

A Taxonomic Account of Commelinaceae Subtribe Cyanotinae in Thailand

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ABSTRACT. – Commelinaceae subtribe Cyanotinae, which contains one species of *Belosynapsis* Hassk. and five species of *Cyanotis* D. Don in Thailand, are described based on morphological data. Keys to the genera and species are presented. Morphological descriptions of both genera are provided, as well as information on each species' distribution, ecology, conservation status, vernacular names, and additional notes. *Cyanotis barbata* D. Don, *Tradescantia ciliata* Blume, and *T. capitata* Blume have also been lectotypified.

KEYWORDS: *Belosynapsis*, *Cyanotis*, Flora of Thailand, synopsis, taxonomy

INTRODUCTION

Commelinaceae subtribe Cyanotinae was recognized as a member of the tribe Tradescantieae and the subfamily Commelinoideae of the family Commelinaceae, and consisted of two genera, *Belosynapsis* Hassk. and *Cyanotis* D. Don, which were found in tropical Africa, Asia, and Oceania (except Australia and New Zealand) (Faden and Hunt, 1991). The shared morphological features of the subtribe for both genera were also reported by Faden and Hunt (1991), including that they existed as generally succulent perennial herbs with solitary or clustered cincinni (inflorescences) that were enclosed by leafy or spathaceous bracts. Their actinomorphic and bisexual flowers are composed of large foliaceous bracteoles. Six fertile stamens with bearded filaments and anthers that split longitudinally or by basal pores are present. The subterminal portion of styles is typically enlarged and occasionally bearded. Their dehiscent capsules have three locules with two seeds or sometimes one seed per locule. Their seeds have a terminal embryotega and a punctate hilum.

Since Hunt (2001) advocated including *Belosynapsis* within *Cyanotis*, Lee et al. (2022) considered the former to be a synonym of the latter based on their phylogenetic analysis. Following Faden and Hunt (1991) and Faden (1998), we complied with the previous classification of Commelinaceae for understanding the subtribe Cyanotinae in Thailand by adopting the segregated genera. *Belosynapsis* is distinguished from *Cyanotis* by its involucre bracts that resemble leaves, petals that are all the same size and shape, and filaments and styles that are not swollen

at the top (Brenan, 1966; Faden, 1998; Hong and DeFilipps, 2000; Thitimetaroch, 2004).

The genus *Belosynapsis* was first described by Hasskarl (1871), based on a single species *B. kewensis* Hassk. It now comprises six species found in Southeast Asia, South Asia, China, Taiwan, and Papua New Guinea (Faden and Hunt, 1991; Hong and DeFilipps, 2000; Peng et al., 2000; Kavade et al., 2012; The Forest Herbarium, Royal Forest Department, 2014). Hong and DeFilipps (2000) described that *Belosynapsis ciliata* (Blume) R.S. Rao is a widespread species growing in moist and wet environments or on rocky areas in evergreen forest distributed in China, Taiwan, Japan, Thailand, Laos, and Vietnam. However, this species has not been included in the Flora of Japan (Fukuoka and Iwatsuki, 2016). *Cyanotis* is a paleotropical genus with approximately 56 species that grow in grassy, rocky, and other habitats or in forests, with a few species being aquatic (Faden and Hunt, 1991; Faden 1998; Faden, 2012; Nandikar and Gurav, 2014). Ten species have been presented in the Tropical East Africa (Faden, 2012); 13 species in India (Nandikar and Gurav, 2014); and five species in China (Hong and DeFilipps, 2000). In Thailand, six species have been enumerated including *C. arachnoidea* C.B. Clarke, and *C. axillaris* (L.) D. Don ex Sweet, *C. vaga* (Lour.) Schult. & Schult., *C. burmanniana* Wight, *C. cristata* (L.) D. Don, *C. thwaitesii* Hassk., and *C. vaga* (Lour.) Schult. & Schult.f. (Pooma, R. and Suddee, 2014). This work aims to provide a synoptic taxonomic account of both genera for the *Flora of Thailand* project, including distributional and ecological data, vernacular names, and species diagnoses, as neither genus has a systematic account. We also provide identification keys for the genera and species.

MATERIALS AND METHODS

This study is largely based on Thai materials of *Belosynapsis* and *Cyanotis* kept in the following herbaria: AAU, BCU, BK, BKF, BM, CMU, K, KKU, KYO, QBG, PSU and TCD (acronyms follow Thiers, 2023). Field observations including collections and photographs were carried out from many parts of Thailand, and the voucher specimens were kept at KKU herbarium. Keys to the genera of Cyanotinae and *Cyanotis* species in Thailand are provided. Type specimens from BM and K were examined, and from C, E, G, L and S were viewed and consulted online through digital herbaria and indicated by "!" after the herbarium code. The abbreviation "n.v." is used to indicate type specimens that have not been seen. Line drawings can be used to define some type specimens, such as the types of *C. axillaris* and *C. cristata*. According to the International Code for Nomenclature (ICN) (Turland et al., 2018), especially articles 9.5, 9.11, 9.12 and 9.17, some scientific names will perform lectotypification. The examination of all scientific names' protologues was based on Linnaeus (1753, 1767 and 1771), Loureiro (1790), Blume (1823 and 1827), Don (1825), Sweet (1826), Romer and Schultes (1830), Dalzell (1851), Wight (1853), Hasskarl (1870 and 1871), Clarke (1881), Trimen (1885 and 1898), Kuntze (1891), Sprague and Fischer (1928), Bakhuizen van den Brink (1950), Plukenet (1962), and Rao and Kammanthy (1966). Additional references of taxa recorded in Bhutan (Notie, 1994), India (Hooker, 1894; Cooke, 1908; Rao, 1965; Fischer, 1956; Karthikeyan et al., 1989; Nandikar and Gurav, 2014), Sri Lanka (Faden, 2000), China (Hong and DeFilipps, 2000), and Southeast Asia (Ridley, 1924; Merrill, 1925; Cherfils, 1937; Backer and Bakhuizen van den Brink, 1968; Hô, 1993; Pooma and Suddee, 2014) were also investigated. Based on data from field collections and herbarium specimens, descriptions of each taxon were carefully constructed. Field observations, data from herbarium specimens, and related literature were combined to offer distributional and ecological information for each species. A distribution map of all Thai Cyanotinae was given using the SimpleMappr program (<https://www.simplemappr.net/>). To provide additional information, vernacular names following Thai Plant Names Tem Smitinand (Pooma and Suddee, 2014), conservation status based on the IUCN Standards and Petitions Committee (2022), and notes on each species are provided.

RESULTS AND DISCUSSION

Taxonomic treatment

Key to the genera of the subtribe cyanotinae

1. Bracteoles elliptic-ovate. Petals free. Filaments and style not swollen apically.....**1. *Belosynapsis***
1. Bracteoles narrowly falcate to ovate-falcate (minute in *C. axillaris*). Petals united below into a corolla tube. Filaments and style with a subapical swelling.....**2. *Cyanotis***

1. *Belosynapsis*

Hassk., Flora 54: 259. 1871; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1082. 1956; Noltie, Fl. Bhutan 3(1): 222. 1994; Faden in K. Kubitzki, Fam. Gen. Vas. Pl. 4: 120. 1998; C.I. Peng & Y.J. Chen, Biol. Bull. Natl. Taiwan Norm. Univ. 35: 80. 2000; D.Y. Hong & DeFilipps in Z.Y. Wu & P. Raven, Fl. China 24: 21. 2000. Type species: *Belosynapsis kewensis* Hassk.

Perennial herbs. *Leaves* distichous or sometimes spirally arranged; lamina sessile, ovate ovate-lanceolate to elliptic-lanceolate. *Inflorescences* both terminal and axillary; bracteoles small or large, persistent; cincinni 1-several flowered. *Flowers* bisexual, actinomorphic, subsessile or pedicellate. *Sepals* equal, *Petals* free or basally fused, not clawed. *Stamens* 6, free, equal, all fertile; filaments not swollen apically, bearded; anthers longitudinally dehiscent. *Style* not swollen apically, bearded. *Capsules* triangular, 3-valved. *Seeds* subtrapezoidal-oblong to square prism, with broadly elliptic embryotega, terminal; hilum punctiform-ovate, subbasal ventral.

Four species, from Madagascar and India to New Guinea. One species in Thailand.

Belosynapsis ciliata (Blume) R.S. Rao, Notes Roy. Bot. Gard. Edinburgh 25(2): 187. 1964; Hô, Câyno Vietnam 3(1): 474. 1993; Noltie, Fl. Bhutan 3(1): 223. 1994; D.Y. Hong & DeFilipps in Z.Y. Wu & P. Raven, Fl. China 24: 21. 2000.— *Tradescantia ciliata* Blume, Cat. Gew. Buitenzorg: 61. 1823. — *Cyanotis ciliata* (Blume) Bakh.f., Blumea 6(2): 399. 1950; Backer & Bakh.f., Fl. Java 3: 14. 1968. Type: Indonesia, Java, Blume s.n. (lectotype: L0041676!; isolectotype: HBG507110!).

— *T. capitata* Blume, Enum. Pl. Java. 1: 6. 1827. — *Cyanotis capitata* (Blume) C.B. Clark in A. DC. & C. DC., Monogr. Phan. 3: 243. 1881; Ridl., Fl. Mal. Pen. 4: 358. 1924; Merr., Enum. Philipp. Fl. Pl. 1: 198. 1925; Cherfils in Lecomte et al., Fl. Indo-Chine 6(7): 871. 1937. — *Belosynapsis capitata* (Blume) Sprague & C.E.C. Fisch., Bull. Misc. Inform. Kew 1928(6): 254. 1928. Type: Indonesia, Java, *Blume* s.n. (lectotype: L0041677!, selected here; isolectotypes: L0041678!, L0041679!).

Succulent herb, with diffuse, decumbent, or creeping stem, usually branching and rooting at nodes near ground, up to 1 m long, densely pubescent in a line on one side. *Leaves* slightly succulent, elliptic-lanceolate to lanceolate-ovate, 2.5–13 by 1.5–2.5 cm, commonly covered with sparsely hirsute-stiff hairs above and densely beneath, base often oblique acute-obtuse, apex acute-acuminate, margin ciliate; leaf sheaths 3–8 by 2–5 cm, glabrous or sparsely hirsute-hispid and densely pubescent one side, mount ciliate. *Inflorescences* loose, head-like, up to 3 cm long, not concealed the messy bracteoles. *Cincinni* with several flowers in short axis, ca 1 cm long; bracteoles 3–5 pairs in two series, often messy, elliptic or lanceolate-oblong, 4–12 by 1.5–5 mm, commonly hirsute-hispid, margin ciliate. *Flowers* pinkish purple to violet-blue. *Sepals* free, lanceolate-elliptic, 4–6.5 by 1.3–2.5 mm, pubescent outside. *Petals* free, bright pinkish purple to violet-blue and white at base, oblanceolate-obovate, 5–7 by 2–4 mm. *Stamens* filaments 6–7 mm long, bearded on middle part; anthers elliptic-ovate or elliptic oblong, 0.8–1 by 0.4–0.5 mm, bright yellowish orange. *Ovary* ovate, 1–1.3 by 0.8–1 mm, greenish white, densely pubescent distally; style slightly straight, 5.5–8.5 mm long, bearded on the upper part; stigma simple. *Capsules* elliptic, ca 4 by 3 mm, densely pubescent, with (1–)2 seeds per locule. *Seeds* trapezoidal-oblong, 1–1.5 by 0.7–1 mm; brown, reticulate all over. (Fig. 1A–1D, 2A–2B)

Thailand.— NORTHERN: Chiang Mai: [25 Sept. 1910, *Kerr* 1416 (TCD); Doi Sutep-Pui NP, 19 Sept. 1987, *Maxwell* 87-1031 (CMU); *ibid.*, 11 Sept. 1990, *Maxwell* 90-984 (L); Fang, 22 Feb. 1958, *Sørensen et al.* 1488 (BKF, L); Ban Pa Daeng, Ba Bae subdistrict, 11 Aug. 1990, *Maxwell* 90-867 (L); Mae Lao, Mae On-Ban Mae Kam Pong, 6 Dec. 2014, *Kamonnate* 816 (QBG); Mae Lao-Mae Sae WS, 17 Sept. 1995, *Larsen et al.* 46601 (AAU, L); Mae Sae WS, Mae Taeng-Pa Pae WS, 17 Sept. 1995, *Nanakorn et al.* 4471 (QBG-2 sheets) & 4514 (QBG-2 sheets); Mae Taeng-Ban Pang Kut, 5 Sept. 2015, *Kamonnate* 751 (QBG); Phayao [Doi Luang NP, Champa Thong Waterfall, 5 Nov. 2015, *Muangyen* 346 (QBG)]; Nan [Wang Tao, 13 Feb. 1958, *Sørensen et al.* 1086 (BKF)]; Lampang

[Mueang Pan, Chae Son NP, 23 Aug. 1995, *Maxwell* 95-551 (CMU); *ibid.*, 10 Aug. 1996, *Panatkool* 87 (CMU)]; NORTH-EASTERN: Phetchabun [Nam Nao NP, 30 May 2013, *Maknoi* 5758 (QBG); Nam Tok Tat Mok NP, 4 Jul. 1997, *Nanakorn et al.* 9350 (QBG-2 sheets)]; Loei [Nong Hin, 22 Sept. 2007, *Thitimetharoch et al.* 798 (BKF, K); *ibid.*, 26 May 2011, *Boonkerd et al.* 2011-186 (BCU); *ibid.*, 15 Jul. 2011, *Boonkerd et al.* 2011-252 (BCU-2 sheets); Phu Kradueng NP, Maholan Cave, 17 Dec. 1982, *Koyama et al.* T-31173 (BKF, QBG); Phu Pha Lom Forest Park, 11 Sept. 2018, *Wangwasit* 180911-10 (QBG)]; Mukdahan [Dong Luang, 24 Aug. 2001, *Pooma et al.* 2485 (BKF-2 sheets)]; Khon Kaen [Pha Nok Khao, 9 Sept. 1963, *Smitinand & Sluemer et al.* 1122 (BKF, K); *ibid.*, 26 Nov. 1965, *Tagawa et al.* T-327 (BKF); *ibid.*, 6 Nov. 1970, *Charoenphol et al.* 4550 (AAU); Phu Pha Man NP, 11 Jul. 2000, *Thitimetharoch* 384 (KKU); *ibid.*, 2 Aug. 2011, *Norsaengsri et al.* 7987 (BKF, QBG); *ibid.*, 16 Aug. 2012, *Norsaengsri et al.* 9967 (QBG); *ibid.*, 25 Jul. 2010, *Norsaengsri & Thongsorn* 6958 (QBG), Pha Nang Non, Phu Pha Man NP, 23 June 2008, *Norsaengsri & Lakoet* 3871 (QBG); Kang Khao Cave, 8 Sept. 2009, *Boonprakop & Norsaengsri* 002 (QBG); Phu Pha Man NP, Pha Phuang Cave, 14 Aug. 2012, *Norsaengsri et al.* 9878 (QBG); Phu Wiang, 16 Sept. 1994, *Nanakorn et al.* 1698 (QBG-2 sheets)]; EASTERN: Chaiyaphum [Chulabhon Dam, Khon San, 24 Sept. 2007, *Thitimetharoch et al.* 820 (BKF); Thung Kramang, 4 Aug. 1972, *Larsen et al.* 31383 (AAU)]; Nakhon Ratchasima [Sakaerat, 24 Oct. 1971, *van Beusekom et al.* 3327 (BKF); Wang Nam Khiao, 15 Nov. 1967, *Ruengsak* 392 (BKF)]; SOUTH-WESTERN: Kanchanaburi [Chaloem Rattanakosin NP, Than Lod Yai Cave, 27 Jun. 2018, *La-ongsri et al.* 5669 (QBG)]; CENTRAL: Saraburi [Muak Lek, 4 Sept. 1924, *Kerr* 9149 (BK, BM, K); *ibid.*, 11 Nov. 1924, *Marcan* 1887 (BM-2, K); *ibid.*, 11 Nov. 1924, *Marcan* 1892 (BM-2, K); *ibid.*, 2 Oct. 1963, *Smitinand & Sleumer et al.* 1330 (BKF, K); *ibid.*, 3 Sept. 1928, *Put* 1906 (BK, BM, K); near Phu Kae, 20 Nov. 1984, *Murata et al.* T-51096 (BKF); Sam Lan NP, 15 Jun. 2000, *Thitimetharoch* 334 (KKU); *ibid.*, 13 Oct. 1973, *Maxwell* 73-477 (AAU, BK); Kaeng Khoi, Thap Kwang, 3 Oct. 1963, *Smitinand & Sleumer et al.* 1336 (BKF, K); Hin Lap, 20 Aug. 1829, *Put* 2418 (BK, BM, K)]; Nakhon Nayok [Khao Yai NP, 6 Sept. 2001, *Maxwell* 01-387 (BKF, L, PSU)]; Bangkok [8 Jul. 1928, *Kerr* 16009 (BK)]; *ibid.*, 14 Sept. 1939, *Kerr* 19725 (K)]; SOUTH-EASTERN: Rayong [24 Aug. 1977, *Phengklai et al.* 3848 (BKF-2 sheets); Khao Chamao, 5 Sept. 1972, *Larsen et al.* 32456 (AAU, BKF)]; Chanthaburi [Phlio Waterfall, 20 Apr. 2000, *Phaisalchantasiri* 13 (PSU)];

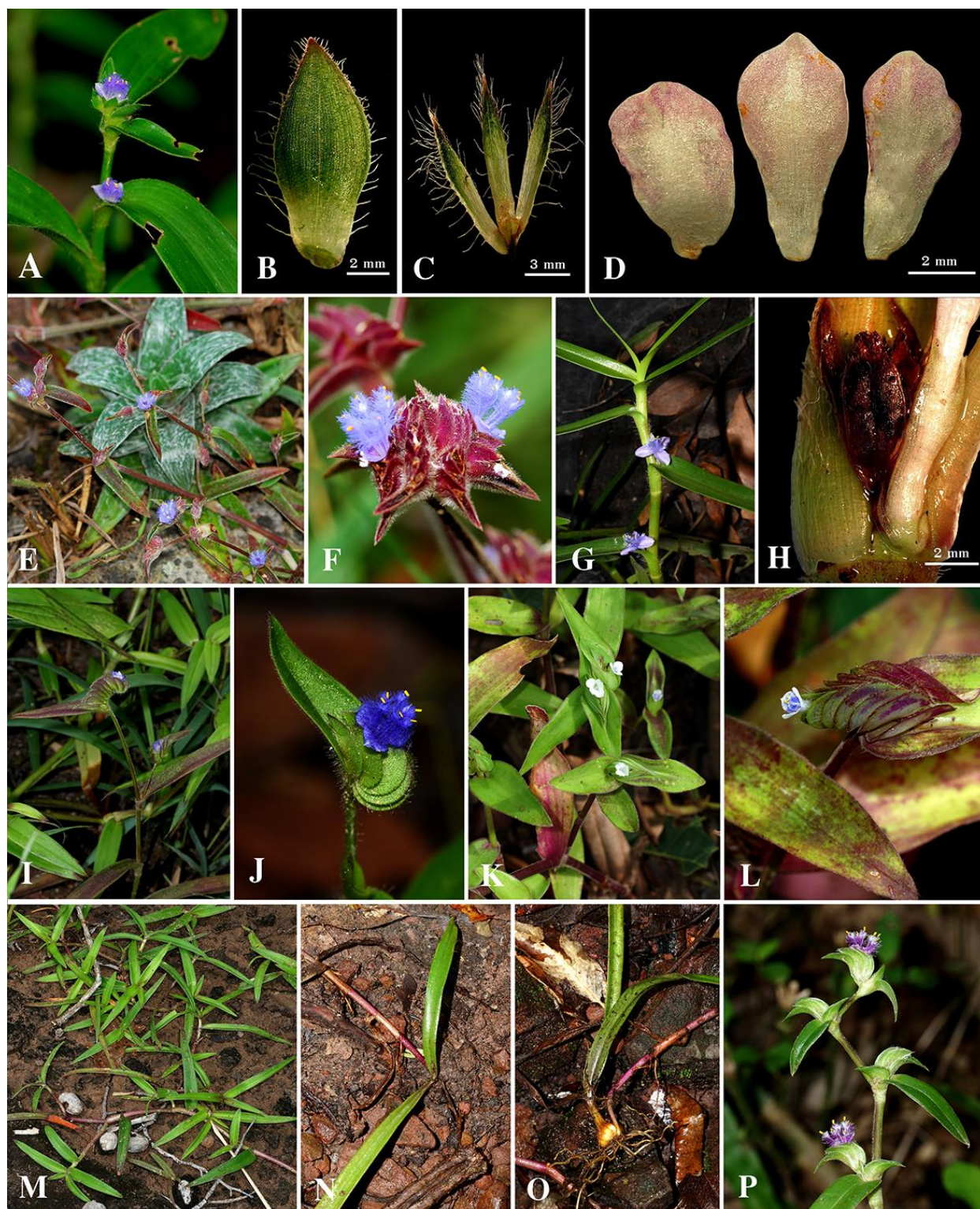


FIGURE 1. Morphological characteristics of Thai Cyanotinae; A-D. *Belosynapsis cilata*: A. Inflorescences, B. Inflorescence bract, C. Calyx, D. Corolla; E-F. *Cyanotis arachnoidea*: E. Rosette and cauline leaves with inflorescences, F. Inflorescences; G-H. *C. axillaris*: G. Inflorescence emerged from the leaf axils, H. Leaf axil (removing the leaf sheath), showing a capsule and a flower with minute bracteole, hyaline calyx, and white corolla tube; I-J. *C. burmanniana*: inflorescences with densely hairs on peduncles, leaves and bracteoles; K-L. *C. cristata*: inflorescences, bracteoles and corolla; M-P. *C. vaga*: M. Habit, N. Basal leaves, O. Basal leaves with subterranean corm, P. Inflorescences.

Khlong Thap Mak Waterfall, Soi Dao WS, Boonsuk 879 (BKF, KKKU, QBG)]; PENINSULAR: Chumphon [Siepyuan, 7 Sept. 1927, Put 983 (BM, K);

Ta Ngao, 21 Jan. 1927, Kerr 11587 (BM, K)]; Surat Thani [Ko Samui, 10 Apr. 1927, Kerr 12598 (BK, K)]; Nakhon Si Thammarat [Khiri Wong, Khlong Tha Rae,

27 Jul. 1951, S.N. 736 (**BKF**), Phatthalung [Riang Thong Waterfall, Si Banphot, 25 Sept. 1986, *Maxwell* 86-734 (**BKF**, **L**, **PSU**)]; Trang [Khao Pina, 16 Nov. 1990, *Larsen et al.* 41476 (**AAU**, **PSU**)]; Pattani [Sai Khao Waterfall, 9 Oct. 1991, *Larsen et al.* 42244 (**AAU**)]; Yala [Bannangsata, Suktalai Waterfall, 8 Oct. 1977, *Puangpen & Kamnoon* 32 (**PSU**)]; Narathiwat [Waeng, Bala-Hala WS, 16 Sept. 2004, *Niyomdham & Puudjaa* 7196-13 (**BKF**)].

Distribution.— India, Bhutan, China (Yunnan, Hainan), Taiwan, Japan, Laos, Cambodia, Vietnam, Malaysia., Philippines, Papua New Guinea.

Ecology.— Limestone outcrops, sandy soil among rocks, damp and wet places or high humus on rocks in bamboo, evergreen, deciduous and gallery forests, 5–1,050 m alt; flowering from June to September, daily flowering time in the morning.

Conservation status.— *Belosynapsis ciliata* is a widespread species in Asia. We designate this species with a status of Least Concern (LC) according to the IUCN Standards and Petitions Committee (2022).

Vernacular.— Ya ka lueam (หญ้ากาเหลื่อม)(General).

Notes.— *Belosynapsis ciliata* is the most common species of the genus (in worldwide view) and distributed throughout Thailand. It is distinguished by its loose, head-like inflorescences with elliptic or lanceolate-oblong bracteoles and free petals. Blume's specimens deposited in L (L0041676 and L0041677), are selected here for the lectotypes of *Tradescantia ciliata* Blume and *T. capitata* Blume, respectively, according to Turland et al. (2018).

2. *Cyanotis*

D. Don, Prodr. Fl. Nepal: 45. 1825; Hook.f., Fl. Brit. India 6: 384. 1894; Cooke, Fl. Pres. Bombay 2: 791. 1908; Ridl., Fl. Mal. Pen. 4: 357. 1924; G. Brückn. in Engler & Prantl, Nat. Pflanzenfam., ed. 2: 167. 1930; Cherfils in Lecomte et al., Fl. Indo-Chine. 6(7): 862. 1937; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1079. 1956; Backer & Bakh.f., Fl. Java 3: 14. 1968; Trimén, Handb. Fl. Ceylon 4: 310. 1898; Noltie, Fl. Bhutan 3(1): 219. 1994; Faden in Kubitzki, Fam. Gen. Vas. Pl. 4: 120. 1998; Faden in Dassan. & Clayton, Revis. Handb. Fl. Ceylon 14: 118. 2000; D.Y. Hong & DeFilipps in Z.Y. Wu & P. Raven, Fl. China 24: 21. 2000; Nandikar & Gurav, Taiwan 59(4): 293. 2014. Type species: *Cyanotis barbata* D. Don

Amischophacelus R.S. Rao & Kammathy, J. Linn. Soc. (Bot.) 59: 305. 1966; Karthik. et al., Fl. India. Enum. Monocot.: 23. 1989. Type species: *Commelina axillaris* L.

Perennial or occasionally annual herbs. *Leaves* alternate, sessile. *Inflorescences* terminal and/or axillary, each cincinnus or group of cincinni usually

subtended by a foliaceous bract, rarely enclosed in the leaf sheaths. *Flowers* bisexual, actinomorphic, subsessile. *Sepals* subequal, basally fused or forming into calyx tube. *Petals* connate below into a corolla tube; corolla lobes not clawed. *Stamens* 6, free, equal, all fertile; filaments with a subapical swelling, bearded; anthers dehiscent by basal pores. *Style* with a subapical swelling, often bearded. *Capsules* 3-locular, 3-valved, , with 2 seeds per locule. *Seeds* with embryotega, ovoid, ellipsoid to oblong-ellipsoid, terminal, hilum punctiform-ovate, subbasal-ventral.

Approximately 56 species, paleotropical distribution, grassy, rocky, or other open habitats, rarely aquatic situation or in the forests, six species in Thailand.

Key to the species

1. Cincinni axillary, enclosed in the leaf sheaths.

Bracteoles membranous, minute...2. *C. axillaris*

1. Cincinni terminal or both terminal and axillary, not enclosed in the leaf sheaths. Bracteoles herbaceous, conspicuous.....2

2. Plants with basal and cauline leaves, usually pubescent with cobweb-like hairs at least on the inflorescence bracts and bracteoles.....3

2. Plants with cauline leaves only, pubescent but never with cobweb-like hairs.....4

3. Basal leaves in a rosette, broadly linear to oblong. Seeds striate, obscurely pitted, brown to dark brown.....1. *C. arachnoidea*

3. Basal leaves not in a rosette, alternate, linear to linear-lanceolate. Seeds reticulate, grey-brown5. *C. vaga*

4. Leaves linear-lanceolate, 0.3–0.7 cm wide, pubescent, if glabrous then pilose at the margin. Bracteoles pilose all over.....3. *C. burmanniana*

4. Leaves narrowly elliptic to elliptic-lanceolate, 0.8–1.3 cm wide, glabrous on both surfaces with ciliate margin. Bracteoles glabrous with ciliate margin.....4. *C. cristata*

1. *Cyanotis arachnoidea* C.B. Clarke in A. DC. & C. DC., Monogr. Phan. 3: 250. 1881; Hook.f., Fl. Brit. India 6: 386. 1894; G. Brückn. in Engler & Prantl, Nat. Pflanzenfam., ed. 2: 168. 1930; Cherfils in Lecomte et al., Fl. Indo-Chine. 6(7): 864. 1937; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1081. 1956; Hồ, Cây cỏ Việt Nam 3(1): 474. 1993; D.Y. Hong & DeFilipps in Z.Y. Wu & P. Raven, Fl. China 24: 21. 2000; Nandikar & Gurav, Taiwan 59(4): 294. 2014.— *Tonningia arachnodea* (C.B. Clarke) Kuntze, Revis. Gen. Pl. 2: 722. 1891.

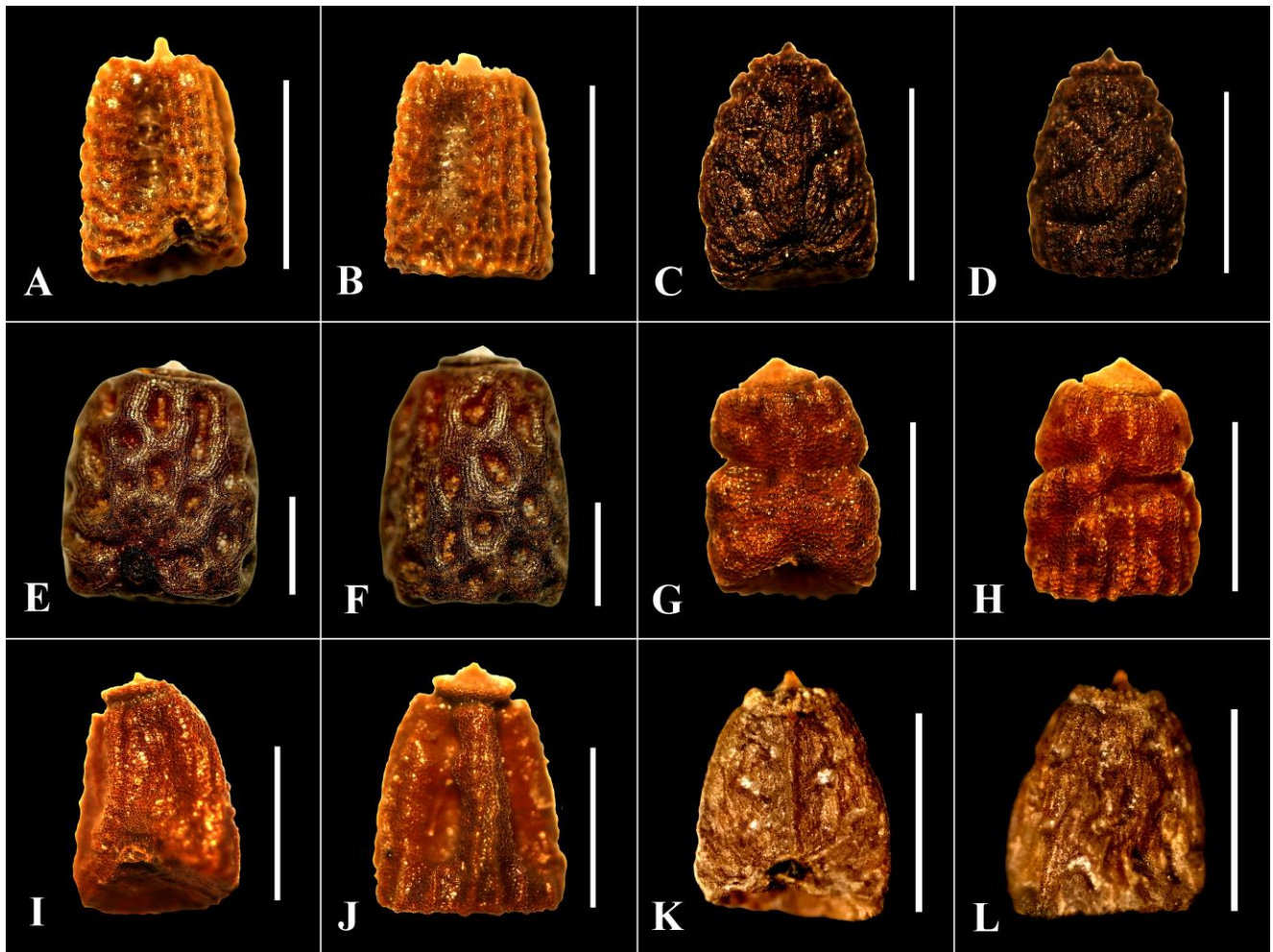


FIGURE 2. Seeds of Cyanotinae in Thailand; A-B. *Belosynapsis ciliata*: A. Adaxial side, B. Abaxial side; C-D. *Cyanotis arachnoidea*: C. Adaxial side, D. Abaxial side; E-F. *C. axillaris*: E. Adaxial side, F. Abaxial side; G-H. *C. burmanniana*: G. Adaxial side, H. Abaxial side; I-J. *C. cristata*: I. Adaxial side, J. Abaxial side; K-L. *C. vaga*: K. Adaxial side, L. Abaxial side. Scale bars: A-L = 1.0 mm.

Type: India, Tamil Nadu, Pulney Mt., 1836, *Wight* 2839 (lectotype: K000854110!, designated by Nandikar & Gurav, 2014).

— *C. pilosa* sensu Wight, *Icon. Pl. Ind. Orient.* 6: 32, t. 2083. 1853; sensu Hook.f., *Fl. Brit. India* 6: 386. 1894; C.E.C. Fisch. in Gamble, *Fl. Madras* 3: 1079. 1957, non Schult. & Schult.f., 1830.

— *C. arachnoidea* var. *obtusa* Trimen, *J. Bot.* 23: 266. 1885. — *C. obtusa* (Trimen) Trimen, *Handb. Fl. Ceylon* 4: 312. 1898; Rao, *Blumea* 14: 349. 1966; Faden in Dassan. & Clayton, *Revis. Handb. Fl. Ceylon* 14: 127. 2000. Type: Sri Lanka, Karagam, cultivated in Royal Botanic Gardens Peradeniya, Aug. 1883, *Trimen s.n.* (lectotype: K000854108!, designated by Faden, 2000).

— *C. nilagirica* Hassk., *Commelin. Ind.* 127: 1870; Hook.f., *Fl. Brit. Ind.* 6: 389. 1894; Karthik. et al., *Fl. Ind. Enum. Monocot.*: 26: 1989. Type: India, Nilgiri, *Perrottet 1811* (holotype: *n.v.*; isotype: G00223653!).

Perennial herb, with distinct basal rosette leaves, usually green to maroon, 7–35 cm tall. *Roots* thin to moderately thick. *Basal leaves* rosette, 5–30 by 0.5–4

cm, broadly linear to oblong, pubescent with cobweb-like hairs all over, rather dense beneath. *Cauline leaves* distichous, linear, pubescent with cobweb-like hairs all over, rather dense beneath; leaf sheaths conspicuous on cauline leaves. *Flowering shoots* lateral, up to 80 cm long, one to several arising from axils of basal rosette leaves, diffuse decumbent to ascending, usually pubescent with cobweb-like hairs. *Inflorescences* terminal and axillary, flattened head-like, commonly a few in clusters, subsessile to pedunculate; inflorescence bracts spathe-like, conduplicate basally, cobweb-like pubescent beneath; bracteoles comprising ca 5 pairs, 3–15 by 2–5 mm, strongly lanceolate-falcate or ovate-falcate, herbaceous, cobweb-like pubescent outside. *Sepals* basally fused, 5–8 by 1.5–3 mm, green, silky pubescent outside. *Petals* purple to violet-blue; corolla lobes broadly ovate, 3.5–6 by 3.5–5 mm; corolla tube 4–5 by 3–4 mm. *Stamens* filaments purple to violet-blue, 8–12 mm long, bearded; anthers bright yellowish orange, elliptic, 1–1.5 by 0.8–1 mm. *Ovary* elliptic, pubescent, style bearded below subapical

swelling. *Capsules* densely pubescent distally, with (1–2) seeds per locule. *Seeds* ovoid to ellipsoid, 1.2–1.5 mm long, brown to dark brown, often with shallowly transverse groove, striate, obscurely pitted. (Fig. 1E–1F, 2C–2D)

Thailand.— NORTHERN: Mae Hong Son [Mueang, Ban Huai Hi, 24 Aug. 1999, *Wattana et al.* 753 (QBG)]; Chiang Mai [Khun Chang Khian, 3 Dec. 1975, *Sadakorn* 651 (BK); Chom Thong, Doi Inthanon NP, 5 Aug. 1988, *Tamura T-60024* (QBG); *ibid.*, Kio Mae Pan Nature Trail, 7 Sept. 1988, *Nanakorn et al.* 11977 (QBG); *ibid.*, 7 Oct. 1998, *La-ongsri* 5 (QBG); *ibid.*, 8 Sept. 2011, *Pooma et al.* 7817 (BKF) & 7818 (BKF); *ibid.*, 21 Nov. 2013, *Traiperm & Layton* 536 (QBG); *ibid.*, 5 Oct. 2017, *Tandang et al.* 10 (QBG); Doi Suthep-Pui NP, 9 Oct. 1958, *Larsen & Hansen* 4868 (BKF); *ibid.*, the summit of Doi Pui, 8 Aug. 1988, *Tamura et al.* T-60717 (BKF); *ibid.*, 22 Sept. 1991, *Maxwell* 91-769 (CMU); *ibid.*, 17 Jul. 1994, *Palee* 242 (CMU); Mae Rim, 1 Sept. 1998, *Nanakorn et al.* 18986 (QBG); *ibid.*, Doi Mon Long, 28 Sept. 1997, *Nanakorn et al.* 9680 (QBG); *ibid.*, 29 Sept. 1998, *Sasrirat s.n.* (QBG); Mae Chaem, Kio Mae Pan, 30 Oct. 1998, *Wongprasert et al. s.n.* (BKF); *ibid.*, 8 Sept. 2011, *Pooma et al.* 7817 (BKF) & 7818 (BKF); Mae Sa, North of Chiang Mai, in rock crevices at summit, 18 Sept. 1995, *Larsen et al.* 46659 (BKF); Mae Taeng, 21 Sept. 1997, *Maxwell* 97-1025 (BKF, CMU); Chiang Rai [Thoeng, Doi Pha Phueng, 27 Jul. 2014, *La-ongsri et al.* 3565 (QBG)]; Lampang [Wang Nuea, Doi Luang NP, 6 Nov. 1998, *Petrmitr* 313 (CMU)]; Tak [Um Phang, Doi Hua Mot, 7 Aug. 2009, *Maknoi* 3408 (QBG)]; NORTH-EASTERN: Loei [Phu Kradueng NP, 23 Dec. 1971, *van Beusekom et al.* 4493 (BKF, K); *ibid.*, 13 Mar. 1924, *Kerr* 8732 (BK, BM, K); *ibid.*, 12 Feb. 1931, *Kerr* 20119 (BK, K); *ibid.*, 28 Mar. 1948, *Suvatabandhu* 180 (BK); *ibid.*, 13 Jul. 1959, *Floto* 7577 (BKF); *ibid.*, 15 Dec. 1963, *Umpai* 131 (BK); *ibid.*, 28 Nov. 1965, *Tagawa et al.* T-550 (QBG); *ibid.*, 7 Sept. 1970, *Larsen* 4700 (BKF); *ibid.*, Top area of Phu Kradueng, 18 Dec. 1982, *Koyama et al.* T-31277 (BKF); *ibid.*, 12 Sept. 1990, *Chantaranothai et al.* 90/92 (TCD) & 90/157 (TCD); *ibid.*, 1 Feb. 2023, *Boonsuk* 957 (KKU); *ibid.*, Na Hao, 29 Jul. 1995, *Nanakorn et al.* 4010 (QBG); *ibid.*, 25 Aug. 1996, *Phengkklai & Fukuoka* 10066 (BKF); Phu Suan Sai NP, Tat Hueang Waterfall, 4 Sept. 2008, *Maknoi* 2838 (BKF, QBG); Phu Luang WS, 14 Oct. 2000, *Norsaengsri* 1045 (QBG); Phu Ruea, 24 Sept. 2004, *Thitimetharoch et al.* 810 (BKF, KKU, QBG); Khon Kaen [Phu Wiang, 16 Sept. 1994, *Nanakorn et al.* 1584 (QBG); Phu Wiang NP, 10 Jun. 2000, *Thitimetharoch* 373 (BKF, KKU); *ibid.*, 26 Sept. 2007, *Thitimetharoch & Faden* 828 (BKF, KKU, QBG);

SOUTH-EASTERN: Trat [Khao Kuap, 27 Dec. 1919, *Kerr* 18095A (BK)].

Distribution.— India (type), Himalayan region, Sri Lanka, China (Yunnan), Myanmar, Malaysia.

Ecology.— High humus litter in open areas on rock crevices, 500–2,500 m alt.; flowering from June to November, daily flowering time in early morning (or when there are dark cloud).

Conservation status.— Although *Cyanotis arachnoidea* can be found mostly the high mountains, but it has no commercial use reported. The conservation status of it can be assessed as LC based on IUCN Standards and Petitions Committee (2022).

Vernacular.— Ueang hin (เอื้องหิน) (Khon Kaen).

Notes.— *Cyanotis arachnoidea* is distinguished by elliptic-lanceolate to oblong basal rosette leaves, a decumbent stem, and linear cauline leaves. The inflorescence is head-like, usually in a few clusters, but can be solitary. All plants have cobweb-like or arachnoid hairs, at least on the inflorescence bracts and bracteoles, and are rarely glabrous. The pubescence is quite related to their habitat. Plants with densely cobweb-like hairs are usually found in arid environments like rock crevices.

2. *Cyanotis axillaris* (L.) D. Don ex Sweet, Hort. Brit.: 430. 1826; C.B. Clark in A. DC. & C. DC., Monogr. Phan. 3: 244. 1881; Hook.f., Fl. Brit. India 6: 388. 1894; Trimen, Handb. Fl. Ceylon 4: 315. 1898; Ridl., Fl. Mal. Pen. 4: 358. 1924; Merr., Enum. Philipp. Fl. Pl. 1: 198. 1925; G. Brückn. in Engler & Prantl, Nat. Pflanzenfam., ed. 2: 168. 1930; Cherfils in Lecomte et al., Fl. Indo-Chine. 6(7): 868. 1937; Bakh.f., Blumea 6(2): 399. 1950; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1082. 1956; Backer & Bakh.f., Fl. Java 3: 14. 1968; Hô, Câycô Vietnam 3(1): 476. 1993; Noltie, Fl. Bhutan 3(1): 222. 1994; Faden in Dassan. & Clayton, Revis. Handb. Fl. Ceylon 14: 119. 2000; D.Y. Hong & DeFilipps in Z.Y. Wu & P. Raven, Fl. China 24: 22. 2000.— *Commelina axillaris* L., Sp. Pl. 1: 42. 1753.— *Tradescantia axillaris* (L.) L., Mant. Pl. Altera 2: 321. 1771; Blume, Enum. Pl. Java. 1: 6. 1827.— *Amischophacelus axillaris* (L.) Rao & Kammathy, J. Linn. Soc., Bot. 59(379): 306. 1966.

Type: t. 174, f. 3, image in Plukenet (1692) (lectotype, designated by Faden, 2000).

Aquatic annual with erect or ascending, spreading or decumbent shoots; branches starting from a short lived, slender rosette stem; stem slender up to 40 cm tall, usually branched, up to 1.5 m long, glabrous or sparsely pubescent and densely hairy on one side. *Roots* thin. *Basal leaves* absent. *Cauline leaves* distichous or occasionally spirally arrange, linear to linear-lanceolate, 2–15 by 0.5–1 cm, glabrous, apex

acuminate, margins scabrid and/or sparsely ciliate on lower part; leaf sheaths short, 0.5–1.2 by 0.3–0.8 cm, swollen when flowering and fruiting, sparsely hirsute and densely hairy on one side, mouth ciliate. *Inflorescences* axillary enclosed in the leaf sheaths; cincinni reduced in fascicles of 4–8 flowers, emerging from the sheath; bracteoles membranous, minute, slightly narrowed falcate, 3–10 by 0.5–2 mm, sparsely hairy on distal portion. *Sepals* basally fused; calyx lobed, lanceolate, 3.5–4 by 1.8–2 mm, greenish, hairy on especially upper midvein outside; calyx tube, 3.5–6 by 1.3–2 mm, hyaline. *Petals* pinkish purple to violet-blue or white; corolla lobes ovate, 4–6 by 3.5–5 mm; corolla tube, 8–10 by 1–2 mm. *Stamens* filaments 11–15 mm long, purple to violet bearded below subapical fusiform swelling; anthers bright yellowish orange, ovate, 0.8–1 by 0.5–0.8 mm. *Ovary* elliptic, ca 1.3 by 0.7 mm, densely pubescent distally which with 6 horns (2 horns or bifid per locule); styles filiform, 11–13 mm long, glabrous, with a subapical swelling. *Capsules* slightly flattened, elliptic, 4–7 by 3–3.5 mm, with 3 or 6 (bifid valve) styler projections, densely pubescent distally, with 2 seeds per locule. *Seeds* oblong-ellipsoid, ca 2 by 1.5 mm (the solitary seed, ellipsoid, ca 2.5 by 1.5–2 mm), dark brown to black, finely reticulate, with sparse, deep pits. (Fig. 1G–1H, 2E–2F)

Thailand.— NORTHERN: Chiang Mai [Mueang, Chaeng Hua Lin, 15 Oct. 1921, *Nai Noi s.n.* (**BK**); Doi Suthep-Pui NP, 27 Jul. 1958, *Floto* 4473 (**BKF**); *ibid.*, 25 Oct. 1958, *Floto* 5904 (**BKF**); Chom Thong, 19 Dec. 1991, *Maxwell* 91-1109 (**CMU**); Doi Inthanon NP, Mae Klang Waterfall, 16 Dec. 1965, *Tagawa et al.* *T-2320* (**BKF**); *ibid.*, 15 Sept. 1995, *Larsen et al.* 46473 (**AAU**); San Kamphaeng, 17 Oct. 1958, *Floto* 5935 (**BKF**); *Thitimetharoch & Faden* 777 (**BKF**); Phayao [University of Phayao, 28 Sept. 2021, *Boonsuk* 897 (**KKU**); Lamphun [Mae Tha, 30 Aug. 1994, *Maxwell* 94-1159 (**BKF**, **CMU**); Lampang [Chae Hom, 14 Oct. 2000, *Panatkool* 401 (**CMU**); Uttaradit [Phichai, 22 Oct. 1992, *Maxwell* 92-644 (**CMU**); Sukhothai [Mueang, 2 Nov. 1971, *Maxwell* 71-637 (**BK**); Phitsanulok [Thung Salaeng Luang NP, 22 Jul. 1966, *Larsen et al.* 729 (**AAU**); *ibid.*, 22 Oct. 1984, *Murata et al.* *T-51459* (**QBG**); Noen Maprang, 18 Nov. 2010, *Maknoi* 4005 (**QBG**); Kamphaeng Phet [28 Nov. 1977, *Phengklai et al.* 3952 (**BKF**); Nakhon Sawan [Bueng Boraphet, 25 Nov. 1987, *Vacharee* 815 (**BK**); *ibid.*, 16 Dec. 1999, *Sasrirat* 161 (**QBG**); NORTH-EASTERN: Loei [Phu Kradueng, 11 Nov. 1970, *Charoenphol et al.* 4908 (**AAU**, **BKF**, **K**); *ibid.*, 30 Oct. 1984, *Murata et al.* *T-42062* (**BKF**); Nong Hin, 22 Sept. 2007, *Thitimetharoch et al.* 800 (**BKF**, **KKU**); Khon Kaen [Chum Phae, 20 Nov. 1958, *Smitinand* 4872 (**BKF**); *ibid.*, Chum Phae –

Chaityaphum, 11 Aug. 1972, *Larsen et al.* 31678 (**AAU**, **BKF**); Waeng Yai, 24 Nov. 2006, *Norsaengsri* 2602 (**QBG**); *ibid.*, 24 Oct. 2008, *Norsaengsri* 4335 (**PSU**, **QBG**); Phu Wiang, 26 Sept. 2007, *Thitimetharoch et al.* 827 (**BKF**, **KKU**, **QBG**); EASTERN: Nakhon Ratchasima [Huai Thalaeng, 20 Dec. 2005, *Pooma et al.* 5946 (**BKF**); Surin [Mueang, 27 Nov. 2007, *Norsaengsri & Wangwasit* 3127 (**QBG**); Sangkha, 30 Nov. 2016, *Muangyen* 1446 (**QBG**); Ubon Ratchathani [Oct.–Nov. 1956, *Gillet* 17 (**K**); SOUTH-WESTERN: Kanchanaburi [Bo Rai, 19 Jul. 1926, *Put* 173 (**K**); Sai Yok, 25 Nov. 1971, *van Beusekom et al.* 3958 (**BKF**, **K**); Mueang, 6 Sept. 2007, *Thitimetharoch & Faden* 755 (**BKF**); CENTRAL: Lop Buri [Chai Badan, 10 Oct. 1926, *Lakshnakara* 261 (**BK**, **K**); Lam Narai, 21 Aug. 2003, *Maknoi* 478 (**QBG**); Suphan Buri [U Thong, 6 Oct. 2009, *Tanming* SP34 (**QBG**); Phra Nakhon Si Ayutthaya [Route from Ang Thong to Ayutthaya, 7 Oct. 1971, *Murata et al.* *T-14752* (**BKF**); Saraburi [Sam Lan NP, 1 Jun. 1974, *Maxwell* 74-555 (**AAU**, **BK**); *ibid.*, 23 Oct. 2004, *Petrmitr* 573 (**BKF**, **CMU**); Phra Phutthabat, Tham Makak, 9 Sept. 2006, *Pooma & Phattarahirankanok* 6303 (**BKF**, **QBG**); Nakhon Nayok [Ongkharak, Yothaka, 7 Oct. 1979, *Paisooksantivatana* 7/52-1979 (**BK**); Bangkok [27 Oct. 1919, *Kerr* 3839 (**BM**, **K**); *ibid.* 29 Aug. 1920, *Kerr* 4434 (**BM**, **K**); *ibid.*, 1 Sept. 1920, *Kerr* 4472 (**BM**, **K**); *ibid.*, 4 Nov. 1921, *Lakshnakara* 256 (**BK**); SOUTH-EASTERN: Sa Kaeo [Aranyaprathet, 20 Oct. 1828, *Put* 2060 (**BK**); Prachin Buri [Si Maha Phot, 12 Nov. 1964, *Sutheesorn* 82 (**BK**); Chachoengsao [Phanom Sarakham, 1 Oct. 1984, *Murata et al.* *T-37031* (**BKF**); Chon Buri [Sattahip, 5 Dec. 1971, *Maxwell* 71-767 (**AAU**, **BK**); *ibid.*, 8 Oct. 1972, *Maxwell* 72-441 (**BK**); Si Racha, 25 Nov. 1927, *Collins* 1913 (**BK**); Chan Ta Then Waterfall, 18 Dec. 1974, *Chermsirivathana* 1974 (**BK**); Rayong [Ban Phe, 14 Dec. 1974, *Geesink & Hiepko* 7815 (**BKF**); 24 Aug. 1977, *Phengklai et al.* 3842 (**PSU**); Klaeng, Eastern Plant Collection Center, 18 Nov. 2008, *Wessumritt & Norsaengsri* 137 (**QBG**); Chanthaburi [Mueang, 17 Oct. 1971, *Maxwell* 71-554 (**AAU**, **BK**); Khao Khitchakut, Khao Phrabat, 27 Aug. 1972, *Larsen et al.* 32128 (**AAU**, **BKF**); Pong Nam Ron, 8 Oct. 1956, *Smitinand* 3566 (**BKF**); PENINSULAR: Trang [Mueang, 21 June 2009, *Pattarakulpisutti & Sridith* 388 (**PSU**); Satun [Mueang, 2 Dec. 1999, *Phaisalchantasasi* 5 (**PSU**); Songkhla [Hat Yai, 26 Nov. 1978, *Hamilton* 41 (**PSU**); Saba Yoi, Khlong Lam Thap, 30 Oct. 1986, *Supapol & Atcharyapanya* 57 (**PSU**); *ibid.*, Tham Talot, 25 Nov. 1990, *Larsen et al.* 41715 (**PSU**); Sathing Phra, 26 Nov. 1983, *Siriruga* 704 (**PSU**); Narathiwat [S of Narathiwat, 8

Mar. 1974, *Larsen & Larsen* 33090 (AAU); Ba Cho, 25 Oct. 1971, *Sadakorn* 281 (BK)].

Distribution.— Tropical Africa, India, Himalayan region, Sri Lanka, Myanmar, China, Indo-China, Malaysia, Java, Northern Australia.

Ecology.— Common in muddy, marshy, moist sandy open areas, 0–500 m alt.; flowering from June to November, daily flowering time in late morning.

Conservation status.— Following Gupta (2011), the conservation status of *Cyanotis axillaris* has been reported as LC.

Vernacular.— Phak plap na (ผักปลานนา)(Bangkok); phak plap (ผักปลาน)(Central); kin kung luang (กินกุ้งหลวง)(Chiang Mai); ya pho phot lek (หญ้าพอผลเหล็ก)(Prachin Buri).

Notes. *Cyanotis axillaris* is distinguished by having inflorescences borne within the leaf axil. It has small and inconspicuous bracteoles, and only flowers emerge from the leaf axils. Two forms have been found and collected. The first one is larger, more robust, and more erect. Leaves are longer, thinner, and less succulent. Six stilar projections (bifid valves) protrude from the capsule. The plant seems to be uncommon in the gallery forest. The second form is smaller, diffusely procumbent, and weed-like in open areas. The leaves are shorter, thicker, and more succulent. The capsule has three stilar projections at the tip and is depressed at the center.

3. *Cyanotis burmanniana* Wight, Icon. Pl. Ind. Orient. 6: 32, t. 2089. 1853; Hô, *Cây cỏ Việt Nam* 3(1): 474. 1993; Faden in Dassan. & Clayton, Revis. Handb. Fl. Ceylon 14: 121. 2000.— *C. papilionacea* (Burm.f.) Schult. & Schult.f. var. *burmanniana* (Wight) C.B. Clarke, Monogr. Phan. 3: 246. 1881; Hook.f., Fl. Brit. India 6: 385. 1894. Type: India, Kerala, Kollam (Quilon), Oct. 1835, *Wight s.n.* (lectotype: K000854122!; isolectotype: K000854123!, designated by Nandikar and Gurav, 2014).

— *C. hirtella* Miq. ex C.B. Clarke in A. DC. & C. DC., Monogr. Phan. 3: 246. 1881. Type: India, *Cuven Dah s.n.* (K, n.v.).

— *C. papilionacea* sensu Hook.f., Fl. Brit. India 6: 384. 1894; Cooke, Fl. Pres. Bombay. 2: 792. 1908; Cherfils in Lecomte et al., Fl. Indo-Chine. 6(7): 867. 1937, pro parte, non Schult. and Schult.f. (1830).

— *C. vaginata* Wight, Icon. Pl. Ind. Orient. 6: 32. t. 2088. 1853; Hassk., Commelin. Ind. 98. 1870; C.B. Clarke in A. DC. & C. DC., Monogr. Phan. 3: 247. 1881; Hook.f., Fl. Brit. India 6: 385. 1894. Type: India, Malabar (Kerala), *Wight s.n.* (lectotype K000854120!; isolectotype K000854121!, designated by Nandikar & Gurav, 2014).

— *C. hispida* Dalzell, Hooker's J. Bot. Kew Gard. Misc. 3: 139. 1851. Type: India, Malwan (Bombay), *Dalzell* 745 (lectotype: CAL, n.v.; isolectotype: NY00247435!, designated by Nandikar & Gurav, 2014).

— *C. hirtella* Miq. ex Hassk., Commelin. Ind.: 112. 1870. Type: India, Mangalore (North Kanara), 1847, *Hohenacker* 130 (lectotype: E00393349!; isolectotypes: C10009567!, FI012074! NY00247434!, S-G-8065!, designated by Nandikar & Gurav, 2014).

Erect to diffuse decumbent annual herb; stem branches filiform, up to 30 cm tall, with scattered hairs or coarse hairs all over, often green with maroon. *Roots* thin. *Basal leaves* absent. *Cauline leaves* distichous, linear-lanceolate, 3.5–8.5 by 0.6–0.9 cm, hirsute on both sides, apex acuminate, margins ciliate; leaf sheaths, 0.5–0.7 by 0.4–0.5 cm, hirsute all over and dense short hairs on one side, mouth ciliate. *Inflorescences* terminal, solitary or a few in fascicles; inflorescence bracts leafy, commonly inconspicuous and usually shorter than the inflorescence, lanceolate-ovate, 0.5–1.5 by 0.3–0.7 cm, hirsute on both sides; inflorescence peduncles 3–7 cm long, usually longer than the distal leaves, hirsute and dense short hairs on one side; cincinni 1–4 cm long; bracteoles comprising 6–20 pairs in lax and loose biseriate, conspicuous, 5–12 by 3–7 mm, falcate, herbaceous, pilose all over. *Sepals* basally fused; calyx lobes elliptic-oblong, 4–5 by 1.5–2 mm, apex acute, hairy outside. *Petals* bright violet-blue; corolla lobes broadly ovate, 4–5 by 4–5 mm; corolla tube, 4–4.2 by 3–3.5 mm. *Stamens* filaments 9–10 mm long, violet-blue bearded below a subapical fusiform swelling; anthers bright yellowish orange, elliptic-oblong, 0.8–1 by 0.3–0.4 mm. *Ovary* elliptic, ca 1 by 0.7 mm, pubescent distally, styles filiform, 8–9 mm long, bearded below an apical swelling. *Capsules* elliptic-oblong, ca 3 by 2 mm, with 2 seeds per locule. *Seeds* ovoid to oblong-ellipsoid, with abaxial longitudinal ridges, often with shallow transverse grooves, reticulate. (Fig. 1I–1J, 2G–2H)

Thailand.— NORTHERN: Mae Hong Son [Khun Yuam, 27 Aug. 2019, *Phaosricha et al.* 1769 (QBG)]; Chiang Mai [Mueang, Huai Kaeo, 14 Oct. 1939, *Suvataa* 7 (BK); *ibid.*, Suan Dok, 21 Sept. 1921, *Nai Noi s.n.* (BK); Doi Noi, 29 Oct. 1911, *Kerr* 2209 (BM, K); Doi Suthep-Pui NP, Hot, 7 Sept. 1958, *Sørensen et al.* 4813 (BKF); 28 Sept. 1958, *Sørensen et al.* 5305 (BKF); *ibid.*, 10 Aug. 1991, *Bensai* 26 (CMU); Fang, 25 Jul. 1968, *Larsen et al.* 2687 (BKF, K); Hot, 7 Sept. 1994, *Nanakorn et al.* 1542 (QBG); *ibid.*, Mai Mueang Nao Aboretum, 30 Aug. 2001, *Sankamethawee* 261 (BKF, CMU); Chiang Dao, Doi Mae Taman, 4 Oct. 1994, *Nanakorn et al.* 1992 (QBG); Chom Thong, Doi Inthanon NP, 13 Aug. 1996, *Nanakorn et al.* 7080

(**QBG**); *ibid.*, Mae Klang Waterfall, 10 Nov. 1965, *Sangkhachand* 27 (**BK**); San Kamphaeng, 29 Aug. 1996, *Maxwell* 96-1163 (**BKF, CMU**); Wiang Haeng, 4 Aug. 2001, *Norsaengsri* 1636 (**QBG**); Chiang Rai [Mae Suai, 30 Nov. 1920, *Kerr* 4669 (**BK, K**)]; Tak [Mae Sot, 15 Oct. 1991, *Paisooksantivathana* Y2626-91 (**BK**); Ban Tak, 13 Sept. 2007, *Thitimetharoch & Faden* 790 (**AAU, BK, BKF, KCU, QBG**); *ibid.*, Mae Salid, 21 May 2011, *Pooma & Pattharahirantricin* 7693 (**BKF, K**); Phitsanulok [Thung Salaeng Luang NP, 21 Jul. 1966, *Larsen et al.* 677 (**BKF**); Wang Thong, 26 Jul. 1973, *Murata et al.* T-17188 (**BKF**)]; NORTH-EASTERN: Phetchabun [Nam Nao, 18 Sept. 1994, *Nanakorn et al.* 1653 (**QBG**); Loei [Sithan, 2 Sept. 1948, *Bunpheng* 207 (**K**)]; Sakon Nakhon [Phu Phan NP, 15 Nov. 1984, *Mitsuta et al.* T-50311 (**BKF**); *ibid.*, 15 Nov. 1984, *Murata & Phengklai* T-50335 (**BKF**) & T-50341 (**BKF**); *ibid.*, Seri Thai Cave, 15 Aug. 2020, *Boonsuk* 872 (**BKF, KCU, QBG**); Kalasin [Sahatsakhan, Phu Sing, 22 Oct. 1975, *Sutheesorn & Sangkhachand* 3466 (**BK**)]; EASTERN: Chaiyaphum [Phu Khiao, 8 Nov. 1966, *S.N.* 277 (**BKF**); Nakhon Ratchasima [Ban Chum Saeng, 22 May 1929, *Nai Noe* 176 (**BK, BM, K**); Phimai, 4 Aug. 1963, *Pradit* 311 (**BK**); Pak Thong Chai, 5 Aug. 1967, *Phengnaren* 418 (**BKF, K**); Dan Khun Thot, 30 Aug. 2018, *Choopan et al.* 2018-363 (**QBG**); Buriram [Ban Kruat, 4 Aug. 1984, *Murata et al.* T-3748 (**BKF**); ca 40 km S of Buriram city, along route 219, 4 Aug. 1984, *Murata et al.* T-37423 (**BKF**); *ibid.*, 4 Oct. 1984, *Murata et al.* T-37439 (**BKF**); 22 Nov. 1976, *Phengklai et al.* 3352 (**BKF, PSU**); Surin [Sangkha, 30 Nov. 2016, *Muangyen* 1436 (**QBG**); Roi Et [Prathum Rat, 14 Sept. 1983, *Paisooksantivathana & Sadakorn* 1292-83 (**BK**); Amnat Charoen [Chanuman, 11 Aug. 2009, *Norsaengsri* 5915 (**QBG**); Si Sa Ket [Kantharalak, 8 Oct. 1984, *Murata et al.* T-49682 (**BKF**); Ubon Ratchathani [Oct.-Nov. 1956, *Gillet* 3 (**K**); Khong Chiam, 16 Sept. 2004, *Pooma et al.* 4729 (**AAU, BKF**); SOUTH-WESTERN: Kanchanaburi [Si Sawat, Erawan Waterfall, 11 Feb. 2001, *Phaisalchantasiri* 22 (**PSU**); 13 Sept. 1931, *Kerr* 20561 (**BK, BM, K**); Ban Thung Na Nang Rok, 25 Nov. 1957, *Burkill HMB* 1235 (**BKF**); Ratchaburi [18 Jul. 1924, *Kerr* 9035 (**BK, BM, K**); Phetchaburi [Huai Sai, 25 Aug. 1999, *Niyomdham* 5786 (**BKF**); *ibid.*, 12 Sept. 1999, *Niyomdham* 5824 (**BKF**); Prachuap Khiri Khan [Hua Hin, 5 Nov. 1927, *Kerr* 13450 (**BK, BM, K**); *ibid.*, 11 Nov. 1928, *Kerr* 16208 (**BK, BM, K**); Sam Roi Yot, Apr. 1951, *Smitinand & Fraser* 49 (**BKF**); Nong Kae, 17 Sept. 2017, *Srisanga* 3990 (**QBG**); Mueang, 21 Dec. 2002, *Aggrimaranssee* 17 (**CMU**); CENTRAL: Chai Nat [Thammamun, 18 Sept. 1930, *Kerr* 19666 (**BK, BM, K**); Lop Buri [Lam

Narai, 21 Aug. 2003, *Maknoi* 479 (**QBG**); Suphan Buri [U Thong, Wat Khao Tham Suea, 6 Oct. 2019, *Tanming SP10* (**QBG**); Saraburi [Sam Lan NP, 14 Jul. 1974, *Maxwell* 74-710 (**BK**); SOUTH-EASTERN: Sa Kaeo [Aranyaprathet, 9 Apr. 1930, *Kerr* 19587 (**BK, BM, K**); Watthana Nakhon, 14 Oct. 1828, *Put* 1922 (**BK, BM, K**); Prachin Buri [Khao Yai NP, 2 Oct. 1984, *Murata et al.* T-37231 (**BKF**); Chon Buri [Si Racha, Khao Khiao, 19 Oct. 1975, *Maxwell* 75-1043 (**BK**); *ibid.*, 11 Oct. 1976, *Maxwell* 76-678 (**BK**); *ibid.*, 25 Oct. 1927, *Collins* 1915 (**BK**); Rayong [Klaeng, Chak Phong, 10 Oct. 2008, *Wessumritt & Norsaengsri* 22 (**QBG**); Chanthaburi [Khao Khitchakut NP (Khao Phra Bat), 27 Aug. 1972, *Larsen et al.* 32122 (**BKF, K**); Khung Kraben, 1 Nov. 1997, *Niyomdham* 5207 (**BKF**); PENINSULAR: Surat Thani [3 Dec. 1926, *Kerr* 11194 (**BM, K**); *ibid.*, Khan Thuli, 9 Sept. 1931, *Put* 4174 (**BK, BM, K**); Songkhla [Mueang, 11 Oct. 1984, *Sirirugsa* 885 (**PSU**); *ibid.*, 8 Apr. 1928, *Kerr* 15106 (**BK, BM, K**); Thepa, 2 Mar. 1981, *Sirirugsa* 360a (**PSU**); *ibid.*, 28 Nov. 1985, *Maxwell* 85-1071 (**BKF, CMU, PSU**); *ibid.*, 23 Oct. 1993, *Larsen et al.* 43932 (**BKF**); *ibid.*, 12 Oct. 2000, *O.N. et al.* 29 (**PSU**)).

Distribution.— India, Sri Lanka.

Ecology.— Sandy soil in deciduous forest or by a small stream, open evergreen jungle, alt. 0-700 m; flowering from July to December, daily flowering time in the morning.

Conservation status.— *Cyanotis burmanniana* is common and found in all parts of Thailand, but no purpose or usage has been recorded. Therefore, we classified this species in the category of LC according to the IUCN Standards and Petitions Committee (2022).

Vernacular.— Pak nok kao (ปากนกแก้ว)(Chai Nat).

Notes.— *Cyanotis burmanniana* is distinguished by its scattered pubescence and very short inflorescence bracts, which are usually shorter than the cincinni. A cincinnus is typically elongated and has up to 20 pairs of herbaceous bracteoles.

4. *Cyanotis cristata* (L.) D. Don, Prodr. Fl. Nepal: 46. 1825; Sweet, Hort. Brit.: 430. 1826; Wight, Icon. Pl. Ind. Orient. 6: 32. t. 2082. 1853; Hassk., Commel. Ind.: 120. 1870; C.B. Clarke in A. DC. & C. DC., Monogr. Phan. 3: 247. 1881; Hook.f., Fl. Brit. India 6: 385. 1894; Trimen, Handb. Fl. Ceylon 4: 311. 1898; Cooke, Fl. Pres. Bombay 2: 794. 1908; Ridl., Fl. Mal. Pen. 4: 358. 1924; Merr., Enum. Philipp. Fl. Pl. 1: 198. 1925; G. Brückn. in Engler & Prantl, Nat. Pflanzenfam., ed. 2: 168. 1930; Cherfils in Lecomte et al., Fl. Indo-Chine. 6(7): 866. 1937; Bakh.f., Blumea 6(2): 399. 1950; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1081.

1956; Backer & Bakh.f., *Fl. Java* 3: 14. 1968; Hô, *Cây cỏ Việt Nam* 3(1): 475. 1993; Noltie, *Fl. Bhutan* 3(1): 222. 1994; Faden in Dassan. & Clayton, *Revis. Handb. Fl. Ceylon* 14: 123. 2000; D.Y. Hong & DeFilipps in Z.Y. Wu & P. Raven, *Fl. China* 24: 21. 2000. — *Commelina cristata* L., *Sp. Pl.* 1: 42. 1753. — *Tradescantia cristata* (L.) L., *Syst. Nat.* (ed. 12): 233. 1767; Willd., *Sp. Pl.* 2(1): 21. 1799; Spreng., *Syst. Veg.* 2: 116. 1825; Blume, *Enum. Pl. Java.* 1: 6. 1827. Type: Java, *Herb. Hermann* [icon] (lectotype BM000594932!, designated by Faden, 2000).

Unbranched erect to densely branching decumbent annual herb, often branching below; stem up to 30 cm tall, often green marked with maroon, with a longitudinal row of dense white short hairs on one side. *Roots* thin. *Basal leaves* absent. *Cauline leaves* distichous, narrowly elliptic to elliptic-lanceolate, 3–10 by 1–2 cm, glabrous, apex acuminate, margins ciliate with densely white hairs; leaf sheaths, 0.5–1 by 0.3–0.7 cm, white dense hairs on one side, mouth ciliate. *Inflorescences* terminal, sometimes in cluster; inflorescence bracts leafy, spathe-like and conduplicate at the base, much longer than the inflorescence, lanceolate-oblong, 2.5–6 by 0.8–1.3 cm; inflorescence peduncles up to 6 cm long, with dense short hairs on one side; cincinni 0.5–2.5 cm long; bracteoles comprising 4–12 pairs, 6–15 by 3–6 mm, falcate, herbaceous, glabrous but with ciliate margin. *Sepals* basally fused; calyx lobe linear-lanceolate to oblanceolate, 4–5 by 2.5–3 mm, green, apex acute, hairy along midvein and margin; calyx tube ca 2 by 2.5 mm, white. *Petals* bright blue or bright violet-blue, corolla lobes ovate, 3–4 by 4–4.5 mm; corolla tube 4–7 by 1.5–2 mm, white. *Stamens* filaments 6–8 mm long, violet-blue bearded below a slightly subapical fusiform swelling; anthers bright yellowish orange, elliptic, ca 0.4 by 0.2 mm. *Ovary* ovate, ca 1.5 by 1 mm; styles filiform, ca 5 mm long, glabrous, urceolate swelling at the apical end. *Capsules* elliptic, ca 2.5–3.5 by 1.5–2 mm, pubescent distally, with 2 seeds per locule. *Seeds* ovoid, 1.5–2 by 1.2–1.5 mm, brown, deeply pitted and longitudinally striate, verrucose on dorsal surface, with a mid-ventral ridge. (Fig. 1K–1L, 2I–2J)

Thailand.—NORTHERN: Mae Hong Son [Khun Yuam, 6 Sept. 1974, *Larsen & Larsen* 34196 (AAU); *ibid.*, 7 Sept. 1974, *Larsen & Larsen* 34240 (AAU); Mueang, Tham Pla, Namtok Pha Suea NP, *Norsaengsri* 10534 (QBG); Chiang Mai [2 Oct. 1910, *Kerr* 1441 (BM, K); Doi Chaingdao WS, 30 Aug. 19449, *Garret* 1279 (K); Doi Inthanon NP, 15 Sept. 1995, *Nanakorn et al.* 4355 (QBG); *ibid.*, 7 Oct. 1998, *La-onsri* 7 (QBG); *ibid.*, 8 Aug. 1909, *Kerr* 756 (BM, K); Doi Suthep-Pui NP, 12 Jul. 1959, *Floto* 4010 (BKF); *ibid.*, 23 Jul. 1959, *Floto* 4363 (BKF); *ibid.*, 15 Jul. 1968,

Larsen et al. 2487 (AAU, BKF, K); *ibid.*, 18 Jul. 1987, *Maxwell* 87-692 (BKF); 30 km W of Bo Luang, 3 Jul. 1968, *Larsen et al.* 2047 (BKF); 20 km W of Bo Luang, 4 Jul. 1968, *Larsen et al.* 2081 (BKF); Hot, 23 Aug. 1999, *Wattana & Suksathan* 621 (QBG); *ibid.*, 29 Aug. 2006, *Pumicong* 376 (CMU, QBG); Mae Rim, Pong Yaeng, 8 Sept. 1995, *Nanakorn et al.* 4153 (QBG); Om Koi, 27 Jul. 2013, *Pongamornkul* 3770 (QBG); *ibid.*, 20 Nov. 2015, *Pongamornkul* 5316 (QBG); *ibid.*, 9 Sept. 2016, *Pongamornkul et al.* 5756 (QBG); Mae Taeng, 21 Sept. 1995, *Nanakorn et al.* 4641 (QBG); Mae On, 4 Sept. 1995, *Palee* 321 (CMU); San Kamphaeng, 27 Sept. 1996, *Nanakorn et al.* 7648 (QBG); Chiang Rai [Mae Fa Luang, 20 Jul. 2006, *J.F. Maxwell* 06-470 (CMU, QBG); Wiang Pa Pao, 24 Sept. 2015, *Tanming* 977 (QBG)]; Phayao [Rong Kham Luang Forest Park, 5 Oct. 2019, *Boonsuk* 848 (BKF)]; Lamphun [Mae Tha, 22 Aug. 1993, *Maxwell* 1253 (BKF); Pa Sang, 24 Aug. 2010, *Norsaengsri* 7206 (QBG)]; Lampang [Chae Hom, Mueang Mai, 26 Jul. 2016, *La-onsri et al.* 4900 (QBG); Chae Son NP, Mueang Pan, 23 Aug. 1995, *Maxwell* 95-562 (BKF, CMU); Sop Prap, *Rakarcha et al.* 897 (QBG)]; Phrae [Huai Rong Waterfall, 9 Sept. 1995, *Larsen et al.* 46256 (BKF)]; Tak [Doi Kha, ca 40 km W of Tak, 22 Jul. 1973, *Murata et al.* T-16811 (BKF); Khun Pha Wo NP, 23 Jul. 1973, *Murata et al.* 16875 (BKF)]; Mae Sot, 8 Aug. 1989, *Paisooksantiwatana* y-2405-89 (BK); *ibid.*, 21 Aug. 1994, *Maxwell* 94-921 (BKF, CMU); Wang Chao, 8 Jan. 1904, *Lindhard* 28 (K); *ibid.*, 10 Oct. 1904, *Hosseus* 72 (BM, K)]; Sukhothai [Rham Kham Haeng NP, 10 Sept. 2010, *La-onsri & Norsaengsri* 1152 (QBG)]; Phitsanulok [Chat Trakan, 20 Aug. 2012, *Romklao Botanical Garden* 0627/2555 (QBG)]; Thung Salaeng Luang NP, 19 Jul. 1966, *Larsen et al.* 470 (BKF); *ibid.*, Kaeng Sopha Waterfall, 22 Jul. 1966, *Larsen et al.* 731 (BKF); *ibid.*, 22 Oct. 1984, *Murata et al.* T-38527 (BKF) & T-51481 (BKF); *ibid.*, *Phusomsaeng et al.* 123 (BKF)]; Kamphaeng Phet [Mae Wong NP, Thon Bunmi Waterfall, 2 Aug. 2000, *Thitimetharoch* 417 (BK, KKKU)]; Nakon Sawan [Taklee, 11 Nov. 1920, *Marcan* 1097 (BM, K)]; NORTH-EASTERN: Loei [Phu Kradueng NP, 28 Aug. 1988, *Tamura* T-60471 (BKF); Na Haeo, 5 Nov. 1995, *Nanakorn et al.* 5102 (QBG); Nong Hin, 22 Sept. 2007, *Thitimetharoch & Faden* 794 (BKF, KKKU); *ibid.*, 22 Sept. 2007, *Thitimetharoch & Faden* 794 (BKF, KKKU)]; Khon Kaen [Phu Wiang NP, 13 Jul. 1996, *Anusornsayium* 002 (BK); *ibid.*, 10 Jun. 2000, *Thitimetharoch* 379 (BKF, KKKU)]; Phu Pha Man NP, Pha Nok Khao, 4 Aug. 2011, *Norsaengsri et al.* 8013 (QBG)]; EASTERN: Nakhon Ratchasima [Ban Tha Ang, 4 Aug. 1965, *Phengnaren* 33 (BKF)]; Pak Thong

Chai, 26 Aug. 1967, *Damrongsak* 152 (**BKF**); Khao Yai NP, near Pak Thong Chai, 2 Nov. 1970, *Charoenphol et al.* 4472 (**BKF, K**); SOUTH-WESTERN: Phetchaburi [Huai Sai, 12 Sept. 1999, *Niyomdham* 5834 (**BKF**); *ibid.*, 21 Sept. 1999, *Puudjaa & Cholkulchana* 688 (**BKF**); Kanchanaburi [Khwaie Noi River, Ka Tha Lai, 12 Jun. 1949, *den Hoed & Kostemans* 931 (**K**); *ibid.*, Brangkasi, 19–22 Jun. 1946, *den Hoed & Kostemans* 666 (**K**); Sangkhla Buri, Wangka, 12 Jun. 1946, *den Hoed & Kostemans* 931 (**BK**); Erawan NP, 3 Jul. 1974, *Larsen & Larsen* 34051 (**AAU, K**); Huai Ban Kao, Kritee, 5 Jul. 1973, *Geesink & Phengklai* 6125 (**AAU, BKF**); Si Sawat, 5 Nov. 1971, *van Beusekom et al.* 3933 (**BKF**); Erawan NP, 5 Sept. 2007, *Thitimetharoch & Faden* 745 (**BKF**); Sai Yok, Dao Dueng, Noen Phra Pu, 11 Sept. 2020, *Thammarong et al.* 2590 (**QBG**); *ibid.*, Lawa Cave, 12 Sept. 2020, *Thammarong et al.* 2617 (**QBG**); Thong Pha Phum, Ban Lin Thin, 25 Aug. 1999, *Wongprasert s.n.* (**BKF**); Chaloe Rattanakosin NP, 27 Jun. 2018, *La-ongsri et al.* 5657 (**QBG**); Prachuap Kiri Khan [Khlong Wan, 20 Oct. 1964, *Chermsirivathna* 103 (**BK**); CENTRAL: Saraburi [Saraburi Botanic Garden, 17 Sept. 1996, *Phengklai & Fukuoka* 10610 (**BKF**); Bangkok [23 Aug. 1920, *Kerr* 4423 (**BM, K**); *ibid.*, 5 Sept. 1920, *Kerr* 4456 (**BM, K**–2 sheets); *ibid.*, 30 Sept. 1923, *Kerr s.n.* (**BK**); *Smith* 90 (**BK**); SOUTH-EASTERN: Chon Buri [Si Racha, Khao Khiao, 23 Jun. 1975, *Maxwell* 75–629 (**AAU, BK**); *ibid.*, Sukhala, 7 Sept. 2004, *Maxwell* 04–472 (**CMU**); Rayong [Ban Khai, 3 Nov. 1971, *Sutheesorn* 2014 (**BK**); Chanthaburi [Pong Nam Ron, 15 Sept. 1964, *Adisai* 876 (**BK**); *ibid.*, trail to Hin Dat Waterfall, Soi Dao WS, 26 Sept. 2020, *Boonsuk* 880 (**KKU**); Tha Mai, 22 Sept. 1994, *Puudjaa* 154 (**BKF**); Trat [Mueang, 23 Oct. 1972, *Maxwell* 72–541 (**BK**); PENINSULAR: Surat Thani [Khan Thuli, 7 Sept. 1931, *Put* 4141 (**BK, BM, K**); Mueang, *Sutheesorn* 1858 (**BK**); Nakhon Si Thammarat [Lan Saka, Kiri Wong, 27 Nov. 1951, *Ploenchit* 189 (**BKF, K**); Thung Song, 18 Dec. 1965, *Umpai* 223 (**BK**); Songkhla [15 km W of Saba Yoi, 25 Nov. 1990, *Larsen et al.* 41715 (**BKF**); Suan Tun Waterfall, 1 Nov. 1993, *Larsen et al.* 41481 (**BKF**); Narathiwat [Ba Cho, 25 Oct. 1971, *Sadakorn* 279 (**BK**)].

Distribution.— Tropical Africa to India, Himalayan region, Sri Lanka, China, Indo-China, Malaysia, Java, Philippines.

Ecology.— In wet and high humus litter on rocks, in gallery and evergreen forest or shade places in deciduous forest, alt. 0–700 m; flowering from May to August, daily flowering time in the morning.

Conservation status.— *Cyanotis cristata* has been listed as LC by Watve (2011) based on IUCN Standards and Petitions Committee (2022).

Vernacular.— Ya hu arak noi (หญ้าหัวรากน้อย)(Chiang Mai); Ya hua muan (หญ้าหัวม้วน)(Surat Thani).

Notes.— *Cyanotis cristata* is like *C. burmanniana* in its habit, which varies from unbranched and erect to densely branching and decumbent, but it could be easily recognized by having glabrous leaves with a ciliate margin, and the leaves are narrowly elliptic to elliptic-lanceolate and broader than 1 cm wide. Its inflorescence bract is leaf-like and larger than the inflorescence. Its bracteoles are bigger than those of other species and glabrous with long setae at the margin. The petals range in color from white to purplish.

5. *Cyanotis vaga* (Lour.) Roem. & Schult., Syst. Veg., ed. 15 bis 7(2): 1153. 1830; Rao, Notes Roy. Bot. Gard. Edinburgh 25(2): 186. 1965; Hook.f., Fl. Brit. India 6: 387. 1894; Hô, Cây cỏ Việt Nam 3(1): 476. 1993; Noltie, Fl. Bhutan 3(1): 220. 1994; D.Y. Hong & DeFilipps in Z.Y. Wu & P. Raven, Fl. China 24: 21. 2000. — *Tradescantia vaga* Lour., Fl. Cochinch. 1: 193. 1790; Spreng., Syst. Veg. 2: 116. 1825; Blume, Enum. Pl. Java. 1: 5. 1827; Hassk., Commelin. Ind.: 62. 1870. Type: China. “Cantone Sinarum” (no specimen cited).

— *C. barbata* D. Don, Prodr. Fl. Nepal: 46. 1825; Hook.f., Fl. Brit. India, 6: 385. 1894; Ridl., Fl. Mal. Pen. 4: 358. 1924; G. Brückn. in Engler & Prantl, Nat. Pflanzenfam., ed. 2: 168. 1930; Cherfils in Lecomte et al., Fl. Indo-Chine. 6(7): 865. 1937. Type: Nepal, *Wallich Cat. no.* 8993A (lectotype: K001132052!, selected here; isolectotype BM000521495!).

Perennial herbs, without basal rosette leaves; stem spreading, prostrate, procumbent, often branching basally and zigzag distal branches, up to 1 m long, usually maroon with silky hairs all over, dense on one side, subterranean corm present. Roots thin. Basal leaves present, not in a rosette, alternate, linear to linear-lanceolate, pubescent with cobweb-like hairs or sparsely whitish hairs. Cauline leaves linear-lanceolate, 2.5–5(–15) by 0.5–1.5(–2.5) cm, sparsely cobweb-like pubescent above and densely beneath, base rounded to amplexicaul, apex acute, margins entire; leaf sheaths 1.5–2.5 by 0.8–0.1 cm, glabrous to pubescent with cobweb-like hairs. Inflorescence terminal and axillary, common with a few in clusters, pubescent cobweb-like hairs, subsessile or with a peduncle up to 3.5 cm long; inflorescence bracts spathe-like, conduplicate, lanceolate, ca 2 by 0.8 cm, usually shorter than the inflorescence, densely silky pubescent beneath; bracteoles comprising 4–7 pairs, 5–15 by 1.2–5 mm,

falcate, herbaceous, very close and tight overlap, glabrous or covered with silky hairs outside; inflorescence peduncles up to 3.5 cm long, densely pubescent on one side. *Flowers* pinkish purple to violet-blue. *Sepals* shortly fused at the base, lanceolate-oblong, 4–6 by 1–1.5 mm, hairy outside. *Petals* pinkish-purple to violet-blue; corolla lobes broadly ovate, ca 3 by 3.5 mm; corolla tube, ca 4.5 by 3 mm, white. *Stamens* filaments 9–10 mm long, purple to violet, bearded below a subapical swelling; anthers bright yellowish orange, elliptic-oblong, ca 1 by 0.4 mm. *Ovary* oblong, ca 1 by 0.4 mm, pubescent distally; styles filiform, ca 10 mm long, bearded below a subapical swelling. *Capsules* elliptic-ovate, 2.5–3.2 by 1.5–1.8 mm, with 2 seeds per locule. *Seeds* ovoid to ellipsoid, ca 1.5 by 1 mm, gray to brown, without transverse grooves, finely reticulate. (Fig. 1M–1P, 2K–2L)

Thailand.—NORTHERN: Mae Hong Son [Pang Ma Pha, 9 Sept. 1974, *Larsen et al.* 34289 (**BKF, K**)]; Chiang Mai [12 Sept. 1909, *Kerr* 801 (**BM, K**)]; Doi Suthep-Pui NP, 22 Oct. 1958, *Sørensen et al.* 5836 (**BKF**); *ibid.*, 23 Nov. 2013, *Traiperm & Layton* 560 (**QBG**); Chiang Dao, Doi Chiang Dao WS, 11 Sept. 1995, *Maxwell* 95-665 (**BKF**); *ibid.*, 28 Sept. 2001, *Norsaengsri* 1713 (**QBG**); Om Koi, 17 Oct. 1979, *Shimizu et al.* T-19037 (**AAU, BKF**); *ibid.*, 18 Oct. 1979, *Shimizu et al.* T-19357 (**AAU, BKF, K**); *ibid.*, Ban Ou Tum, 18 Nov. 2015, *Pongamornkul* 5273 (**QBG**); 18 Nov. 2015, *Pongamornkul* 5232 (**QBG**); *ibid.*, 20 Nov. 2015, *Pongamornkul* 5315 (**QBG**); *ibid.*, 22 Dec. 1987, *Niyomdham* 167 (**BKF, K**); *ibid.*, 22 Dec. 1978, *Niyomdham et al.* 167 (**BKF**); Doi Inthanon NP, 13 Sept. 1974, *Larsen & Larsen* 34471 (**K**); *ibid.*, 5 Dec. 1984, *Koyama & Phengklai* T-44210 (**BKF**); Mae Klang Waterfall, 8 Nov. 1965, *Sangkhaachand* 6 (**BK**); *ibid.*, 11 Nov. 1965 *Sangkhaachand* 38 (**BK**); *ibid.*, 1 Oct. 1971, *Murata et al.* T-15473 (**AAU, BKF**); *ibid.*, *Phengklai et al.* 11264 (**BKF**); Doi Ang Ka, 9 Dec. 1933, *Lakshnakara* 1453 (**BK**); Mae Ya Waterfall, 15 Dec. 1998, *Konta et al.* 4534 (**BKF**), Mai Mueang Nao Aboretum, 30 Aug. 2001, *Sankamethawee* 261 (**BKF, CMU**); *ibid.*, 17 Oct. 2001, *Sankamethawee* 306 (**BKF, CMU**); Fang, Doi Ang Khang, *Bunsongthae* 188 (**QBG**); Mae Rim, Pong Yaeng, 5 Aug. 1994, *Nanakorn et al.* 1256 (**QBG**); *ibid.*, Doi Mon Long, 1 Sept. 1994, *Nanakorn et al.* 19003 (**QBG**); *ibid.*, 18 Aug. 1998, *Pongamornkul* 276 (**QBG**) & 290 (**QBG**); Mae Taeng, 6 Oct. 1994, *Nanakorn et al.* 2333 (**QBG**); *ibid.*, 29 Aug. 1997, *Maxwell* 97-910 (**BKF, CMU**); Wiang Haeng, 4 Aug. 2001, *Norsaengsri* 1638 (**QBG**); Chiang Rai [Mae Sai, 27 Aug. 2010, *van de Bult* 1050 (**BKF**)]; Nan [Na Noi, Khun Sathan NP, 18 Jan. 2017,

Muangyen 1628 (**QBG**) & 2692 (**QBG**); Pua, Doi Phu Kha NP, 5 Sept. 2001, *Srisanga* 2147 (**BKF, CMU, QBG**); Lamphun [Mae Tha, 22 Oct. 1993, *Maxwell*, 93-1253 (**BKF**)]; Lampang [Sop Prap, 2 Aug. 2020, *Rakarcha et al.* 909 (**QBG**); Doi Chong NP, *Rakarcha et al.* 931 (**QBG**) & 937 (**QBG**)]; Tak [Doi Hua Mot, Um Phang, 27 Aug. 2008, *Karaket* 15 (**BKF, L**)]; Sukhothai [Khao Luang NP, *Niyomdham* 3948 (**BKF**)]. Phitsanulok [Wang Thong, Thung Salaeng Luang NP, 22 Oct. 1984 (**QBG**); Nakhon Thai, Phu Hin Rong Kla NP, 14 Oct. 1998, *Suksathan* 1292 (**QBG**)]; Kamphaeng Phet [Khao Sanam Priang, *van de Bult* 445 (**BKF**)]; NORTH-EASTERN: Phetchabun [Nam Nao NP, 18 Sept. 1994, *Nanakorn et al.* 1660 (**QBG**); *ibid.*, 3 Sept. 2014, *Maknoi* 7132 (**QBG**); *ibid.*, 3 Sept. 2013, *Khattiyot* 394 (**QBG**) & 415 (**QBG**)]; Loei [Phu Kradueng NP, 23 Aug. 1948, *Bunpheng* 186 (**K**); *ibid.*, 20 Mar. 1958, *Sørensen et al.* 2337 (**BKF**); *ibid.*, 9 Nov. 1970, *Charoenphol et al.* 4700 (**BKF, K**); *ibid.*, 9 Sept. 1948, *Bunpheng* 235 (**BKF, K**); *ibid.*, 20 Aug. 1951, *Bunpheng* 334 (**BKF, K**)]; Bueng Kan [Bung Khla, 10 Aug. 2004, *Nielsen et al.* 1618 (**BKF**)]; Sakon Nakhon [Phu Phan NP, Kham Hom Waterfall, 15 Aug. 2020, *Boonsuk* 873 (**KKU**)]; Mukdahan [Phu Pha Thoep NP, 27 Oct. 1998, *Wongprasert s.n.* (**BKF**); *ibid.*, *Murata et al.* T-50709 (**BKF**)]; Kalasin [Somdet, 24 Oct. 1975, *Sutheesorn & Sangkhachand* 3558 (**BK**)]; Khon Kaen [Chum Phae, 22 Nov. 2007, *Norsaengsri & Lakoet* 3054 (**QBG**); Phu Wiang NP, 16 Sept. 1994, *Nanakorn et al.* 1718 (**QBG**)]; EASTERN: Chaiyaphum [Phu Khiao WS, Oct. 1999, *Phengklai* 12290 (**BKF**); Thep Sathit, 9 Nov. 2014, *Kertsawang* 3367 (**QBG**)]. Nakhon Ratchasima [Lat Bua Khao, 9 Nov. 1931, *Put* 4353 (**BK, BM, K**)]; SOUTH-WESTERN: Kanchanaburi [Thong Pha Phum, Khao Laem NP, 15 Sept. 2016, *Muangyen* 1318 (**QBG**)]; Ratchaburi [Khao Krachom, 19 Nov. 1995, *Niyomdham* 4510 (**AAU, BKF**)]; Prachuap Kiri Khan [Huai Yang Waterfall, 24 Oct. 1964, *Chermsirivathana* 171 (**BK**)]; CENTRAL: Saraburi [Sam Lan NP, 9 Oct. 1973, *Maxwell* 73-443 (**BK**); *ibid.*, 25 Aug. 1974, *Maxwell* 74-853 (**BK**)]; Nakhon Nayok [Mueang, Sarika, Khao Lon, 20 Sept. 1897, *Bornyorot s.n.* (**BK**)]; Bangkok [23 Oct. 1916, *Kerr* 11049 (**BK, BM, K**)]; SOUTH-EASTERN: Chon Buri [Si Racha, 15 Nov. 1926, *Put* 466 (**BK, K**)]. PENINSULAR: Surat Thani [Ko Tao, 2 Jan. 1927, *Kerr* 11230 (**BK**)].

Distribution.—Africa, India, Himalayan region, Java, Philippines.

Ecology.—Common in open areas with high humus litter and wet rocks, 300–1,300 m alt.; flowering from July to August, daily flowering time in early morning, but late morning in Peninsula.

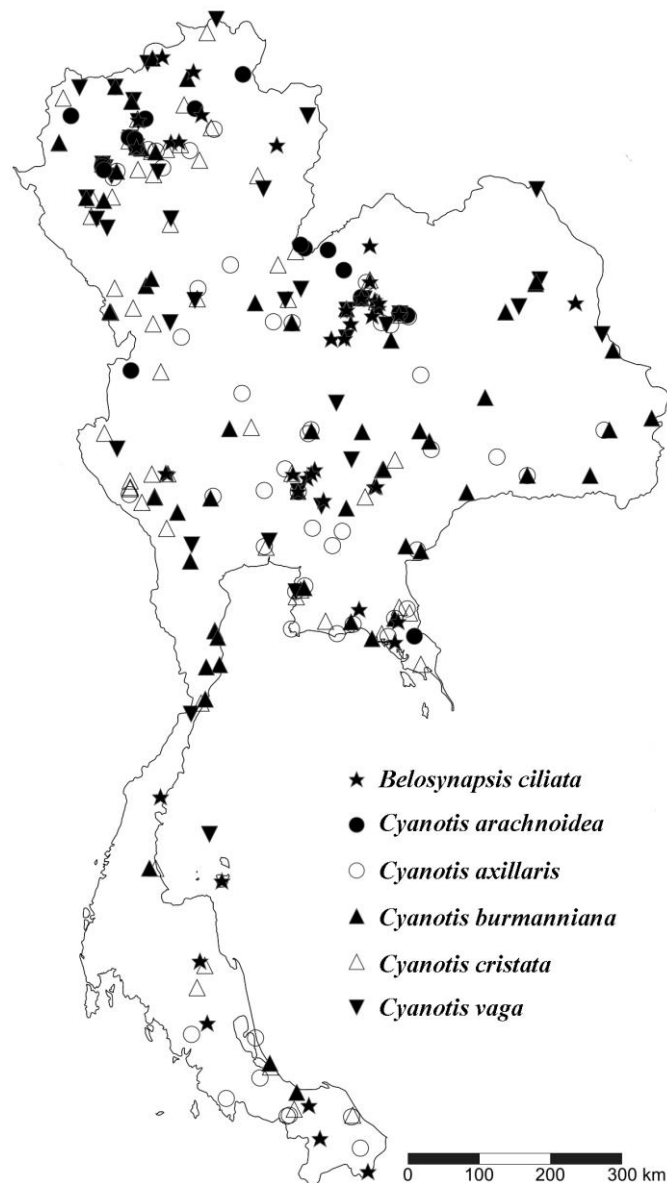


FIGURE 3. Distribution map of Cyanotinae in Thailand.

Conservation status.— *Cyanotis vaga* is common and can grow in various habitats. The conservation status can be assessed as LC according to the IUCN Standards and Petitions Committee (2022).

Vernacular.— Ya khrua fai (หญ้าเครือไฟ)(General); phak plap na (ผักปลาบนา)(Sakon Nakhon); ya kap phai (หญ้ากาบไผ่), ya kan daeng (หญ้าคันแดง)(Loei); ya pong lep mue nang (หญ้าป่องเล็บมือนาง)(Chon Buri).

Notes.— *Cyanotis vaga* is a spreading, prostrate, or procumbent plant with zigzag distal branches. Its basal leaves are linear and alternately arranged with the subterranean corm. *Cyanotis vaga*'s indumentum is variable from glabrous to sparsely pubescent or having cobweb-like hairs especially on bracteoles, leading to confusion with *C. arachnoidea*. However, the shape of

the basal leaves, including the seed surface sculpturing, may distinguish this species from the latter. Furthermore, *C. thwaitesii*, a Sri Lankan species based on Faden (2000), was reported in the checklist of Thai plants by The Forest Herbarium, Royal Forest Department (2014), but many herbarium specimens collected in Thailand and labeled as *C. thwaitesii* are congruent with the characters of *C. vaga* in the form of having cobweb-like pubescence with alternate basal and linear leaves. It may be a hybridization between *C. arachnoidea* and *C. vaga*. As a result, we conclude that *C. thwaitesii* does not exist in Thailand. The Wallich specimen, Wallich Cat. no. 8993A, deposited at K (K001132052), is selected for the lectotype of *Cyanotis barbata* D. Don according to Turband et al. (2018).

In conclusion, the subtribe Cyanotinae in Thailand consists of two genera, *Belosynapsis* and *Cyanotis*, containing one and five species, respectively. The key to genera was built using the characteristics of bracteoles, petals, stamens, and styles. *Cyanotis* species can be distinguished by morphological characteristics such as cincinnus position, presence of basal rosette leaves, shape and width of leaves, pubescence and size of bracteoles, pubescence with cobweb-like hairs, and seed surface, which have been used to build the key to species. All members of the subtribe Cyanotinae in Thailand are also assessed for conservation status in accordance with the IUCN Standards and Petitions Committee (2022) and are depicted in the Thailand distribution map (Fig. 3).

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