

## A revision of Boraginaceae subfamily Boraginoideae in Thailand

### ศึกษาทบทวนพืชวงศ์ย่อย Boraginoideae วงศ์ Boraginaceae ในประเทศไทย

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**ABSTRACT.** A taxonomic revision of Boraginaceae subfamily Boraginoideae in Thailand is presented. Four genera and seven species are recognized: three species in *Cynoglossum*, two in *Trichodesma* and one each in *Maharanga* and *Onosma*. Keys to the genera and species together with descriptions and distributional information of each species are provided.

**บทคัดย่อ.** ศึกษาทบทวนอนุกรมวิธานพืชวงศ์ย่อย Boraginoideae วงศ์ Boraginaceae ในประเทศไทย จำนวน 4 สกุล 7 ชนิด ได้แก่ สกุล *Cynoglossum* 3 ชนิด สกุล *Trichodesma* 2 ชนิด สกุล *Maharanga* และ สกุล *Onosma* สกุลละ 1 ชนิด สร้างรูปวิธานจำแนกสกุล และชนิด บรรยายลักษณะพืชอย่างละเอียด และข้อมูลการกระจายพันธุ์

**Keywords:** taxonomic revision, Boraginaceae, Boraginoideae, Thailand

**คำสำคัญ:** การศึกษาทบทวนอนุกรมวิธาน, วงศ์ปอหมัน, วงศ์ย่อยปอหมัน, ประเทศไทย

#### INTRODUCTION

Boraginaceae are a relatively large family of 142 genera and 2,450 species with a cosmopolitan distribution (Mabberley, 2008). Hutchinson (1959) and Heywood (1993) accepted that Boraginaceae should be further divided into four subfamilies, namely Boraginoideae, Cordioideae, Ehretioideae and

Heliotropioideae. The Boraginoideae are distinguished from the other subfamilies by a gynobasic style and fruits that break up into four separate nutlets. The Boraginoideae are herbs or subshrubs and distributed worldwide, occurring mostly in warm temperate areas, occurring in a variety of habitats from grassland to stony slopes on limestone, from sea level to approximately 1,000 m.

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Traditionally the Boraginoideae are divided into nine tribes based mainly on style and fruit characters, namely Boragineae, Cynoglosseae, Echiochileae, Echieae, Eritrichieae, Lithospermeae, Myosotideae, Trichodesmeae and Trigonotideae (Heywood *et al.*, 2007). Fletcher & Kerr (1951) were the first botanists to work on Thai Boraginaceae, listing nine genera and 35 species in *Florae Siamensis Enumeratio*. More recently the Forest Herbarium, Royal Forest Department (2001) enumerated nine genera and 25 species. The aim of the present study was to prepare a taxonomic revision of Boraginoideae as a precursor to the Flora of Thailand Boraginaceae account.

#### MATERIALS AND METHODS

The work was primarily based on a study of herbarium specimens in AAU, BCU, BK, BKF, BM, C, CMU, K, KKU, L, P, PSU, QBG and TCD (Holmgren & Holmgren, 1998) and the Herbarium of the Department of Biology, Chiang Mai University. Field-work was also carried out to collect fertile materials in various parts of the country. Morphological characters and measurements were taken directly from living or dried herbarium specimens. Ecological and distributional data were recorded. Photographs of living specimens were also taken in the field.

#### TAXONOMIC TREATMENT

##### BORAGINOIDEAE

DC., *Prodr.* 9: 466. 1845; C.B. Clarke in Hook.f., *Fl. Brit. India* 4: 134. 1883; Trimen, *Handb. Fl. Ceylon* 3: 192. 1895; Gagnep. & Cour. in Lecomte, *Fl. Indo-Chine* 4(3): 197.

1914; Ridl., *Fl. Malay. Penin.* 2: 438. 1923; Backer & Bakh.f., *Fl. Java* 2: 457. 1965; Ng, *Tree Fl. Mal.* 4: 58. 1989; Nowicke & Miller in Dassan. & Fosberg, *Fl. Ceylon* 7: 3. 1991; Riedl, *Fl. Males.* 13: 43. 1997; Mill in Grierson & Long, *Fl. Bhutan* 2(2): 865. 1999.

Perennial herb, rarely subshrub, usually covered by hairs. *Leaves* alternate, rarely opposite, exstipulate, with reticulate venation. *Inflorescences* cymose, paniced or scorpioid cyme, with or without bracts. *Flowers* bisexual, pentamerous, actinomorphic. *Calyx* campanulate, cup-shaped or less coherent, slightly enlarged in fruit, sometimes spreading after flowering. *Corolla* campanulate, funnel-shaped or tubular; fornicies papillate at base of corolla lobes or variously distributed hairs inside the corolla. *Stamens* as the same number as corolla lobes, alternate with the corolla lobes, inserted on the corolla tube, included or exerted; anthers sessile or with distinct filaments, bilocular, dorsally fixed to the filament apice, laterally dehiscent. *Ovary* superior, 4-locular with 1 ovule in each locule, sometimes part of the locules aborted; style gynobasic; stigma indistinct to capitate. *Nutlets* mostly dry, smooth, shiny or with glochids.

Four genera and seven species are indigenous to Thailand.

## KEY TO THE GENERA

1. Nutlets with glochids ..... **1. Cynoglossum**  
 1. Nutlets without glochid ..... 2  
 2. Corolla tube shorter than corolla lobe ..... **4. Trichodesma**  
 2. Corolla tube longer than corolla lobe ..... 3  
 3. Anthers included in corolla tube ..... **2. Maharanga**  
 3. Anthers exerted from corolla tube ..... **3. Onosma**

**1. CYNOGLOSSUM**

L., Sp. Pl.: 134. 1753 & Gen. Pl., ed. 5: 168. 1754; C.B. Clarke in Hook.f., Fl. Brit. India 4: 155. 1883; Gagnep. & Cour. in Lecomte, Fl. Indo-Chine 4(3): 225. 1915; Popov, Fl. URSS 19: 657. 1953; Backer & Bakh.f., Fl. Java 2: 463. 1965; Nowicke & Miller in Dassan. & Fosberg, Fl. Ceylon 7: 25. 1991; Riedl, Fl. Males. 13: 79. 1997; Mill in Grierson & Long, Fl. Bhutan 2(2): 907. 1999. Type: *Cynoglossum officinale* L.  
*Paracynoglossum* Popov, Fl. URSS 19: 717. 1953; R.R. Mill, Notes Roy. Bot. Gard. Edinb. 41: 473. 1984.

Perennial herb. *Leaves* alternate, entire, lower leaves usually already withered at

flowering, lanceolate or oblong-lanceolate. *Inflorescences* terminal and axillary. *Flowers* pentamerous, ebracteate. *Calyx* green or greyish, deeply 5-lobed. *Corolla* white, blue or purple, sometimes white with blue or purple, campanulate or funnel-shaped; fornications papillate at base of corolla lobes, tube shorter than lobes. *Stamens* 5, separate, included; filaments inserted near base of corolla tube; anthers oblong, introrse, glabrous. *Ovary* glabrous; style short; stigma capitate, persisting on the fruit. *Nutlets* ovate, with dense glochids.

A genus of 50-60 species in tropical and temperate regions, three species are indigenous to Thailand.

## KEY TO THE SPECIES

1. Branches of inflorescence crowded in upper part of inflorescence only ..... **1. C. amabile**  
 1. Branches of inflorescence at different levels ..... 2  
 2. Leaves greyish-green, pubescent; corolla 4–5.5 mm long ..... **2. C. furcatum**  
 2. Leaves greyish-white, velvety; corolla 1–2 mm long ..... **3. C. lanceolatum**

**1. Cynoglossum amabile** Stapf & Drumm., Bull. Misc. Inform., Kew 1906: 202. 1906; Backer & Bakh.f., Fl. Java 2: 463. 1965; B. Verdcourt in R.M. Polhill, Fl. Trop. E. Africa 46: 104. 1991; Zhu, Riedl & Kamelin,

Fl. China 16: 422. 1995; Riedl, Fl. Males. 13: 82. 1997; Mill in Grierson & Long, Fl. Bhutan 2(2): 909. 1999. Type: China, Yunnan, Mengzi, *W. Hancock* 133 (lectotype K!), chosen by Verdcourt, 1991).

Perennial herb, 20–40 cm high, with rootstock; stem single, unbranched, greyish white, densely strigose. *Leaves* greyish green, velvety, sessile, chartaceous, lanceolate or oblong-lanceolate, 5.5–17 by 2–4 cm in lower leaves, 2–8 by 2–2.5 cm in upper leaves; apex acute; base obtuse or acute; margin entire; densely silvery strigose on both surfaces; midrib, lateral veins and reticulations impressed on upper surface, distinct on lower surface; lateral veins in 4–6 pairs. *Inflorescences* 14–20 cm long, terminal on main stem, upper part with crowded branches, erect cymose, scorpioid, strigose, with 8–20 flowers, ebracteate. *Flowers* with pedicels 1–2 cm long. *Calyx* 5-lobed, greyish, campanulate, 2–2.5 mm long; lobes unequal; tube 2–2.5 mm long; lobes ovate to oblong; apex acute, 2–3.5 mm long, densely strigose outside, pubescent inside, slightly enlarged in fruit. *Corolla* 5-lobed, blue or bluish, funnel-shaped, 5–6 mm long; fornicies papillate at base of corolla lobes; tube ca. 2.5 mm long; lobes broadly ovate or orbicular, 5–7 mm long, glabrous on both sides. *Stamens*: anthers sessile below fornicies, ovate-lanceolate, ca. 1 mm long. *Ovary* with 4 separate lobes, ovate, glabrous; style ca. 2 mm long; stigma 1. *Nutlets* whitish, ovate, 3–5 mm in diam., dorsally concave to convex, Fig. 1 A-B.

Thailand.— NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Inthanon).

Distribution.— China, Malesia.

Ecology.— Exposed areas or open hillsides, alt. 2,000–2,520 m.

Specimens examined.— *A. Henry* 9365 (K); *G. Murata*, *K. Iwatsuki* & *C. Phengklai*

T-15272 (BKF); *C. Niyomdham* 5264 (BKF); *Pratt* 887 (K); *K. Ruengsawang* 93 (KKU); *T. Shimizu*, *H. Koyama* & *A. Nalampoon* 10053 (BKF); *P. Suksathan* 2166 (QBG); *J.A. Soulié* 861 (K); *S. Tsugaru* T-61870 (BKF).

**2. *Cynoglossum furcatum*** Wall. in Roxb., Fl. Ind., ed. Carey & Wall. 2: 6. 1824; C.B. Clarke in Hook.f., Fl. Brit. India 4: 155. 1883; C.B. Rob., Philipp. J. Sc. Bot. 4: 696. 1909; Alston in Trimen, Handb. Fl. Ceylon 6: 201. 1931; Nowicke & Miller in Dassan. & Fosberg, Fl. Ceylon 7: 26. 1991; Zhu, Riedl & Kamelin, Fl. China 16: 422. 1995; Riedl, Fl. Males. 13: 83. 1997; Mill in Grierson & Long, Fl. Bhutan 2(2): 908. 1999.

Perennial herb, 30–60 cm high, with rootstock; stem erect with numerous branches especially in the upper part, branchlets yellowish brown, covered by soft appressed hairs. *Leaves* greyish-green, sessile, chartaceous, lanceolate, ovate-lanceolate or oblong-lanceolate, 6–9 by 1.2–2.5 cm in lower leaves, 2.5–3 by 0.2–1 cm in upper leaves; apex acute; base obtuse or acute; margin entire, sometimes semi-amplexicaulous; densely pubescent along the veins on both surfaces; midrib, lateral veins and reticulations impressed on upper surface, distinct on lower surface; lateral veins in 4–7 pairs. *Inflorescences* 10–30 cm long, axillary and terminal on main stem and lateral branches, densely strigose; cymes divaricate, scorpioid, with numerous flowers, ebracteate. *Flowers* with pedicels 1–3 mm long. *Calyx* 5-lobed, greyish, campanulate, 1.3–2.9 mm long; tube ca. 0.1 mm long; lobes ovate to oblong, apex acute, 2.8–3 mm long, densely strigose

outside, glabrous inside, slightly enlarged in fruit. *Corolla* 5-lobed, blue or purple, funnel-shaped, 4–5.5 mm long, fornicies papillate at base of corolla lobes; tube 1.5–2 mm long; lobes broadly ovate or orbicular, 3–3.2 mm long, glabrous on both sides. *Stamens*: anthers subsessile, attached on middle part of corolla tube, ovate-lanceolate or ovate 0.5 mm long. *Ovary* with 4 separate lobes, ovate, glabrous; style *ca.* 1 mm long; stigma 1. *Nutlets* ovate, *ca.* 2–3 mm in diam., Fig. 1 C-E.

Thailand.— NORTHERN: Chiang Mai (Doi Inthanon), Nan (Doi Phu Kha, Phu Wae).

Distribution.— Afghanistan, Pakistan, Himalayas, India, China, Japan, Malesia.

Ecology.— Evergreen forest or along the way between hills, alt. 1,600–2,500 m.

Specimens examined.— *N. Drechsler* & *C. Scholz* 60 (QBG); *F. Konta* & *S. Khao-iam* 11398 (BKF); *F. Konta*, *C. Phengkklai* & *S. Khao-lam* 4 8 7 7 (BKF); *G. Murata* s.n. (BKF); *G. Murata*, *K. Iwatsuki*, *C. Phengkklai* & *C. Charoenphol* s.n. (BKF); *C. Niyomdham* 5264 (BKF); *R. Pooma* 1069 (BKF); *K. Ruengsawang* 85 (KKU); *T. Santisuk* 1030 (BKF); *T. Shimizu*, *K. Iwatsuki*, *N. Fukuoka*, *M. Hutoh*, *D. Chaiglom* & *A. Nalampoon* s.n. (BKF); *P. Srisanga*, *C. Puff* & *W. Pongamornkul* 43 (QBG); *P. Srisanga*, *S. Watthana* & *W. La-ongsri* 8 8 2 (QBG); *BGO Staff* 11 (QBG), 4391 (QBG), 6594 (QBG), s.n. (QBG); *P. Suksathan* 1790 (QBG).

Note.— *C. furcatum* is similar to *C. lanceolatum* in having branches of inflorescence at different levels and small nutlets, but it differs in its pubescent, greyish-green leaves and its blue or purple flowers. The

species is widespread as an ornamental plant.

**3. *Cynoglossum lanceolatum*** Forssk., Fl. Aegypt.-Arab.: 41. 1775; C.B. Clarke in Hook.f., Fl. Brit. India 4: 156. 1883; Zhu, Riedl & Kamelin, Fl. China 16: 423. 1995; Dayang Awa in Tree Fl. Sabah & Sarawak 2: 94. 1996; Riedl, Fl. Males. 13: 87. 1997; Mill in Grierson & Long, Fl. Bhutan 2(2): 907. 1999. Type: Yemen, Hadie, *Forsskal* s.n. (holotype C!).

*Cynoglossum micranthum* Desf., Tabl. Ec. Bot.: 220. 1804; C.B. Clarke in Hook.f., Fl. Brit. India 4: 156. 1883; C.B. Rob., Philipp. J. Sc. Bot. 4: 696. 1909; Gagnep. & Cour. in Lecomte, Fl. Indo-Chine 4(3): 225, fig. 27 (2-6). 1915. Type: *Forsskal* 312 (holotype C!).

Perennial herb, 30–50 (–100) cm high, with rootstock; stem erect with numerous branches especially in the upper part, densely hispid. *Leaves* greyish-white, velvety, with petioles 2–4 cm long in lower leaves, 1–3 mm long in upper leaves, chartaceous, lanceolate or oblong-lanceolate, 4.5–7 by 1.3–2 cm in lower leaves, 1–2.5 by 0.1–0.2 cm in upper leaves; apex acute; base obtuse or acute; margin entire; silvery strigose on both surfaces, densely along veins; midrib, lateral veins and reticulations impressed on upper surface, distinct on lower surface, lateral veins in 3–6 pairs. *Inflorescences* 2–30 cm long, axillary and terminal on main stems and branches, strigose; cymes divaricate, scorpioid, with 15–30 flowers, ebracteate. *Flowers* with pedicels 1–1.7 mm long. *Calyx* 5-lobed, green, campanulate, 1–1.3 mm long; tube

ca. 0.1 mm long; lobes ovate or oblong, apex acute, 0.9–1.2 mm long, densely short appressed pubescent outside, glabrous inside, slightly enlarged in fruit. *Corolla* 5-lobed, white or bluish, funnel-shaped, 1–2 mm long, with 5 papillate fornications at base of corolla lobes; tube 0.8–1 mm long; lobes broadly ovate, 0.8–1 mm long, glabrous on both sides. *Stamens*: anthers sessile, attached on middle part of corolla tube, ovate-lanceolate, 0.1–0.2 mm long. *Ovary* with 4 separate lobes, ovate, glabrous; style 0.2–0.5 mm long; stigma 1. *Nutlets* ovate, ca. 2 mm in diam., Fig. 1 F-G.

Thailand.— NORTHERN: Chiang Mai (Doi Angkhang, Doi Chang, Doi Chiang Dao, Doi Inthanon, Doi Sutep, Fang), Chiang Rai (Khunkorn Waterfall), Nan (Doi Phu Kha, Phu Wae); EASTERN: Loei (Phu Ruea); SOUTH-WESTERN: Uthai Thani (Ban Dong, Ban Rai).

Distribution.— Africa, Arabia, Afghanistan, Pakistan, Himalayas, India, Myanmar, Laos, Cambodia, Vietnam, China, Taiwan, Japan, Malesia.

Ecology.— Common species in hill evergreen or mixed deciduous forest, alt. 500–2,550 m.

Specimens examined.— *C. Charoenphol* 42 (BKF), 43 (BKF); *L. Chanpach-chod* 123 (Herbarium of Department of Biology, Chiang Mai University); *A.F.G. Kerr* 239 (K), 5542 (BK, K), 6558 (BK, K, E); *H. Koyama, H. Nagamasu & W. Nanakhon* T-39741 (BKF); *H. Koyama, H. Terao & T. Wongprasert* T-32302 (BKF), T-32724 (BKF), T-33196 (BKF), T-33626 (BKF); *K. Larsen* 2939 (BKF); *K. Larsen, T. Santisuk & E. Warncke*

2077 (BKF); *J.F. Maxwell* 91-604 (E), 99-66 (BKF, Herbarium of Department of Biology, Chiang Mai University); *W. Nanakhon* 551 (BKF); *B. Na Songkhla et al.* 464 (BCU); *Y. Paisooksantivatana* Y259-80 (BK, Herbarium of Department of Biology, Chiang Mai University), Y613-81 (BK), Y625-81 (BK), Y1632A-85 (BK); *C. Phengkklai et al.* 6652 (BKF), 7442 (BKF), 7472 (BKF), 7485 (BKF); *W. Pongamornkul* 169 (QBG), 185 (QBG); *K. Ruengsawang* 73 (KKU), 80 (KKU); *J. Sadakorn* 206 (BK); *T. Shimizu, H. Toyokuni, H. Koyama, T. Yahara & T. Santisuk* T-20349 (BKF), T-20496 (BKF); *T. Smitinand* 1732 (BKF), 6727 (BKF), 8726 (BKF), 8993 (BKF); *T. Smitinand & F. Floto* 5983 (BKF); *P. Srisanga, S. Watthana & W. La-ongsri* 864 (QBG); *BGO Staff* 2538 (QBG); *S. Suthesorn* 2422 (BK), 3137 (BK), 3353 (BK), 4068 (BK), 4288 (BK), 4301 (BK); *S. Tsugaru* 61700 (BKF); *A. Ubolcholkate* (BCU); *Umpai* 504 (BK).

Note.— *C. lanceolatum* is common species in Thailand except in the peninsula. The plant is easily distinguished by its velvety greyish-white and lanceolate leaves.

## 2. MAHARANGA

A.DC., Prodr.: 10: 71. 1846; I.M. Johnst., J. Arnold Arbor. 35(1): 78. 1954; Zhu, Riedl & Kamelin, Fl. China 16: 346. 1995. Type: *Onosma emodi* Wall. [= *Maharanga emodi* (Wall.) A.DC.].

Perennial herb, erect to decumbent. *Leaves* alternate, crowded on short branches, lower leaves usually already withered at flowering. *Inflorescences* terminal. *Flowers* with pedicels, bracteate. *Calyx* greenish white, 5-lobed, persistent. *Corolla* blue or

pale bluish purple; tube longer than lobes. *Stamens* 5, united, included; filaments attached above middle of corolla tube; anthers oblong, glabrous. *Ovary* glabrous; style included, glabrous; stigma subcapitate. *Nutlets* 4-lobed, breaking up into 4 pieces.

A genus of *ca.* nine species, widely distributed in Bhutan, India, Nepal and China, one species is indigenous to Thailand.

**1. *Maharanga lycopsioides*** (C.E.C. Fisch.) I.M. Johnst., J. Arnold Arbor. 35(1): 81. 1954; Zhu, Riedl & Kamelin, Fl. China 16: 347. 1995.

*Onosma lycopsioides* C.E.C. Fisch., Bull. Misc. Inform., Kew 1940(1): 39-40. 1940. Type: India, Assam, Naga Hills, Japvo, 3,050 m, 27 Sept. 1935, *N.L. Bor* 6507 (holotype K!).

Perennial herb, 10–40 cm high with rootstock; stems several, erect to decumbent, with arising leafy branches from a cluster of lower leaves, with densely hispid and short strigose hairs. *Leaves* sessile, slightly coriaceous, lanceolate, elliptic-lanceolate or oblong-lanceolate, 8–15 by 0.5–1.5 cm in lower leaves, 4.5–9 by 0.5–1 cm in upper leaves; sometimes semi-amplexicaulous; apex acute; base acute or attenuate; margin entire, revolute; upper surface dark green, sparsely white hispid; lower surface light green, densely white strigose; midrib impressed on upper surface, distinct on lower surface, veins indistinct. *Inflorescences* 5–10 cm long, terminal on main stem; cymes divaricate, scorpioid, with 3–13 flowers; bracts ovate-lanceolate, 7–10 by 2–3 mm, densely hispid and strigose. *Flowers* with pedicels 5–7 mm long. *Calyx* 5-lobed, cup-shaped, 7–9 mm

long; tube 2.5–3 mm long; lobes narrowly triangular or ovate-lanceolate, 4.5–6 mm long, densely hispid and short strigose outside, densely strigose inside, slightly enlarged in fruit. *Corolla* 5-lobed, tubular, 1.1–1.4 cm long, pubescent; tube 1–1.3 cm long; lobes triangular, *ca.* 1 mm long, densely pubescent outside, inside short strigose near base of filament. *Stamens* 4–5 mm long, glabrous, inserted near base of corolla tube; anthers united, included, oblong, 3–5 mm long, sterile apex *ca.* 1 mm long. *Ovary* with 4 separate lobes, ovate; style 1.2–1.4 cm long; stigma 1, subcapitate. *Nutlets* brownish, shiny, ovate, *ca.* 2 mm in diam., Fig. 2 A-B.

Thailand.—NORTHERN: Chiang Mai (Doi Chiang Dao).

Distribution.—India, Southwest China.

Ecology.—Scattered on rocky limestone hills in exposed area, alt. 2,225 m.

Specimens examined.—*K. Ruengsawang* 120 (KKU); *P. Suksathan* 2150 (QBG) & 2861 (QBG).

Note.—This is a rare species in Thailand which is restricted to Doi Chiang Dao, Chiang Mai province.

### 3. *ONOSMA*

L., Sp. Pl., ed. 2, 1: 196. 1762. I.M. Johnst., J. Arnold Arbor. 32(3): 201. 1951; Zhu, Riedl & Kamelin, Fl. China 16: 348. 1995. Type: *Onosma echioides* L.

Perennial herb, erect to decumbent. *Leaves* alternate, with a crowded of lower leaves, old leaves persistent, forming a

brush-like, lanceolate to cuneate, sometimes semi-amplexicaulous. *Inflorescences* terminal on main stem. *Flowers* with pedicels, bracteate. *Calyx* greenish white, less coherent, 5-lobed. *Corolla* cream-coloured, tubular, 5-lobed; tube longer than lobes. *Stamens* 5, inserted near base of corolla tube; anthers united into tube, exerted from corolla. *Ovary* glabrous; style exerted; stigma capitate. *Nutlets* ovate.

A genus of ca. 145 species, widely distributed in Bhutan, India, Nepal and China, one species is indigenous to Thailand.

**1. *Onosma burmanica*** Collett & Hemsl., J. Linn. Soc., Bot. 28: 93. 1891; I.M. Johnst., J. Arnold Arbor. 32(3): 218. 1951. Type: Myanmar, Shan hills, 4,000 ft., *Collett* 941 (holotype K!).

Perennial herb, 30–60 (–100) cm high with rootstock; stems elongate, unbranched, erect to decumbent, slightly woody, with densely hispid and short strigose hairs. *Leaves* sessile, slightly coriaceous, lanceolate to cuneate, 4–10 by 0.2–0.5 cm in lower leaves, 3–5 by 0.2–0.4 cm in upper leaves; apex acute; base acute attenuate; margin entire, revolute; upper surface dark green, densely white hispid; lower surface light green, densely white strigose; midrib impressed on upper surface, distinct on lower surface, indistinct veins. *Inflorescences* 15–25 cm long; cymes divaricate, paniculate, with 12–30 flowers; bracts ovate-lanceolate, 3–6 by 2–2.5 mm, densely hispid and strigose. *Flowers* with pedicels 5–10 mm long. *Calyx* 5–9 mm long; tube ca. 0.1 mm long; lobes

narrowly lanceolate, 4.5–8 mm long, densely hispid and strigose on both sides, slightly enlarged in fruit. *Corolla* 0.8–1 cm long, pubescent; tube 6–7.5 mm long; lobes triangular 1–1.4 mm long, sparsely pubescent outside, inside with short strigose near base of filament. *Stamens* 4–5 mm long, glabrous; anthers lanceolate, 5–7 mm long, sterile apex ca. 2.5 mm long. *Ovary* ovate, glabrous; style 1–1.3 cm long; stigma 1. *Nutlets* brownish, shiny, 2–4 mm in diam., Fig. 2 C-D.

Thailand.— NORTHERN: Tak (Doi Hua Mot).

Distribution.— Myanmar.

Ecology.— Scattered on limestone hills in exposed area, alt. 900–1,000 m.

Vernacular.— Yat napha (หยาดนภา).

Specimens examined.— *R. Pooma et al.* 4641 (BKF); *K. Ruengsawang* 130 (KKU).

Note.— This is a rare species in Thailand which is restricted to Doi Hua Mot, Tak province.

#### 4. TRICHODESMA

R. Br., Prodr. Fl. Nov. Holl.: 496. 1810; C.B. Clarke in Hook.f., Fl. Brit. India 4: 153. 1883; Trimen, Handb. Fl. Ceylon 3: 201. 1895; Brand in Engl., Pflanzenr., Fam. IV 252: 19. 1921; Backer & Bakh.f., Fl. Java 2: 462. 1965; Nowicke & Miller in Dassan. & Fosberg, Fl. Ceylon 7: 24. 1991; Riedl, Fl. Males. 13: 124. 1997; Mill in Grierson & Long, Fl. Bhutan 2(2): 910. 1999. Type: *Borago zeylanica* Burm.f. [= *Trichodesma zeylanicum* (Burm.f.) R. Br.].

Perennial herb or subshrub. *Leaves* opposite or alternate, entire, oblong, elliptic, lanceolate or oblong-lanceolate. *Inflorescences* terminal. *Flowers* ebracteate. *Calyx* green or greyish, campanulate, deeply 4–5-lobed. *Corolla* white, blue or purple, campanulate, with 8–10 papillate fornications at base of corolla lobes; tube shorter than lobes. *Stamens* 4–5, exerted, distinct, sessile, attached above

middle of corolla tube; anthers oblong, twisted apex, densely woolly. *Ovary* with 4 separate lobes, glabrous; style short; stigma capitate, persisting on the fruit. *Nutlets* ovate.

A genus of ca. 40 species, widely distributed in tropical and subtropical regions of Africa, Asia and Australia, two species are indigenous to Thailand.

#### KEY TO THE SPECIES

1. Subshrub, at least 1 m high; leaf base cuneate or attenuate; calyx rounded at base  
 .....1. **T. calycosum**  
 1. Herb, less than 50 cm high; leaf base semi-amplexicaulous; calyx sagittate at base  
 .....2. **T. indicum**

**1. *Trichodesma calycosum*** Collett & Hemsl., J. Linn. Soc., Bot.: 28: 92. 1890; I.M. Johnston, J. Arnold Arbor. 33(2): 75. 1952; Zhu, Riedl & Kamelin, Fl. China 16: 414. 1995; Mill in Grierson & Long, Fl. Bhutan 2(2): 910. 1999. Type: Myanmar, Shan hills at 4,000 ft., *H. Collett* s.n. (holotype K!).

*Trichodesma calcareum* Craib, Bull. Misc. Inform., Kew 1914: 8. 1914. Type: Thailand, Doi Chiang Dao, crevices of limestone rock, alt. 900 m, *A.F.G. Kerr* 2856 (holotype K!).

Subshrub, 1–1.5 m high; branchlets quadrangular, pubescent. *Leaves* with petioles 1–3 cm long in lower leaves, subsessile in upper leaves, chartaceous, elliptic, 10–32 by 4–15 cm in lower leaves, 4–9 by 1–2.4 cm in upper leaves; apex acute; base cuneate or attenuate; margin entire; upper surface dark green, strigose; lower surface light green, sparsely strigose; midrib, lateral veins and reticulations impressed on upper surface, distinct on lower surface; lateral veins in 6–8

pairs. *Inflorescences* up to 20 cm long, terminal on main stem and branches; with paniculate cymes, numerous, pubescent. *Flowers* with pedicels 1–3 cm long. *Calyx* rounded at base; 1–1.5 cm long, 4–5-lobed; tube 5–7 mm long; lobes ovate-triangular, 7–8 mm long, densely strigose on both sides, slightly enlarged and inflated in fruit. *Corolla* white, 1.3–1.5 cm long, with 10 papillate fornications at base of corolla lobes; tube shorter than calyx, 4–5-lobed; tube 5–7 mm long; lobes broadly ovate, 4–8 mm long, apex cirrhose or caudate, glabrous on both sides. *Stamens* 9–10 mm long; sessile; anthers 4–6 mm long, twisted apex 5–8 mm long, densely woolly. *Ovary* ovate, 5–7 mm long, glabrous; style 1–1.2 cm long, pubescent; stigma 1. *Nutlets* broadly ovoid, glabrous, 6–7 mm long.

Thailand.— NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Pui), Nan (Doi Phu Kha),

Lamphun, Lampang; SOUTH-WESTERN: Kanchanaburi (Si Sawat).

Distribution.— India, Myanmar, Laos, China.

Ecology.— Lower montane or hill evergreen forest, alt. 900–1,900 m.

Specimens examined.— *C. Chermisrivathana* 503 (BK); *A.F.G. Kerr* 2854 (K), 10182 (BK); *T. Smitinand* 7300 (BKF), s.n. (BKF); *P. Srisanga* 1358 (QBG); *P. Srisanga, S. Sasirat, W. Pongamornkul, S. Sukiam & P. Panyachan* 2469 (QBG); *Winit* 403 (BK), 1531 (BK), 1849 (BK).

Note.— *T. calycosum* has large inflorescence up to 20 cm long and large elliptic lower leaves up to 32 long. It can easily be distinguished by rounded at base of calyx and densely strigose on both sides. This species is distributed from northern towards south-western of Thailand.

**2. *Trichodesma indicum* (L.) Sm.** in Rees, *Cyclop.* 36/1, n.1. 1817; C.B. Clarke in Hook.f., *Fl. Brit. India* 4: 153. 1883; Trimen, *Handb. Fl. Ceylon* 3: 201. 1895; C.B. Rob., *Philipp. J. Sc. Bot.* 4: 696. 1909; Lecomte, *Fl. Indo-Chine* 2: 331. 1914; Brand in Engl., *Pflanzenr. Fam.* IV 252: 38. 1921; Nowicke & Miller in Dassan. & Fosberg, *Fl. Ceylon* 7: 24. 1991; Riedl, *Fl. Males.* 13: 124. 1997.

*Borago indica* L., *Sp. Pl.*: 137. 1753. Type: *Herb. Linn.* 188/2 (lectotype LINN).

Annual herb, 20–40 cm high; stems numerous branches, sparsely scabrous. *Leaves* sessile, subcoriaceous, oblong, lanceolate or lanceolate-oblong, lower leaves 5.5–9 by 1–1.4 cm, upper leaves 2.5–4.5 by 0.5–1.4 cm;

apex acute; base semi-amplexicaulous; margin entire; base in lowermost leaves narrow, upper surface dark green, scabrous; lower surface light green, scabrous; midrib impressed on upper surface, distinct on lower surface; lateral veins in 3–7 pairs. *Inflorescences* short, terminal on stem and branches, with 2–3 flowers. *Flowers* with pedicels 1.5–3.5 cm long, green, curved downwards in fruit, sparsely scabrous. *Calyx* sagittate at base, sagittate lobes 2–3 mm wide in flower, 4–5 mm wide in fruit; 1–1.5 cm long; tube 2–4 mm long; lobes narrowly triangular, densely scabrate outside, sparsely scabrate inside, persistent in fruit. *Corolla* blue or purple, 3.3–4 mm long, with 8 papillate fornicies at base of corolla lobes; tube shorter than calyx, 5-lobed; tube 5–7 mm long; lobes rounded to acuminate, ca. 7.5 mm long, acuminate or caudate at apex, glabrous on both sides. *Stamens* 10–14 mm long, sessile; anthers 5–7 mm long, twisted apex 5–6 mm long, densely woolly. *Ovary* ovate, 0.5–0.8 mm long; style 0.9–1.5 cm long, glabrous; stigma 1. *Nutlets* whitish, ovate or oblong, smooth, 4 by 1–3 mm, Fig. 2 E-F.

Thailand.— NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Suthep-Pui), Lamphun (Bah Sahng, Mae Lea, Lei Kaw), Lampang, Tak (Mae Lamung); SOUTH-WESTERN: Kanchanaburi (Si Sawat).

Distribution.— Afghanistan, Pakistan, India, Myanmar, Philippines, Mascarene Islands.

Ecology.— In grassland, evergreen hardwood forest, alt. 350–1,850 m.

Vernacular.— Phak phaeo khao (ผักเผือกขาว).

Specimens examined.— *S. Gardner* 717 (Herbarium of Department of Biology, Chiang Mai University); *H.B.G. Garrett* 900 (K); *A.F.G. Kerr* 6108 (K), 10182A (BKF, K); *J.F. Maxwell* 96-170 (BKF, Herbarium of Department of Biology, Chiang Mai University), 04-754 (Herbarium of Department of Biology, Chiang Mai University), 39084 (Herbarium of Department of Biology, Chiang Mai University); *K. Ruengsawang* 128 (KKU); *Winit* 403 (BKF, K), 531 (BKF, K), 1531 (BKF, K), 1849 (BKF, K).

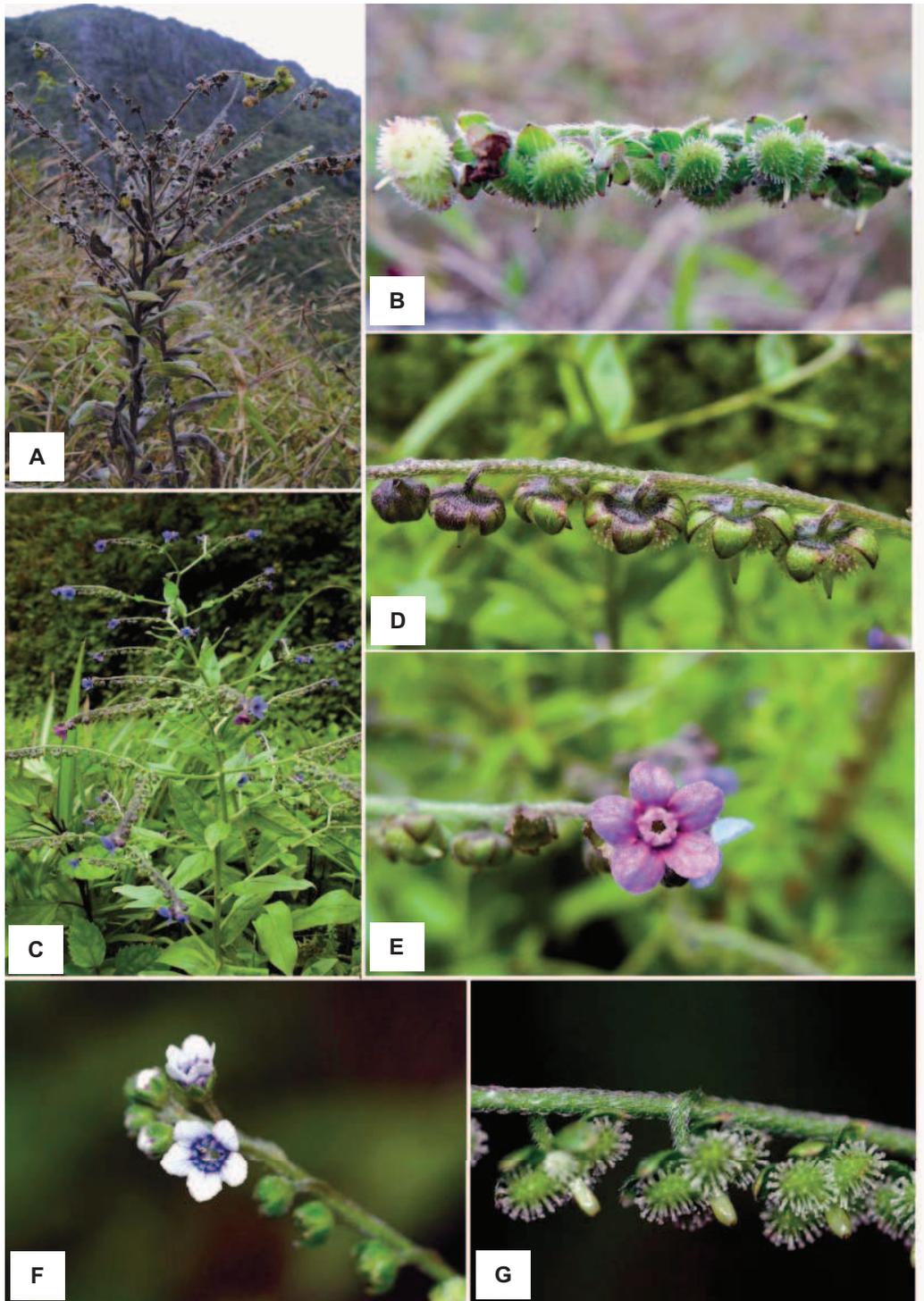
Note. — The species is distinguished by its having sagittate at base of calyx and short inflorescence with 2–3 flowers. Leaves are lanceolate-oblong, with semi-amplexicaulous base.

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**FIGURE 1.** A-B) *Cynoglossum amabile*, (A) Habit, (B) Fruits; C-E) *C. furcatum*, (C) Habit, (D) Fruits, (E) Flower; F-G) *C. lanceolatum*, (F) Inflorescence, (G) Fruits.



**FIGURE 2.** A-B) *Maharanga lycopsioides*, (A) Habit, (B) Inflorescence; C-D) *Onosma burmanica*, (C) Habit, (D) Inflorescence; E-F) *Trichodesma indicum* (E) Habit, (F) Inflorescence.