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The genus *Leucophanes* (Calymperaceae, Bryophyta) in Thailand

CHATCHABA PROMMA[1] & SAHUT CHANTANAORRAPINT[1]

ABSTRACT. A review of the genus *Leucophanes* Brid. in Thailand is presented based on the study of fresh and herbarium specimens. Four species are recognized, namely *L. angustifolium* Renauld & Cardot, *L. candidum* (Schwägr.) Lindb., *L. glaucum* (Schwägr.) Mitt. and *L. octoblepharioides* Brid. The genus is widely distributed in the southern half of the country. A key to species, descriptions and line drawings are provided, and notes on the ecology and geographical distribution of the species.

KEY WORDS: bryophytes, Calymperaceae, *Leucophanes*, mosses, Thailand.

INTRODUCTION

The genus *Leucophanes* was established by Bridel (1826), based on a collection of *L. octoblepharioides* of Nees v. Esenbeck from Java. This genus is a member of the family Calymperaceae. It includes 12 species worldwide, distributed mainly in tropical and subtropical regions particularly in Asia and Africa (Salazar Allen, 1993). Plants of *Leucophanes* are characterized by whitish-green leaves growing in loose to dense tufts or cushions; stems erect, sparsely branched, branches short; leaves multistratose, narrowly to broadly lanceolate to retuse at apex, costa percurrent to short excurrent, with a stereid band.

A monograph of *Leucophanes* had been published by Salazar Allen (1993), but there are few reports of this genus from Thailand, probably due to the paucity of bryological studies in this country. This study is based on fresh specimens from fieldwork as well as herbarium specimens in BCU, BKF, L and PSU. In addition, the distributions of each species were assessed by fieldwork throughout Thailand during 2010−2013, and using the available taxonomic literature. Distributional and ecological data were compiled, and detailed descriptions, illustrations and key to species are provided.

Four species of *Leucophanes* have been recorded for Thailand: *L. angustifolium* Renauld & Cardot, *L. candidum* (Schwägr.) Lindb., *L. glaucum* (Schwägr.) Mitt. and *L. octoblepharioides* Brid. Thai species are mostly epiphytes, growing on tree trunks, usually from ground level to 3 m high but are also found on decaying wood, soil and rocks, including limestone and sandstone. They are found in various forest types, from dry to moist deciduous or evergreen forests, *i.e.* coastal, mangrove, spring, lowland evergreen and montane forests, from lowland to over 1500 m a.s.l.

Based on geographical localities from the field surveys, herbarium specimens and data from previous publications (Brotherus, 1901; Dixon, 1932, 1935; Tixier & Smitinand, 1966; Touw, 1968; Thaithong, 1984; Sornsamran & Thaitong, 1995), the genus is widely distributed in the southern half of the country; it does not seem to occur in the northern part except for one locality (Fig. 1). The Southern Peninsular region exhibits great diversity of species. The most common species of *Leucophanes* in Thailand is *L. octoblepharioides*, distributed in 5 floristic regions including North-Eastern, Eastern, South-Eastern, South-Western and Peninsular region (Fig. 1), while *L. candidum* has a restricted distribution, found only in the Peninsular region.

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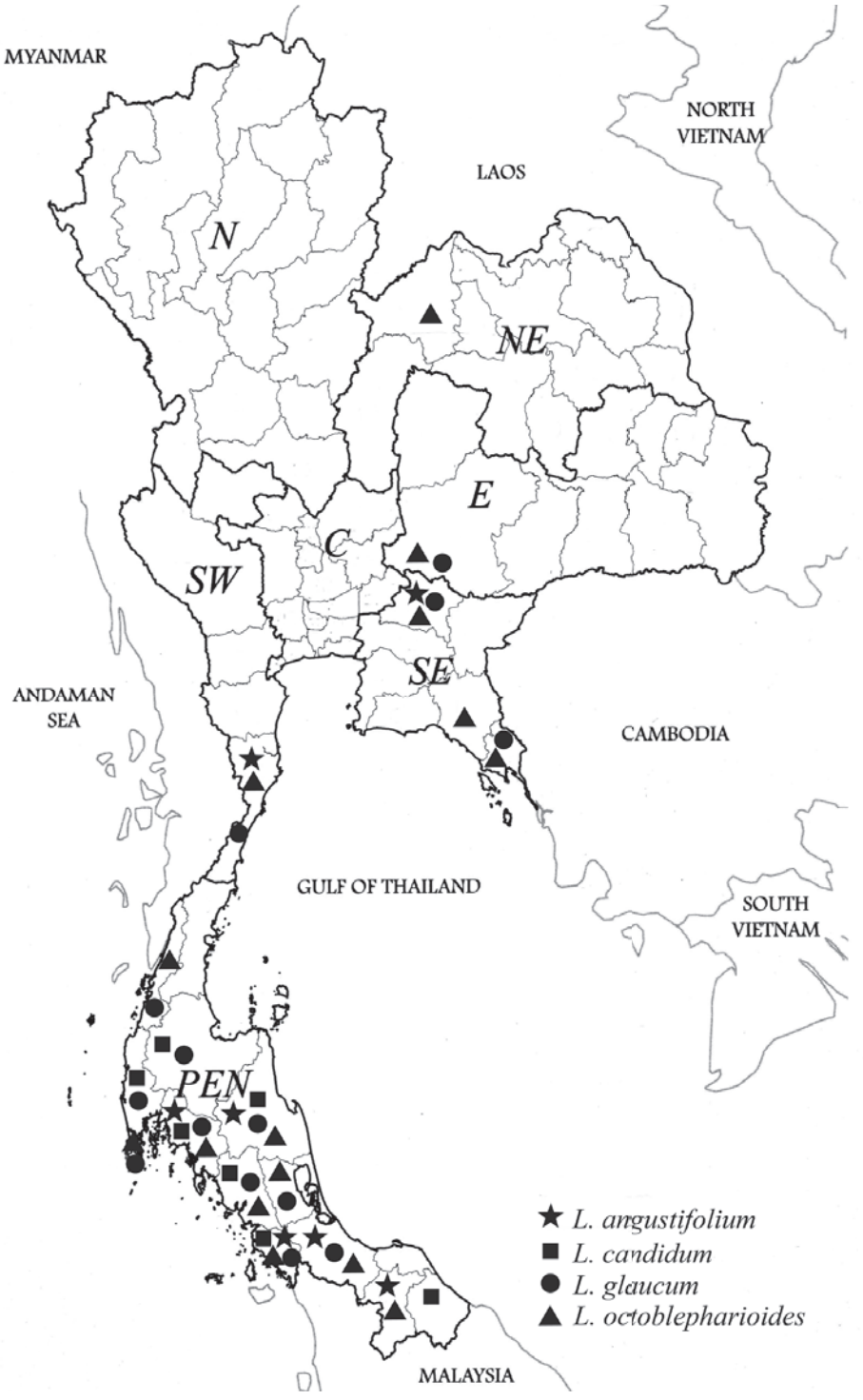

Figure 1. Distribution of the species of *Leucophanes* in Thailand. Thai Floristic regions N= Northern, NE= North-Eastern, E= Eastern, SE= South-Eastern, C= Central, SW= South-Western, PEN= Peninsular.

TAXONOMIC TREATMENT

Leucophanes Brid.

Bryol. Univ. 1: 763. 1826; A. Eddy, Handb. Males. Mosses 2: 40. 1990; Enroth, Acta Bot. Fenn. 139: 98. 1990. N. Salazar, Bryophyt. Biblioth. 46: 54. 1993. Type species: *L. octoblepharioides* Brid.

Plants epiphytic or terrestrial, small to moderately large, whitish-green, in loose to dense tufts or cushions. *Stems* erect, orange-brown to dark red, sparsely branched, branches short; stem in cross section rounded to irregularly triangular; central strand absent, large central cells surrounded by one or two layer of small, thick-walled cortical cells. *Rhizoids* papillose, orange-red to brownish-red, arising from stem and apex of leaves. *Leaves* erect to more or less contorted when dry, loosely overlapping when moist, narrowly to broadly lanceolate, concave to keeled at base or through most of their length, plane above; apex acuminate, acute, obtuse, retuse or bent backwards; costa percurrent to shortly excurrent, smooth to strongly spinose on back and apex, convex on the abaxial side, flat on the adaxial side; margins entire below, serrate above with single or paired teeth; marginal sterome forming a distinct, sharply differentiated border; basal hyaline lamina asymmetrical, sheathed at leaf base, hyaline lamina extending 1/9–1/2 leaf length on both sides of costa, irregularly bistratose; hyalocysts in surface view rectangular with rectilinear to sinuose walls, quadrate, irregularly pentagonal to hexagonal. *Leaf in cross section* multistratose, a central layer of quadrangular chlorocysts, surrounded on each surface by one or more layers of porose hyalocysts; median strand or sterome composed of stereids and 2–4 well- developed guide cells, deeply immersed below the upper surface in limb, exposed or covered by abaxial hyalocysts. *Gemmae* on leaf apex, papillose, fusiform-clavate.

Dioicous or *monoicous. Sporophytes* rare; setae 3.1–15 mm long, sinistrorse, smooth; capsules 1.8–3.0 mm long, dark orange, erect to horizontal; stomata superficial at neck of urn; peristome teeth 16, more or less papillose, lanceolate, with a colorless prostome, 2–3 cells high; opercula long, subulate-rostrate. *Calyptrae* cucullate. *Spores* 10–20 μm in diameter.

KEY TO SPECIES OF *LEUCOPHANES* IN THAILAND

1. Plant robust; leaf broadly lanceolate, recurved or squarrose, costa smooth on the dorsal side throughout the leaves **L. candidum**
1. Plant small to medium size leaf narrowly lanceolate to laceolate, erect-spreading to recurved-patent, costa strongly spinose or smooth on the dorsal side in upper parts of leaves
   2. Leaf contorted when dry. Hyalocysts in surface view on abaxial surface at median leaf oblong with sinuose walls and concave bulging end walls **L. glaucum**
   2. Leaf little altered when dry, not twisted. Hyalocysts in surface view on abaxial surface not as above
      3. Costa strongly spinose on the dorsal side in upper parts of leaves. Leaf in transverse section with 1 or 2 irregular layers of hyalocysts on the abaxial and adaxial sides of chlorophyllous layer **L. angustifolium**
      3. Costa smooth on the dorsal side of leaves, rarely spinose at apex. Leaf in transverse section with 1 layer of hyalocysts on both sides of chlorophyllous layer **L. octoblepharioides**

1. Leucophanes angustifolium Renauld & Cardot, Rev. Bot. Bull. Mens. 9: 395. 1981; Enroth, Acta Bot. Fenn. 139: 98. Fig. 27a–f. 1990; N. Salazar, Bryophyt. Biblioth. 46: 69. Figs. 147–173. 1993. Type: Réunion Island, *Rodriguez 74c* (lectotype **PC** designated by Salazar Allen (1993); isolectotypes **PC**, **S**). Figs. 2–3.

Plants small to medium, 0.5–1.2 cm high, growing in rather loose tufts. *Stems* erect, simple or branched. *Leaves* narrowly lanceolate to linear; 3.6–7.1×0.2–0.4 mm, weakly straight or curved, straight or curved, keeled, little altered when dry; apices mostly acute, dentate; margins distinctly bordered, entire below, serrulate and gradually more strongly serrate above midleaf; costae strongly spinose on the dorsal side in the upper parts of leaves, exposed on abaxial surface; hyaline lamina to 1/5–1/3 the length of leaf; hyalocysts in surface view on abaxial surface at base quadrate to rectangular, at median leaf irregularly rectangular or quadrate, 14–44×8–22 μm, with rectilinear walls, at apex oblong to rounded-quadrate. *In cross section of leaf* chlorocysts in a central layer, surrounded by one or more layers of hyalocysts; near leaf base, hyalocysts adaxially and abaxially in one layer, median sterome 14–36 cells, marginal sterome 4–16 cells; at midleaf, hyalocysts in 1–2 layer on

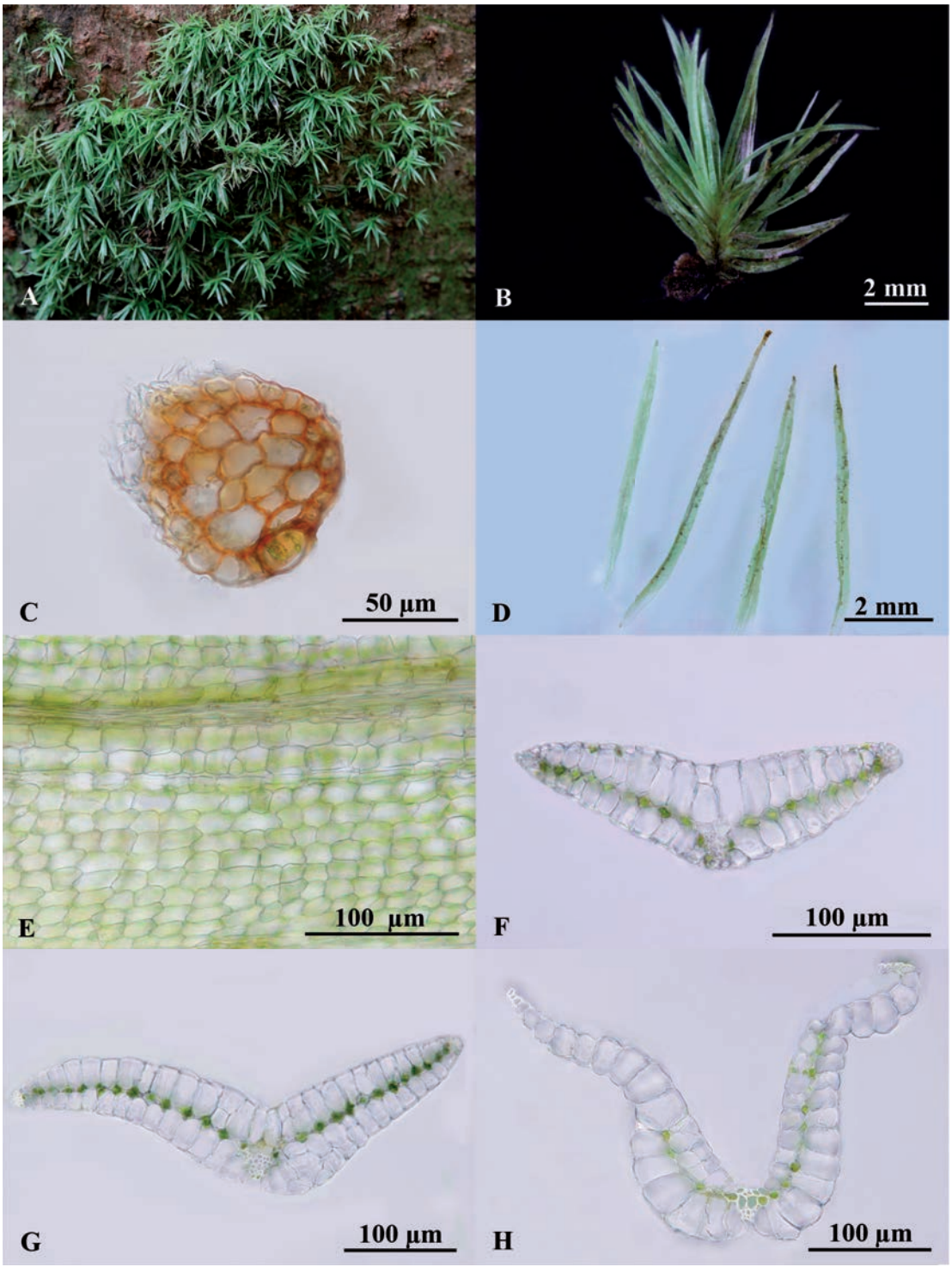

Figure 2. *Leucophanes angustifolium* A–B. Habit; C. Cross section of stem; D. Leaves; E. Hyalocysts in surface view on abaxial surface at midleaf; F–H. Cross sections of leaf, F. near apex, G. midleaf, H. near base. All from *Chantanaorrapint & Promma 5* (PSU). Photos by C. Promma.

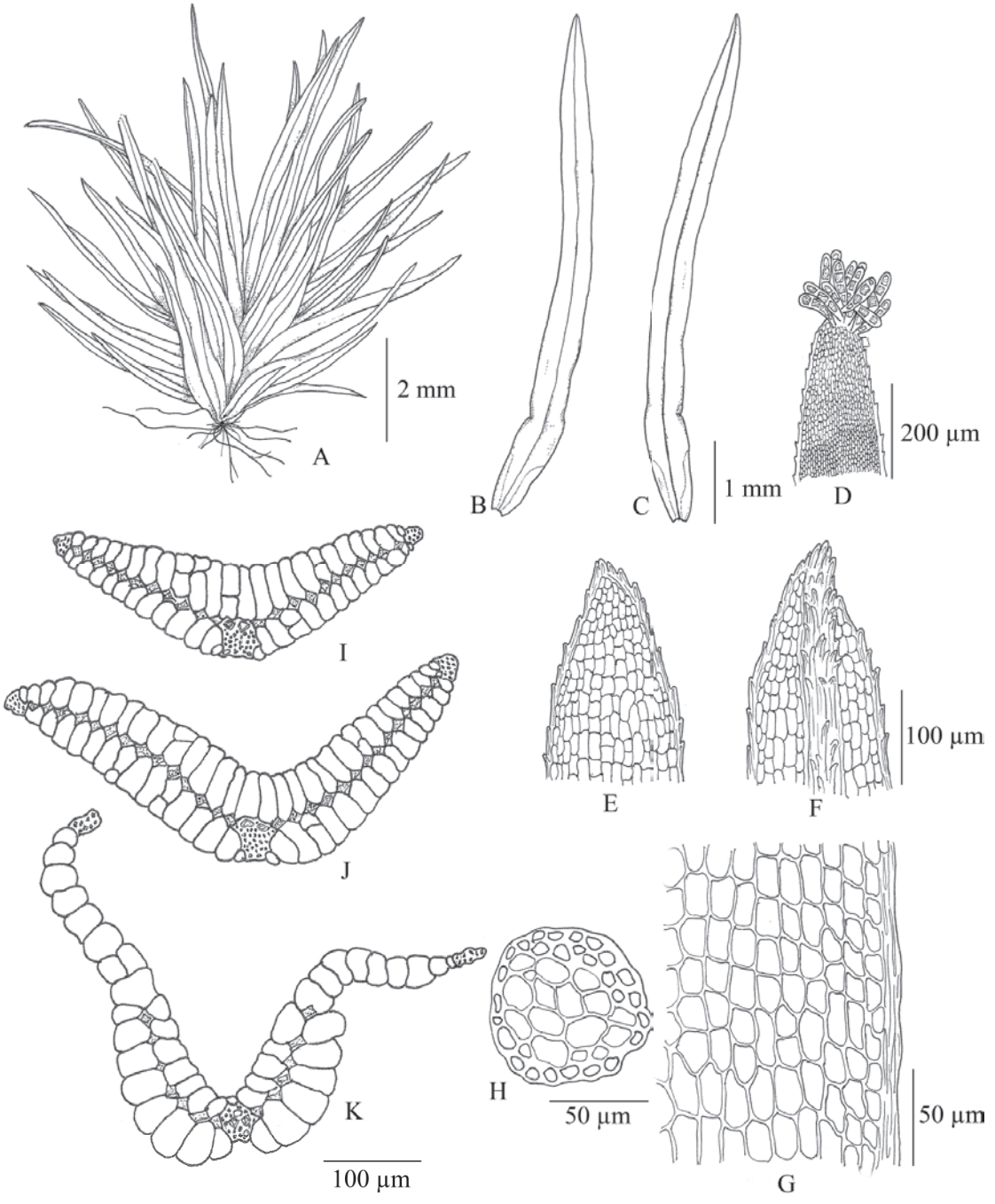

Figure 3. *Leucophanes angustifolium*: A. Habit; B–C. Leaf, B. adaxial, C. abaxial; D-F. Leaf apex, D. with gemmae, E. adaxial, F. abaxial; G. Hyalocysts in surface view on abaxial surface at midleaf; H. Cross section of stem; I–K. Cross sections of leaf, I. near apex, J. midleaf, K. near base. All from *Chantanaorrapint & Promma 5* (PSU). Drawn by C. Promma.

both side, median sterome 20–56 cells, marginal sterome 7–16 cells; near leaf apex hyalocysts in two layer on either side of chlorophyllous layer, median sterome 16–44 cells, marginal sterome 6–14 cells. *Gemmae* common at the leaf apex. *Sporophytes* not seen.

Thailand.— SOUTH-WESTERN: Prachuap Khiri Khan; SOUTH-EASTERN: Prachin Buri; PENINSULAR: Krabi, Nakhon Si Thammarat, Satun, Songkhla, Yala.

Distribution.— The Pacific Islands, Australia (Queenland), New Guinea, Japan (Ryukyu Islands), SE Asia, India, Sri Lanka, Comoros Islands (Mayotte), La Réunion, Seychelles (Mahé), tropical Africa (Salazar Allen 1993).

Habitat and ecology.— On bark at base and trunk of trees, decaying wood, soil, sandy soil and rocks, sometime found in association with *L. octoblepharioides*. In lowland and montane forests to ca 1000 m.

2. Leucophanes candidum (Schwägr.) Lindb., Oefvers. Förh. Hongl. Svenska Vetensk. Akad. 21: 602. 1865; Enroth, Acta Bot. Fenn. 139:102. Fig. 23a–e. 1990; A. Eddy, Handb. Males. Mosses 2: 42.Fig. 192. 1990; N. Salazar, Bryophyt. Biblioth. 46: 95. Figs. 346–383. 1993.— *Syrrhopodon candidus* Schwägr., Spec. Musc. Suppl.1. 2(2): 105. t. (183)182. Figs. 1–8. 1827. Type: Indonesia, *Reinwardt s.n.* (lectotype **G**, designated by Salazar Allen (1993); isolectotypes **BM**, **G**).— *Leucophanes densifolius* Mitt., Bonplandia 9:366.1861; Dixon, J. Siam Soc., Nat. Hist. Suppl. 9(1): 12. 1932; Tixier, Ann. Sci. Phom Pehn 4: 91. 1971. Type: Fiji, *Milne s.n.* (syntype **NY**). Figs. 4–5.

Plants medium to moderately large, 1.6–6.2 cm high, growing in dense tufts or cushions. *Stems* erect, simple or branched. *Leaves* crowded, broadly lanceolate, 2.7–5.5×0.6–1.0 mm, strongly keeled, recurved, mostly spreading or squarrose sometime erect, little altered when dry; apices mostly sharply apiculate; margins bordered, narrow marginal stereome, entire below, serrulate at least near apex; costae smooth on the dorsal side throughout the leaves, exposed on abaxial surface; hyaline lamina narrow, to 1/8–1/5 the length of leaf; hyalocysts in surface view on abaxial surface at base rectangular, short hexagonal to oblong triangular, at median leaf irregularly pentagonal to hexagonal, oblong hexagonal with rectilinear walls, 16–44×16–36 µm, at apex oblong hexagonal. *In cross section of leaf* chlorocysts in a central layer, surrounded by one layer of hyalocysts ; near leaf base hyalocysts adaxially and abaxially in 1 layer, median sterome 3–15 cells, marginal sterome 4–14 cells; at midleaf hyalocysts in 1 layer on either side of chlorophyllous layer, median sterome 6–24 cells, marginal sterome 5–14 cells; near leaf apex hyalocysts in 1 layer on either side of chlorophyllous layer, median sterome 10–24 cells, marginal sterome 5–14 cells. *Gemmae* not seen. *Sporophytes* 8–10 mm long; setae very slender, smooth, rugulose just beneath capsule; capsules cylindrical, 1–2 mm long, erect and symmetrical; opercula long rostrate; calyptrae cucullate; peristome teeth of 16 simple teeth, brownish, articulate, outer surfaces coarsely papillose.

Thailand.— PENINSULAR: Surat Thani, Phangnga, Krabi, Nakhon Si Thammarat, Trang, Satun, Narathiwat.

Distribution.— The Pacific Islands, Australia (Queenland), New Guinea, Philippines, Malaysia, Indonesia, Thailand (Salazar Allen 1993).

Habitat and ecology.— On bark of trees and rocks, in lowland forests to ca 300 m.

3. Leucophanes glaucum (Schwägr.) Mitt., J. Linn. Soc., Bot. Suppl. 1: 25. 1859; Enroth, Acta Bot. Fenn. 139: 104. Fig. 24a–f. 1990; A. Eddy, Handb. Males. Mosses 2: 45. Figs. 193–195. 1990; N. Salazar, Bryophyt. Biblioth. 46: 101. Figs. 384–445. 1993.— *Syrrhopodon glaucus* Schwägr., Spec. Musc. Suppl. 2(2): 103. 181. 1827. Type: Indonesia. Moluccas, *Gaudichaud 10* (lectotype **G**; isolectotypes **G**, **L!**, **BM**).— *Leucophanes glaucescens* Müll. Hal. ex M. Fleisch., Musci Fl. Buitenzorg. 1: 178. 1904; Broth. in J. Schmidt, Fl. Koh Chang Pt. 3. 1: 116. 1900–1961; Dixon, J. Siam Soc., Nat. Hist. Suppl. 9(1): 12. 1932; Tixier. Ann. Sci. Phom Pehn. 4: 91–166. 1971. Type: Indonesia. Java, *Fleischer s.n.* (syntype **FH**); Sumatra, *Fleischer s.n.* (syntype **FH**), Andaman Islands, *Kurz* (syntype **FH**).— *Leucophanes albescens* Müll. Hal., Bot. Zeitung. 22: 347. 1864; Dixon, J. Siam Soc., Nat. Hist. Suppl. 8(1): 19. 1929; Dixon, J. Siam Soc., Nat. Hist. Suppl. 9(1): 12. 1932; Touw, Nat. Hist. Bull. Siam Soc. 22 (3–4): 228. 1968; Tixier, Nat.

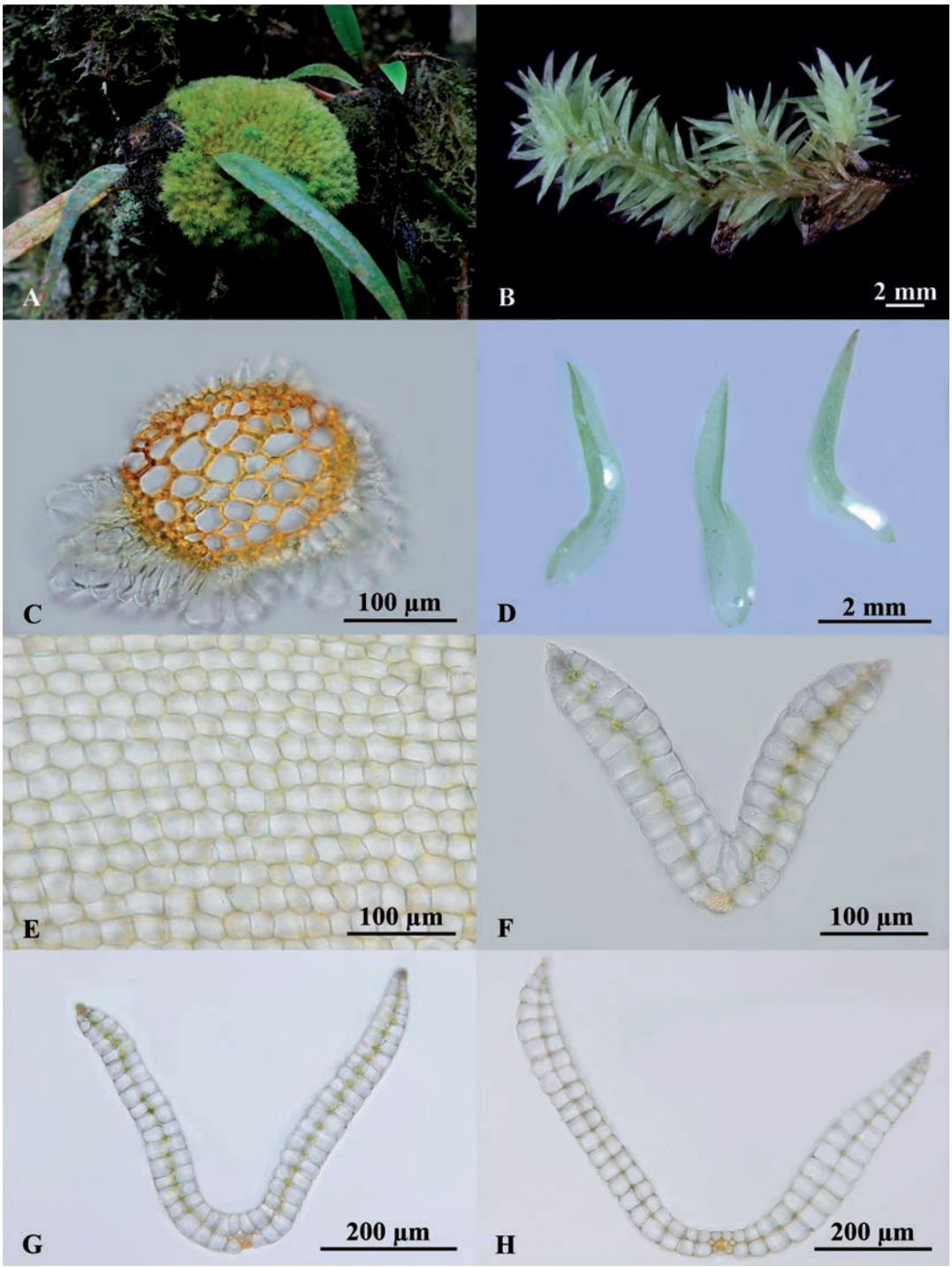

Figure 4. *Leucophanes candidum*: A–B. Habit; C. Cross section of stem; D. Leaves; E. Hyalocysts in surface view on abaxial surface at midleaf; F–H. Cross sections of leaf, F. near apex, G. midleaf, H. near base. All from *Chantanaorrapint 2442* (PSU). Photos by C. Promma.

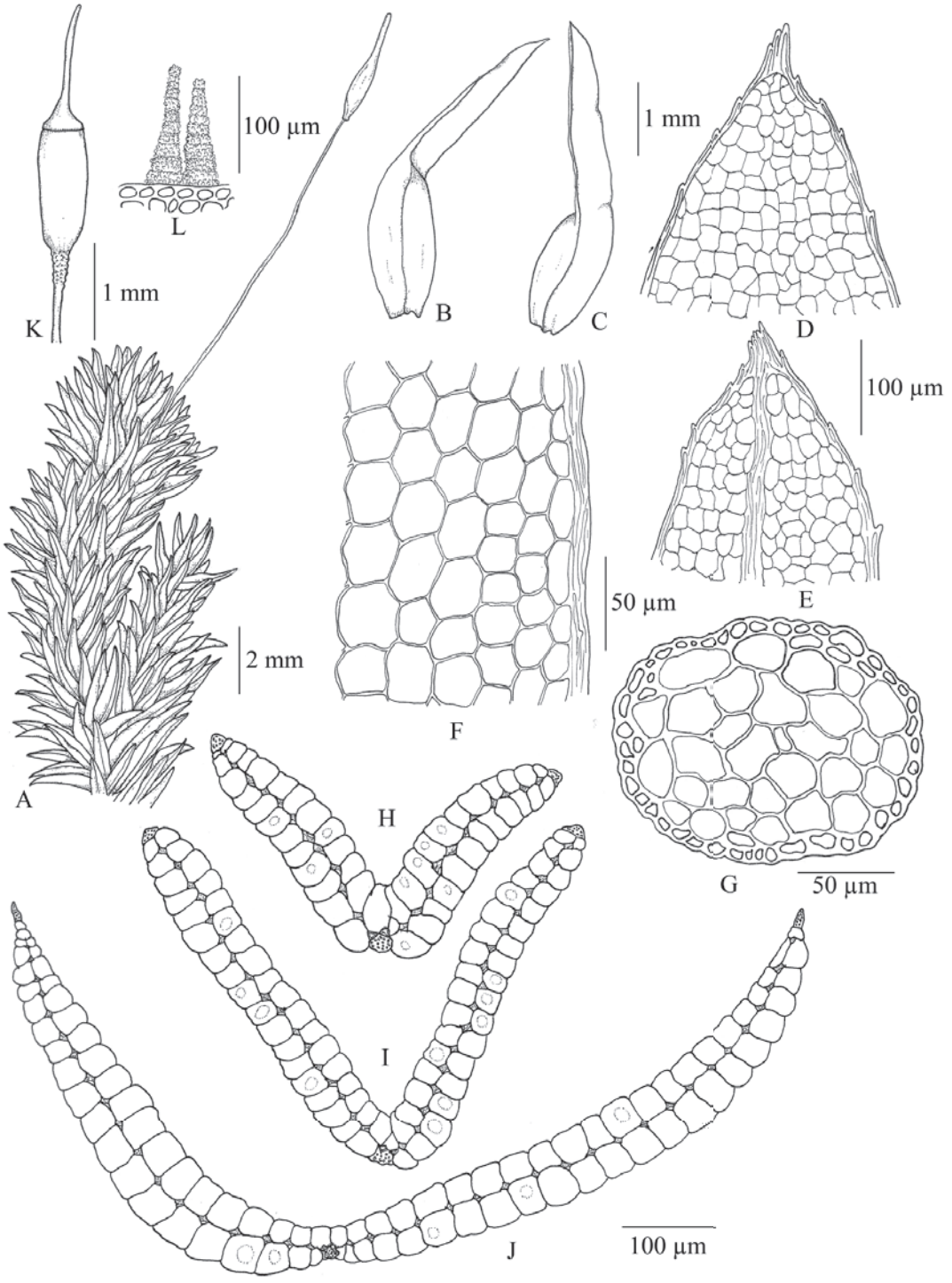

Figure 5. *Leucophanes candidum*: A. Habit; B–C. Leaf, B. adaxial, C. abaxial; D–E. Leaf apex, D. adaxial, E. abaxial; F. Hyalocysts in surface view on abaxial surface at midleaf; G. Cross section of stem; H–J. Cross sections of leaf, H. near apex, I. midleaf, J. near base; K. Capsule; L. Peristome teeth. A., K–L. From *Smitinand & Sleumer 1258* (BKF), B-J. From *Chantanaorrapint 2442* (PSU). Drawn by C. Promma.

Hist. Bull. Siam Soc. 23(4–5): 542. 1970; Thaithong, J. Hattori Bot. Lab. 56: 86. 1984. Type: Malaysia, *J. Lange s.n.* (isotype **BM**, **FH**, **S**). Figs. 6–7.

Plants small to medium, 0.3–1.0 cm high, growing in rather dense to very dense tufts or cushions. *Stems* erect, simple or branched, loosely foliate below, densely foliate above. *Leaves* narrowly lanceolate to linear lanceolate, 1.8–3.3×0.3–0.5 mm, spreading to curved or nearly erect, sheathing base, upper parts keeled to channeled, often twisted when dry; apices mostly acute to apiculate; margins distinctly bordered, entire below, serrulate and gradually more strongly serrate above midleaf; costae strongly spinose on the dorsal side in upper parts of leaves, exposed on abaxial surface; hyaline lamina to 1/3–1/2 the length of leaf; hyalocysts in surface view on abaxial surface at base quadrate to rectangular, at midleaf 18–52×10–26 μm, oblong with sinuose walls and concave bulging end wall, at apex irregularly quadrate oblong. *In cross section of leaf* chlorocysts in a central layer, surrounded by one or more layers of hyalocysts, near leaf base hyalocysts in 1 layer adaxially and in 2–3 layer abaxially, median sterome 14–30 cells, marginal sterome 3–8 cells; at midleaf hyalocysts in 1 layer on either side of chlorophyllous layer, median sterome 22–58 cells, marginal 8–18 sterome cells; near leaf apex hyalocysts in 1 layer on either side of chlorophyllous layer, median 16–58 sterome cells, marginal sterome 8–18 cells. *Gemmae* at leaf apex. *Sporophyte* not seen.

Thailand.— NORTH-EASTERN: Loei; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Prachuap Khiri Khan; SOUTH-EASTERN: Prachin Buri, Trat; PENINSULAR: Ranong, Surat Thani, Phangnga, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla.

Distribution.— The Pacific Islands, Australia (Queenland), New Guinea, Japan, Taiwan, SE Asia, India, Sri Lanka, Seychelles (Salazar Allen 1993).

Habitat and ecology.— On bark at base and tree trunks, occasionally on decaying wood, soil and sandy soil, sometime found in association with *L. octoblepharioides*, common in lowland forests, but also in mangroves, below 750 m.

4. Leucophanes octoblepharioides Brid., Bryol. Univ. 1: 763. 1827; Enroth, Acta Bot. Fenn. 139: 96. Fig. 19a–g. 1990; A. Eddy, Handb. Males. Mosses 2: 46. Fig. 192. 1990; N. Salazar, Bryophyt. Biblioth. 46: 62. Figs. 90–112. 1993. Type: Indonesia, Java, *Nees v. Esenbeck* (lectotype **B**, designated by Salazar Allen (1993); isolectotype **BM**); Nepal, *De Candolle* (syntype **B**). Figs. 8–9.

Plants small to medium, 0.5–1.2 cm high, growing in loose to dense tufts or cushions. *Stems* erect, simple or branched. *Leaves* linear-lanceolate, 2.9–4.8×0.2–0.5 mm, crowded, erect-spreading to recurved-patent, flat above, more or less keeled below, little altered when dry; apices mostly obtuse to acute; margins distinctly bordered, entire below, serrulate at least near apex; costae smooth on the dorsal side, rarely spinose at apex, usually exposed on abaxial surface, rarely covered by abaxial hyalocysts; hyaline lamina to 1/4–1/3 the length of leaf; hyalocysts in surface view on abaxial surface at base rectangular, rhombic-elongated, or quadrate, at midleaf quadrate to irregularly rectangular, 16–44×10–22 μm, with rectilinear walls, at apex oblong, rounded-quadrate to rectangular. *In cross section of leaf* chlorocysts in a central layer, surrounded by one layer of hyalocysts, near leaf base hyalocysts adaxially and abaxially in 1 layer, median sterome 10–20 cells, marginal sterome 3–8 cells; at midleaf hyalocysts in 1 layer on either side, median sterome 16–38 cells, marginal sterome 8–16 cells; near leaf apex hyalocysts in 1 layer on either side, median sterome 16–30 cells, marginal sterome 6–14 cells. *Gemmae* common at leaf apex. *Sporophytes* not seen.

Thailand:— NORTH-EASTERN: Loei; EASTERN: Nakhon Ratchasima; SOUTH-WESTERN: Prachuap Khiri Khan; SOUTH-EASTERN: Prachin Buri, Chanthaburi, Trat; PENINSULAR: Ranong, Phuket, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Yala.

Distribution.— The Pacific Islands, Australia (Queenland), New Guinea, Japan (Ryukyu Islands), Taiwan, SE Asia, India, Sri Lanka, Mauritus, Seychelles (Salazar Allen 1993).

Habitat and ecology.— On bark at base and tree trunks, roots, trunks of tree fern, decaying wood, soil, and sandy soil, sometime found in association with *L. glaucum* and *L. angustifolium*. Common in lowland and montane forests to ca 1000 m.

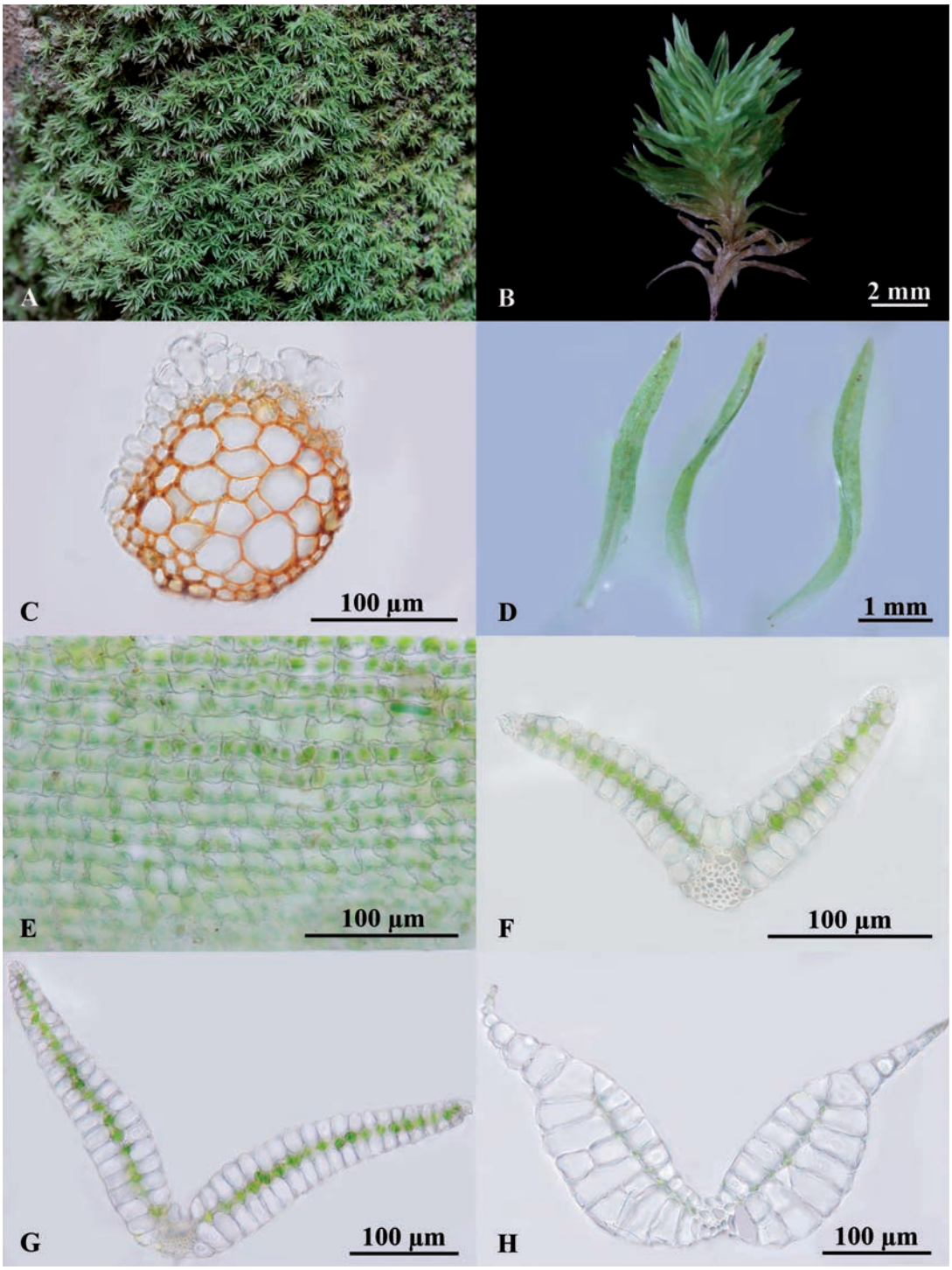

Figure 6. *Leucophanes glaucum*: A–B. Habit; C. Cross section of stem; D. Leaves; E. Hyalocysts in surface view on abaxial surface at midleaf; F–H. Cross sections of leaf, F. near apex, G. midleaf, H. near base. All from *Chantanaorrapint* & *Promma 1* (PSU). Photos by C. Promma.

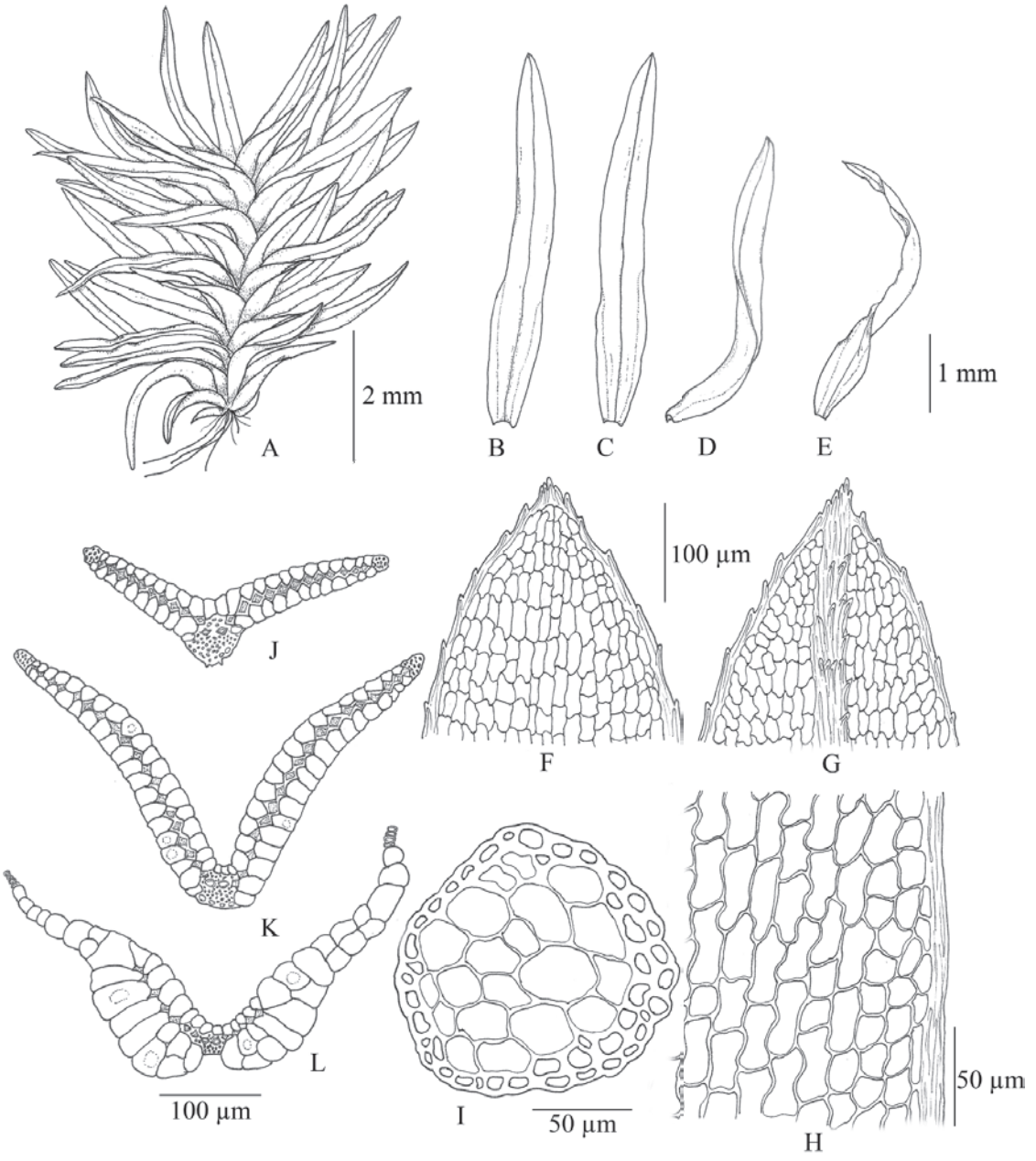

Figure 7. *Leucophanes glaucum*: A. Habit; B–E. Leaf, B. adaxial, C. abaxial, D.lateral, E. when dry; F–G. Leaf apex, F. adaxial, G. abaxial; H. Hyalocysts in surface view on abaxial surface at midleaf; I. Cross section of stem; J–L. Cross sections of leaf, J. near apex, K. midleaf, L. near base. All from *Chantanaorrapint* & *Promma 1* (PSU). Drawn by C. Promma.

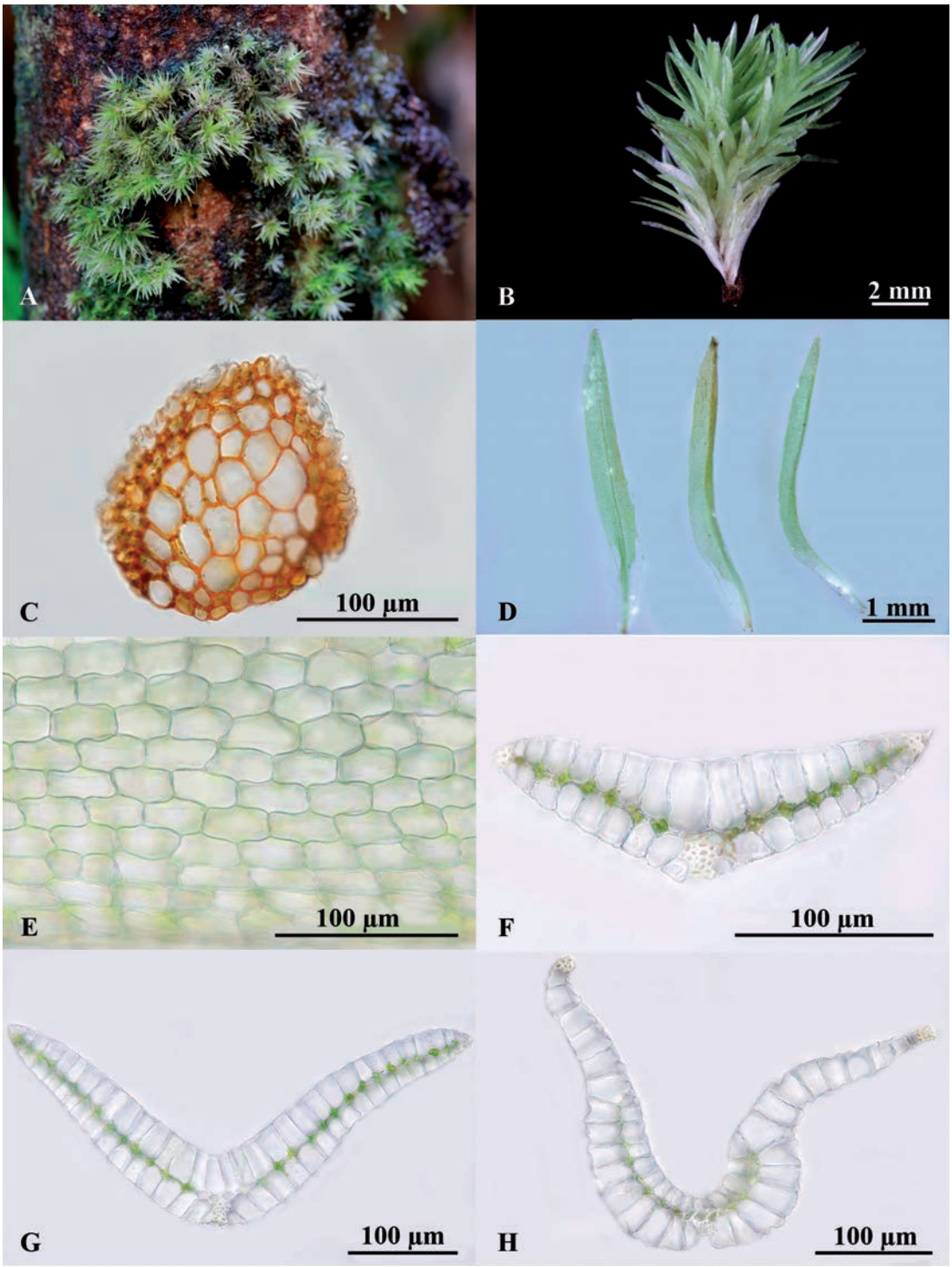

Figure 8. *Leucophanes octoblepharioides*: A–B. Habit; C. Cross section of stem; D. Leaves; E. Hyalocysts in surface view on abaxial surface at midleaf; F–H. Cross sections of leaf, F. near apex, G. midleaf, H. near base. All from *Chantanaorrapint 2353* (PSU). Photos by C. Promma.

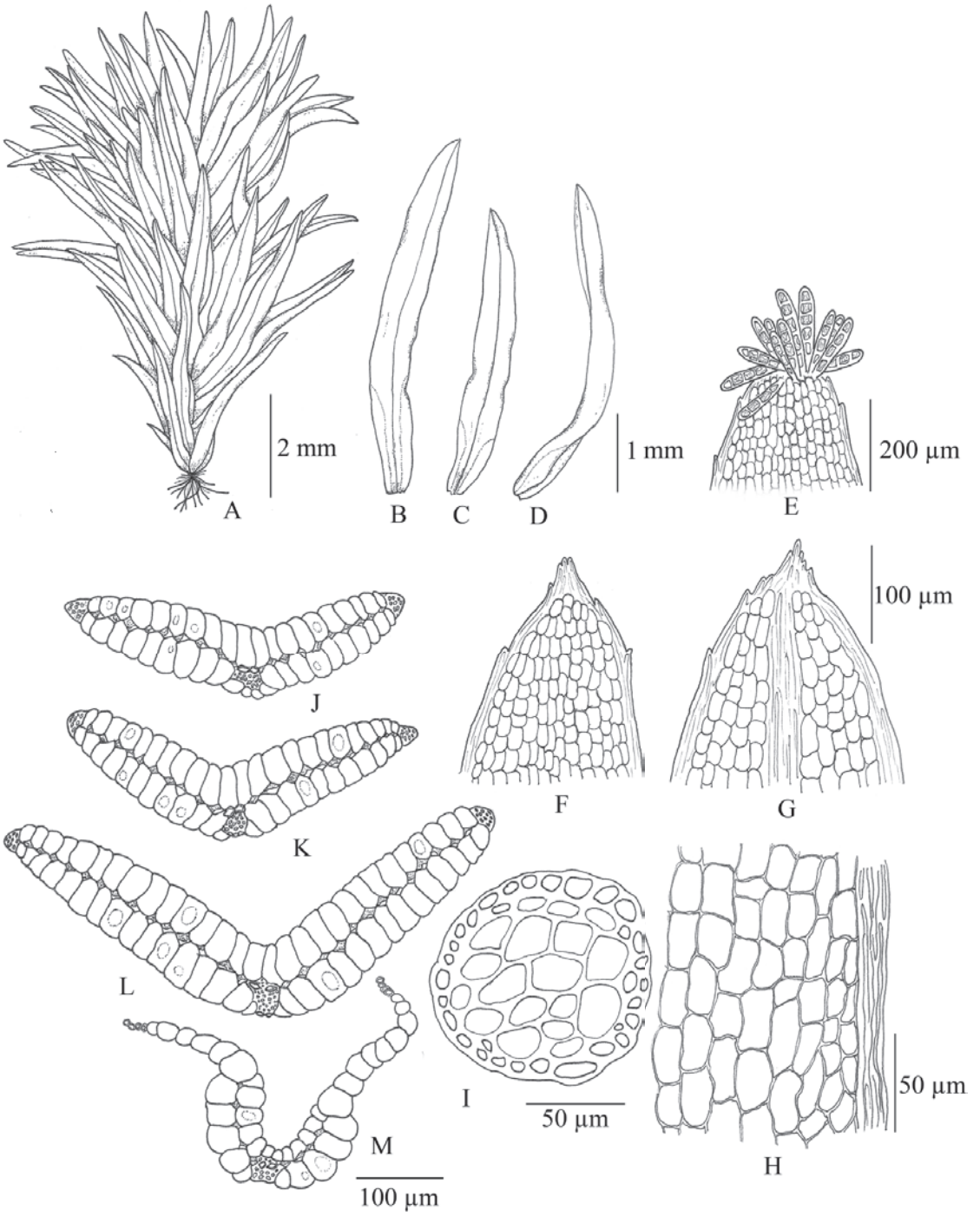

Figure 9. *Leucophanes octoblepharioides*: A. Habit; B–D. Leaf, B. adaxial, C. abaxial, D. lateral; E–G. Leaf apices, E. with gemmae, F. adaxial, G. abaxial; H. Hyalocysts in surface view on abaxial surface at midleaf; I. Cross section of stem; J–M. Cross sections of leaf, J–K. near apex, L. midleaf, M. near base. All from *Chantanaorrapint 2353* (PSU). Drawn by C. Promma.

Note.— Salazar Allen (1993) had divided *L. octoblepharioides* into three subspecies, based on leaf structures, peristome and spore ornamentation. She reported 2 subspecies, *L. octoblepharioides* subsp. *octoblepharioides* and *L. octoblepharioides* subsp. *meijeri* Salazar Allen, in Thailand. The first subspecies is rather common in this country, while the later is known only from a single collection from Khao Yai national park (*Touw 12396* (**BKF**, **BM**, **L**)). According to Salazar Allen (1993), subsp. *meijeri* differs from subsp. *octoblepharioides* in leaf costa completely covered by hyalocysts on the abaxial side from base to apex. However, an investigation of *Touw 12396* (sterile specimens) revealed that a leaf costa in selected leaves of the same plant has no hyalocysts on the abaxial surface. As this character may vary even in the same plant and has not been frequently recorded from other Thai collections, we are hesitant to assign Thai material to subspecific level due to the lack of collections with sporophytes.

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SPECIMENS EXAMINED

Leucophanes angustifolium Renauld & Cardot

Promma 7, *11*, 23 July 2011, Nakhon Si Thammarat, Ron Phibun, Khao Ram Rome (**PSU**); *Chantanaorrapint & Promma 5*, 22 Oct. 2011, Krabi, Klong Thom, Sra Morakot (**PSU**); *Chantanaorrapint 1302*, 24 Dec. 2006, Nakhon Si Thammarat, Nopphitam, Khao Nan National Park, Klong Kan Station (**PSU**); *Chantanaorrapint 1409*, 22 Feb. 2007, Nakhon Si Thammarat, Ron Phibun, Khao Ram Rome (**PSU**); *Chantanaorrapint 1453*, *1457*, 17 April 2007, Nakhon Si Thammarat, Nopphitam, Khao Nan National Park (**PSU**); *Chantanaorrapint 2369B*, 16 May 2011, Prachuap Khiri Khan, Thap Sakae, Huai Yang, Khao Luang (**PSU**); *Chantanaorrapint 2437*, 28 May 2011, Yala, Betong, Ban Chulabhorn Pattana 10 (**PSU**);

Touw 11414, *11498*, 2 Feb. 1966, Nakhon Si Thammarat, granitic massive Khao Luang (**BKF**, **L**); *Chantanaorrapint*, *Inuthai & Promma 499*, 19 Nov. 2011, Prachin Buri, Khao Yai National Park, (**PSU**); *Chantanaorrapint*, *Inuthai & Promma 606*, 4 Dec. 2011, Yala, Betong, Ban Chulabhorn Pattana 10 (**PSU**); *Chantanaorrapint*, *Inuthai & Promma 646*, 5 Dec. 2011, Yala, Betong, Ban Piyamit 2 (**PSU**); *Chantanaorrapint*, *Inuthai & Promma 732*, 14 Dec. 2011, Songkhla, Khlong Hoi Khong, Pa Dum Waterfall (PSU); *Chantanaorrapint*, *Inuthai & Promma 771*, 16 Dec. 2011, Satun, Thungwa, Than Plio Waterfall (**PSU**).

Leucophanes candidum (Schwägr.) Lindb.

Smitinand & Sleumer 1258, 24 Sept. 1963, Surat, Khao Na Daeng (**BKF**); *Chantanaorrapint 2348*, 17 Feb. 2011, Phang Nga, Thai Muang, Khao Lam Pee-Had Thai Muang National Park (**PSU**); *Chantanaorrapint 2442*, 10 Aug. 2011, Satun, Thungwa, Than Plio Waterfall (**BKF**, **PSU**); *Chantanaorrapint*, *Inuthai & Promma 772*, 16 Dec. 2011, Satun, Thungwa, Than Plio Waterfall (**BKF**, **PSU**); *Chantanaorrapint*, *Inuthai & Promma 797*, *798*, 11 Jan. 2012, Trang, Palian, Chao Pa Waterfall (**BKF**, **PSU**); *Chantanaorrapint*, *Inuthai & Promma 1800*, 9 Dec. 2012, Nakhon Si Thammarat, Nopphitam, Krung Ching Waterfall (**PSU**).

Leucophanes glaucum (Schwägr.) Mitt.

Promma 2, *3*, 22 July 2011, Nakhon Si Thammarat, Thung Song, Nam Tok Yong National Park (**PSU**); *Promma 13*, *14*, *16*, 2 Aug. 2011, Songkhla, Hat Yai, Ton Nga Chang Wildlife Sanctuary, Ton Nga Chang Waterfall (**PSU**); *Promma 17B*, 13 Aug. 2011, Krabi, Klong Thom, Sra Morakot (**PSU**); *Inuthai 732*, 28 Sept. 2011, Satun, Thungwa, Than Plio Waterfall (**PSU**); *Inuthai 747*,*750*, 23 Oct. 2011, Trang, Yan Ta Khao, Peninsular Botanic Garden (Thung Khai) (**PSU**); *Chantanaorrapint & Promma 1*, 22 Oct. 2011, Krabi, Klong Thom, Sra Morakot (**BKF**, **PSU**); *Chantanaorrapint & Promma 19*, *20*, *23*, 23 Oct. 2011, Trang, Na Yong, Khao Chong Wildlife Conservation Development and Extension Center (**BKF**, **PSU**); *Thaithong 1004*, 25 April 1979, Ranong, Ban-Dan (**BCU**); *Thaithong 1124*, 26 April 1979, Phangnga, mangrove forest site 3 (**BCU**); *Boonkerd 11*, 24 April 1980, Phangnga, on the way to Rue-sri Sawan cave (**BCU**); *Porn-sook-sawang 5*, 5 May 1981, Ranong, Ka-pure (**BCU**); *Porn-sook-sawang 50-51*, sd., Satun, Tarutao Island, Ta-lo-wow Bay (**BCU**); *Touw 11129*, *11145*, *11147*, 24 Jan. 1966, Phuket Island, near Thalang, Khao Kluai (BKF, L); *Touw 11334*, 29 Jan. 1966, Mainland Phuket, near Tong Lang village (**BKF**, **L**); *Touw 12288*, 18 Feb. 1966, Prachin Buri, Khao Yai National Park (**BKF**, **L**); *Chantanaorrapint*, *Inuthai & Promma 471*, 19 Nov. 2011, Prachin Buri, Khao Yai National Park (**PSU**); *Chantanaorrapint*, *Inuthai & Promma 503B*, 19 Nov. 2011, Nakhon Ratchasima, Khao Yai National Park, Pha Kluai Mai Waterfall (**PSU**); *Chantanaorrapint*, *Inuthai & Promma 697*, 13 Dec. 2011, Phatthalung, Tamot, Lan Mom Jui Waterfall (**BKF**, **PSU**); *Chantanaorrapint*, *Inuthai & Promma 718*, *721*, 13 Dec. 2011, Phatthalung, Kong La, Manora Waterfall (**PSU**).

Leucophanes octoblepharioides Brid.

Promma 1, 22 July 2011, Nakhon Si Thammarat, Tung Song, Nam Tok Yong National Park (**PSU**); *Promma 5*, *6*, *8*, *9*, *10*, 23 July 2011, Nakhon Si Thammarat, Ron Phibun, Khao Ram Rome (**PSU**); *Promma 15*, 2 Aug. 2011, Songkhla, Hat Yai,Ton Nga Chang Wildlife Sanctuary, Ton Nga Chang Waterfall (**PSU**); *Promma 17A*, 13 Aug. 2011, Krabi, Klong Thom, Sra Morakot (**PSU**); *Chantanaorrapint 1465*, 18 April 2007, Nakhon Si Thammarat, Nopphitam, Khao Nan National Park, San yen (**PSU**); *Chantanaorrapint 1588*, 20 April 2007, Nakhon Si Thammarat, Nopphitam, Khao Nan National Park, San yen (**PSU**); *Chantanaorrapint 2353*, *2354*, 22 April 2011, Satun, La Ngu, Tarutao National Park, Tarutao Island (**PSU**); *Chantanaorrapint 2361*, *2369A*, 16 May 2011, Prachuap Khiri Khan, Thap Sakae, Huai Yang, Khao Luang (**PSU**); *Chantanaorrapint 2436*, 28 May 2011, Yala, Betong, Ban Chulabhorn Pattana 10 (**PSU**); *Thaithong s.n.*, 24 March 1975, Satun, La Ngu, Tarutao National Park, Tarutao Island (**BCU**); *Touw 11196*, 24 Jan. 1966, Phuket Island, near Thalang, Khao Kluai (**BKF**, **L**); *Touw*

11212, *11230*, 25 Jan. 1966, Phuket Island, near Thalang, Khao Phara (**BKF**, **L**); *Touw 12396*, 19 Feb. 1966, Prachin Buri, Khao Yai National Park, Kluai Mai Waterfall (**BKF**, **L**); *Touw 12334*, 18 Feb. 1966, Prachin Buri, Khao Yai National Park (**BKF**, **L**); *Phloechit 2630*, sd., Nakhon Si Thammarat, Khiriwong, Thap Chang (**BKF**); *Chantanaorrapint*, *Inuthai & Promma 493*, 19 Nov. 2011, Prachin Buri, Khao Yai National Park (**PSU**); *Chantanaorrapint*, *Inuthai & Promma 502*, *503A*, 19 Nov. 2011, Nakhon Ratchasima, Khao Yai National Park, Pa Kluai Mai Waterfall (**PSU**); *Chantanaorrapint*, *Inuthai & Promma 519*, *520*, *531*, *541*, 1 Dec. 2011, Songkhla, Khlong Hoi Khong, Pa Dum Waterfall (**BKF**, **PSU**); *Chantanaorrapint*, *Inuthai & Promma 629*, 4 Dec. 2011, Yala, Betong, Ban Chulabhorn Pattana 10 (**PSU**); *Chantanaorrapint*, *Inuthai & Promma 649*, *653*, *667*, 4 Dec. 2011, Yala, Betong, Ban Piyamit 2 (**PSU**); *Chantanaorrapint*, *Inuthai & Promma 716*, 13 Dec. 2011, Phatthalung, Kong La, Manora Waterfall (**BKF**, **PSU**); *Chantanaorrapint*, *Inuthai & Promma 731*, 14 Dec. 2011, Songkhla, Khlong Hoi Khong, Pa Dum Waterfall (**BKF**, **PSU**).