes triangular-lanceolate with a prominent mid vein at the base and slightly concave at both side (*vs.* corolla lobes narrow elliptical and flat at the base), the corolline corona white with a acute apex slightly flexion (*vs.* reddish with obtuse and straight apex), staminal corona lobes bilobed, cylindrical with obtuse and papillate apices (*vs.* conical with acute and smooth apex), style-head spherical with five symmetrical fleshy protrusions (*vs.* inverted conical with two parts) (Table 1).

Type: VIETNAM. Danang City, Hoa Vang District, Ba Na Nui Chua Nature Reserve, 16°04'38"N, 107°51'18"E, 456 m in elevation, 5 March 2024, T.S. Hoang *et al.* HTS4450 (holotype: VAFS!).

Description: Perennial rheophytic herb, to 35 cm tall, roots fascicled. Stems erect, glabrous, usually branched at base, internodes 1–3 cm long. Leaves opposite, petioles subsessile, ca. 1–2 mm long, glabrous, leaf blades lanceolate, 5–10 × 0.5–1.5 cm, base cuneate, apex long acuminate, margin entire and sparsely ciliate, midvein prominent on both surfaces, fresh green, lateral veins in

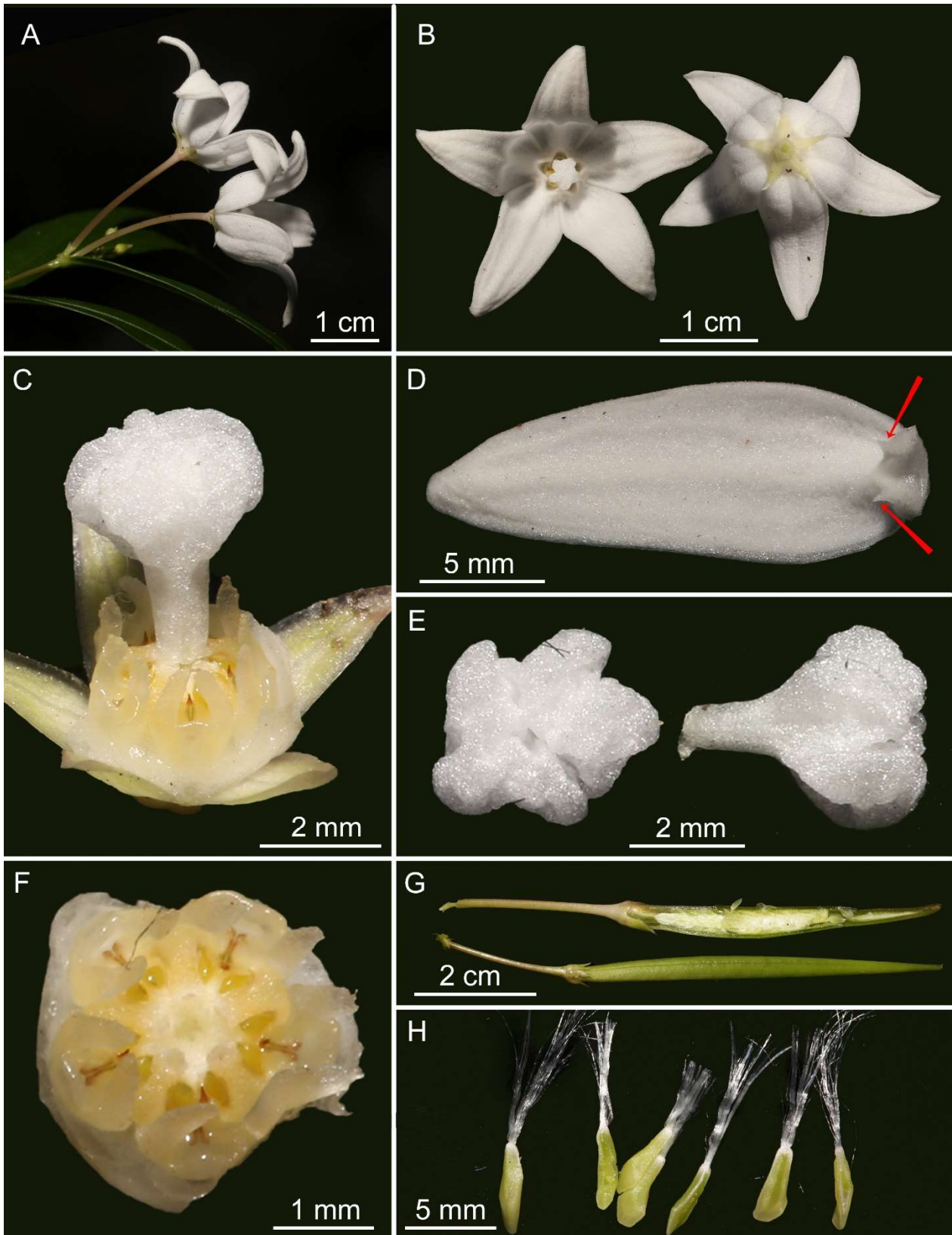


Fig. 2. Morphology of *Pentasacme banaense* sp. nov. **A:** Flowers, lateral view. **B:** Flowers, anterior (left) and inferior (right) view. **C:** Gynostegium and staminal coronas, lateral view. **D:** Corolla lob with corolline coronas (arrowed). **E:** Style-heads, anterior (left) and lateral (right) view. **F:** Staminal coronas and anthers, top view on gynostegium. **G:** Follicles. **H:** Seeds.

Table 1. Morphological comparisons between *Pentasacme banaense* and *P. malipoense*.

Characters	<i>P. malipoense</i>	<i>P. banaense</i>
Leaf blades	noticeably widest at about one-third of the distance from the leaf base	equally wide in the middle and lower part
Calyx	reddish	flavescent
Corolla	corolla reddish at base and glabrous	pure white with densely short pubescence
Corolla lobes	narrow elliptical and flat at the base	triangular-lanceolate with a prominent mid vein at the base and slightly concave at both side
Corolline corona	reddish, obtuse and straight apex	white, acute and slightly flexion apex
Staminal corona	acute and smooth apex	obtuse and papillate apices
Style-head	inverted conical with two parts	spherical with five symmetrical fleshy protrusions

4–7 pairs, inconspicuous. Cymes subsessile, shorter than leaves, 3–6-flowered; bracts lanceolate, 1–2 mm long, apex acute; pedicels reddish, 1–2.5 cm long; calyx flavescent, lobes ovate-lanceolate, apex acuminate, 2.5–3 × 1–1.5 mm. Corolla campanulate, deeply lobed, white, with densely short pubescence, lobes triangular-lanceolate, mid vein prominent at base and slightly concave at both side, 1–1.5 × 0.3–0.5 cm, far longer than tube. Corolline corona white, reduced to five separate scales, coronal scales triangular with a acute and slightly flexion apex, ca. 1 mm high and ca. 1.5 mm wide at base, white and pubescent, adnate to the corolla tube between the lobes. Staminal corona cup-shaped, fleshy, adnate to the base of the corolla tube, 5 lobed, lobes ovate and split into two incurved horns with obtuse and papillate apex, shorter than gynostegium. Gynostegium ca. 2.5 mm in diameter; anther appendages cylindrical, flavescent, fleshy, apex obtuse and inflexed on the base of style-head. Pollinia ovoid, attached to the caudicle at middle; style-head spherical shape, five symmetrical fleshy protrusions, 2–3 mm long, spongy. Follicles solitary, cylindrical-lanceolate, 4–6 cm long, ca. 3 mm in diam. Seeds oblong-spathulate, 2–3 × 1 mm, coma 0.5–1.2 cm, white.

Phenology: Flowering was observed from February to March and fruiting from March to April.

Etymology: The specific epithet is derived from the type locality, i.e., Ba Na Nui Chua Nature Reserve of Vietnam.

Vernacular: The Vietnam name is given as “Ngũ giác Bà Nà”.

Habitat and Distribution: Based on our field observations, *P. banaense* typically grows on moist rocks along both sides of streams, often co-occurring with species such as *Phyllagathis suberalata* C. Hansen, *Indosinia involucrata* (Gagnep.) J.E. Vidal, *Argostemma bachmaense* T.V. Do, *Phoebe angustifolia* Meisn., *Sonerila* sp., and *Ficus subpyriformis* Miq.

Additional specimens examined

P. caudatum: BANGLADESH. Sylhet, *Wallich 8234a* (BM001014181!); 5 October 1867 *C.B. Clarke 5562* (BM001014180!); CHINA. Hong Kong, *J.G. Champion 192* (K000872783!, K000872784!, K000872785!); Guangxi, 16 May 2020, *B.Pan et al. GXIBPB110B09* (KUN1501165!); Hainan, 16 July 2018, *L.Wu 6616* (CSF1066516!); MYANMAR. 24 May 1908, *J.H. Lace s. n.* (E00646527!).

P. malipoense: CHINA. Yunnan Province, Malipo County, Tianbao Town, 18 June 2020, *C.Liu et al. 20CS19486* (HITBC0083546!,

PE02375948!); Ibid., 20 October 2014, *Y.P. Chen & Y.Tong EM126* (HITBC0103415!).

P. pulcherrima: BHUTAN. Samdrup Jongkhar to Deothang road, 8 km above Samdrup Jongkhar, 21 June 1979, *Grierson & Long 2137* (E00288720!, CAS0006648!, K000872860!); Deothang District, 13 September 1998, *Noltie et al. 199* (E00103754!); NEPAL. Western Development Region, Gandaki Zone, Gorkha District, Machha Khola to Tatopani, 26 July 2008, *H.Ikeda et al. 20812041* (E00647225!).

P. shanense: MYANMAR. Southern Shan State, June 1909, *MacGregor 535* (isotype: E00288719!); Maymyo Plateau, 28 June 1913, *J.H. Lace 6239* (K000872861!, E00646528!); N. Shan States District, 6 July 1912, *J.H. Lace 5846* (K000872862!, E00646525!, E00646526!).

P. tubulosum: CHINA. Yunnan Province, Mojiang County, Puyehe gorge of Xinfu Town, 22 June 2020, *C.Liu, M.J. Feng & X.J. Hu 20CS19500* (HITBC0083547!); Zhenyuan County, Puyehe Gorge of Gucheng Town, 27 July 2021, *Y.X. Gong 306* (HITBC0083388!); Ibid., 11 April 2022, *H.B. Ding & Y.X. Gong D181* (HITBC0083389!).

P. wallichii: BANGLADESH. Sylhet, *Wallich 8235* (isotype: E00179674!, E00179675!, BR0000006966676!); INDIA. Kumaun, 14 August 1884, *J.F. Duthie 3147* (E00646529!); 18 August 1886, *J.R. Reid s. n.* (E00646532!); *Biskam 2319* (E00646534!); *Stewarts s. n.* (E00646535!); NEPAL. Eastern of Kutharpekot, Bim Khola, 27 April 1954, *Stainton et al. 272* (E00646530!); Bheri Valley, Jaldi Gad, 28 June 1966, *Stainton 5476* (E00646531!); Barpak, 16 October 1981, *Stainton 8463* (E00646533!).

The key to the seven known species of *Pentasacme*

1. Corolla long tubular, lobes fused to the upper part *P. tubulosum*
1. Corolla campanulate, lobes united only at base.
 2. Leaves elliptic or ovate-elliptic, more than 1.5 cm wide; flowers large.
 3. Stems pubescent; style-head conical, concealed by anthers *P. pulcherrima*
 3. Stems glabrous; style-head shortly rostrate, exsert above anthers *P. wallichii*
 2. Leaves lanceolate, less than 1.5 cm wide.
 4. Flowers small; corolla lobes less than 1 cm.
 5. Stems glabrous; corolla lobes ovate-acuminate, apex filiform ... *P. caudatum*
 5. Stem nodes sparsely hairy; corolla lobes oblong-lanceolate, apex acuminate *P. shanense*
 4. Flowers large; corolla lobes more than 2 cm.
 6. Calyx reddish; corolla reddish at base, glabrous; style-head inverted conical with two parts *P. malipoense*
 6. Calyx flavescent; corolla pure white, minutely pubescent; style-head spherical shape with five symmetrical fleshy protrusions *P. banaense*

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