

PRELIMINARY STUDY ON GENTIANACEAE OF THAILAND

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KEY TO GENERA

1. Autotrophic plants with green leaves.
 2. Plants erect or creeping. Fruit a capsule.
 3. Plants glabrous or covered with small papillae. Calyx regularly lobed.
 4. Corolla without such glands. Ovary sessile or stipitate
 5. Filaments without a basal scale. Flowers either solitary or in loose inflorescences. Inland plants.
 6. Ovary sessile. Corolla-tube urceolate or cylindric. Lobes without plicae.
 7. Calyx tubular or urceolate. Corolla more or less zygomorphic. Ovary 1-locular. Calyx with longitudinal ribs or crest or wings
 1. **Canscora**
 7. Calyx deeply divided, nearly to the base. Corolla actinomorphic. Ovary 2-locular. Calyx with longitudinal wings.
 3. **Exacum**
 6. Ovary stipitate. Corolla-tube infundibular to cylindric. Lobes with conduplicate plicae in between.
 5. **Gentiana**
 5. Filaments with a basal scale. Flowers in axillary clusters. Coastal plants. (Expected to be found in Thailand)
 - Enicostema
 4. Corolla with 1 or 2 distinct glands at base of each lobe. Ovary sessile.
 7. **Swertia**
 3. Plants pubescent (distinctly on stems and pedicels). Calyx 2- lipped
 4. **Microrphium**
 2. Plants twining. Fruit a berry.
 6. **Crawfurdia**
 1. Saprophytic plants without chlorophyll.
 2. **Cotylanthera**

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1. C A N S C O R A

Lamk., Enc. 1 : 601. 1783; Benth. & Hook.f., Gén. Pl. 2 : 811. 1876.

—*Heterocanscora* C.B. Clarke, J. Linn. Soc. 14 : 431. 1875. —*Orthostemon* R.Br.,

Prod. : 451. 1810. — *Pladera* Soland. ex Roxb., Fl. Ind. ed. 2 : 400. 1832.

— *Phyllocyclus* Kurz, J. Asiat. Soc. Beng. 42 (2) : 235. 1873.

KEY TO SPECIES

1. Leaves without basal rosette, those along the stem over 1 cm long, not adpressed to stem.
 2. Stems not winged.
 3. Calyx distinctly angular or winged.
 4. Calyx 3 — winged, bract broad, connate-perfoliate. **3. C. pentanthera**
 4. Calyx 6 — winged, bract small, subulate **4. C. hexagona**
 3. Calyx round in cross- section or slightly longitudinally ribbed.
 5. Leaves not united around stem.
 6. Leaves narrowly ovate; corolla white or purple, lobes unequal (not 2- lipped); style longer than ovary. **6. C. andrographioides**
 6. Leaves elliptic to cordate; corolla pink, 2- lipped; style shorter than ovary. **7. C. diffusa**
 5. Leaves connate — perfoliate. **5. C. helferiana**
 2. Stems distinctly winged. **2. C. decussata**
 1. Leaves with a basal rosette; those along stem much smaller, 3- 5 mm long, adpressed to stem. **1. C. carinata**

1. Canscora carinata P. Dop, Bull. Soc. Bot. Fr. 59 : 145. 1912; P. Dop & Gagnep. in Fl. Gen. I.- C. 4 : 192. 1914; Fletcher & Kerr in Fl. Siam. En. 3 : 66. 1951.

Fig.1

T h a i l a n d .—NORTH- EASTERN : Nakhon Phanom, Kut Lukha, *Put* 1925(BK,BKF, BM, K),*Smitinand* 8438 (BKF).—**EASTERN :** Buri Ram, *Phengkklai et al.* 3491 (BKF).

D i s t r i b u t i o n .—Laos (type).

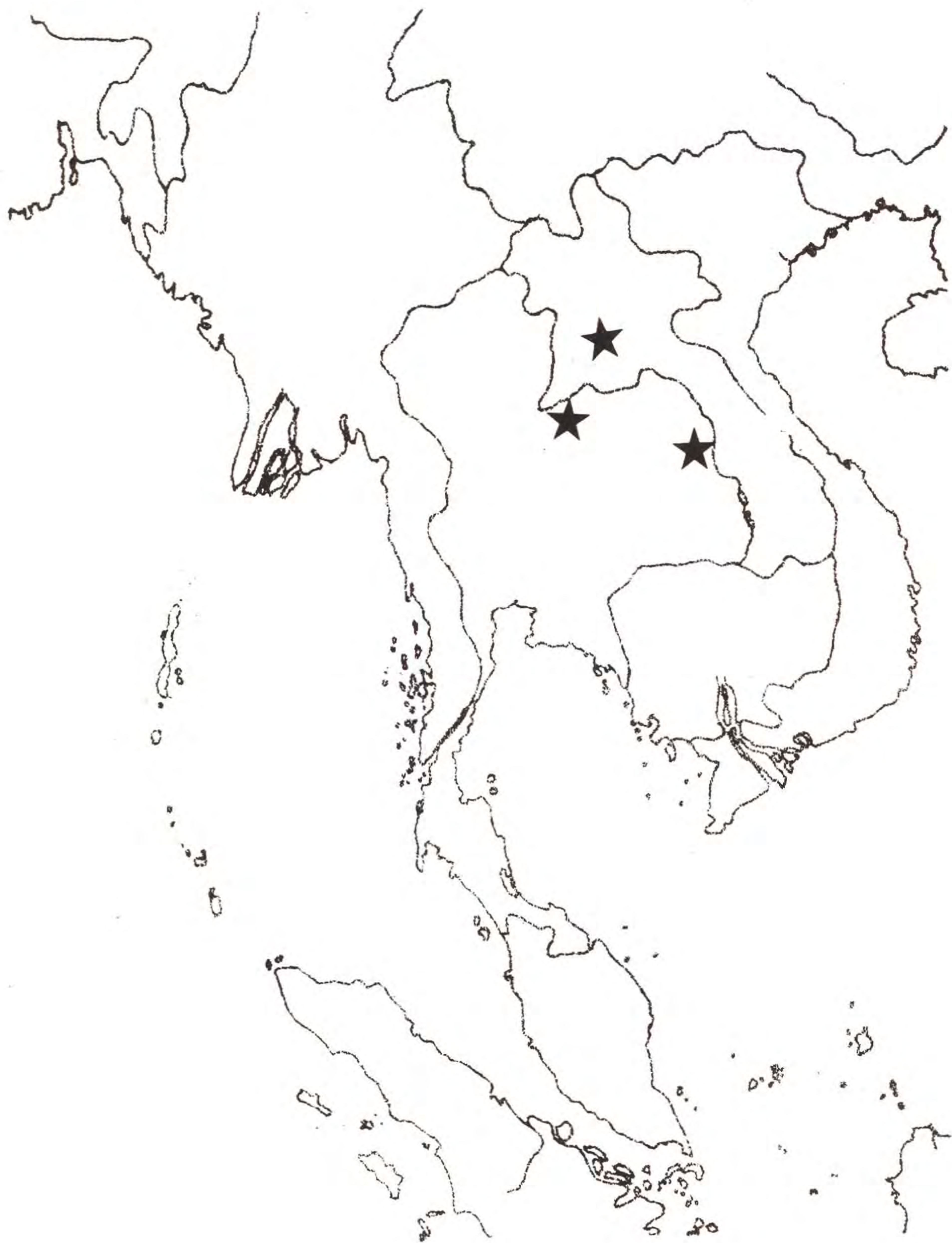


Fig. I. Map showing the distribution of *Canscora carinata* P. Dop.
The distribution pattern is highly generalized.

2. **Canscora decussata** (Roxb.) Schult., Mant. 3 : 229. 1827; C.B. Clarke in Hook.f., Fl. Br. Ind. 4 : 104. 1885; P. Dop & Gagnep. in Fl. Gén. I.- C. 4 : 191. 1914; Fletcher & Keer in Fl. Siam. En. 3 : 66. 1951. —*Pladera decussata* Roxb., Fl. Ind. ed. Carey 1 : 418. 1820.

Thailand —NORTHERN : Chiang Mai, Doi Suthep, *Kerr* 1521 (BKF, BM, K); SOUTH- EASTERN : Prachin Buri, *Chermsirivathana* 1569 (BK, BKF)

Distribution .—Tropical Africa, Madagascar, India (type), Burma.

3. **Canscora pentanthera** C.B. Clarke, J. As. Soc. Beng. 74(2) : 89. 1906; Ridl., Fl. Mal. Pen. 2 : 433. 1922; Fletcher & Kerr in Fl. Siam. En. 3 : 67. 1951.

Fig.2

Thailand .—SOUTH-WESTERN : Prachuap Khiri Khan, Sam Roi Yot, *Put* 2484 (ABD, BKF, BM, K), *Kerr* 10955 (BK, BM); PENINSULAR : Chumphon, Khao Wiang, *Put* 1022 sheet 1 (BK, K), Sheet 2 (K), *Kerr* 11379 (ABD, BM, BK, BKF), Langsuan, Tako, *Kerr* 11875 (BK, BM), *Put* 1627 (ABD, BK, BKF, BM); Ranong, Khao Talu, *Kerr* 11789 (ABD, BK, BM, K); Phangnga, Koh Kalut, *Kerr* 17323 (BK, BM, K); Krabi, Koh Pipidon, *Kerr* 18926 (BK, BM, K), *Hansen & Smitinand* 12297 (BKF, C); Satun, Tung Nui, *Kerr* 14652 (BK, BM).

Distribution .—Malaya (type)

Ecology .—In crevices of limestone rocks in bamboo forest and on old walls, from 10- 300 m altitude.

Vernacular .—Kra poh pla (กะเพาะปลา), Pak khom hat khao (ผักโขมหัดเขา) (Peninsular).

4. **Canscora hexagona** Kerr, Kew Bull. 1940 : 181; Fletcher & Kerr in Fl. Siam. En. 3 : 67. 1951. Fig.3

Thailand .—NORTHERN : Tak, *Lakshnakara* 1538 (BK); Tak, Phumipol, *Suvanakoses* 486 (BK); EASTERN : Nakhon Ratchasima, Chan Tuek, *Kerr* 8059, (ABD, BK, BKF, E, K); SOUTH-WESTERN : Kanchanaburi, Si Sawat, *Beusekom, Phengkklai, Geesink & Wongwan* 3814 (BKF, K, L).

Distribution .—Endemic to Thailand (type, *Kerr* 8059).

Ecology .—At foot of rocks in shade up to 300 m altitude.

5. **Canscora helferiana** (Kurz) C.B. Clarke in Hook.f., Fl. Br. Ind. 4 : 106. 1885; Fletcher & Kerr in Fl. Siam. En. 3 : 66. 1951. —*Phyllocyclus helferiana* Kurz, J. As. Soc. Beng. 42 (2) : 236. 1873; C. B. Clarke, J. Linn. Soc. 14 : 432. 1875.

Fig.4



Fig. 2. Map showing the distribution of *Canscora pentanthera* C.B. Clarke.
The distribution pattern is highly generalized.



Fig. 3. Map showing the distribution of *Canscora hexagona* Kerr.
The distribution pattern is highly generalized.



Fig. 4. Map showing the distribution of *Canscora helferiana* (Kurz) C.B. Clarke.
The distribution pattern is highly generalized.

T h a i l a n d .—NORTHERN : Chiang Mai, Chiang Dao, *Bunchuai* 1385 (BKF). Doi Khun Krong, Chiang Dao, *Adisai* 689 (BK); **SOUTH—WESTERN :** Kanchanaburi, Sai Yok, *Kerr* 10550 (ABD, BK, BM, E, K), Tha Khanun, *Kerr* 10278 (BK, K), Tapo *Larsen & Smitinand* 9214 (BKF, C), *Larsen & Smitinand* 9215 (C) *Larsen & Smitinand* 8631 (C).

D i s t r i b u t i o n .—Burma (type)

E c o l o g y .—In crevices of limestone cliff and on damp limestone rocks near river, at 300 m altitude.

6. ***Canscora andrographioides*** C. B. Clarke, J. Linn. Soc. 14 : 431. 1875; C. B. Clarke in Hook.f., Fl. Br. Ind. 4 : 105. 1885; P. Dop in Lec., Fl. Gén. I.-C. 4 : 191. 1914., Ridl., Fl. Mal. Pen. 2 : 433. 1922; Fletcher & Kerr in Fl. Siam. En. 3 : 65. 1951.—*C. diffusa* auct. non (Vahl) G. Don; Wall., Cat. n. 4361. 1831; C. B. Clarke in Hook. f., Fl. Br. Ind. 4 : 103. 1885, quoad Wall. 4361. **Fig.5**

T h a i l a n d .—NORTH—EASTERN : Loei, Ban Na Luang, *Chermsirivathana* 1023 (BK); **EASTERN :** Chaiyaphum, Thungkamang, *Beusekom*, *Phengkklai*, *Geesink & Wong Wan* 4369 (BKF, L), Nakhon Ratchasima, Khao Yai National Park, *Phengkklai* 695 (BKF), *Beusekom*, *Charoenpol* 1684 (BKF, L); *Smitinand & Robbins* 7894 (BKF), *Smitinand & Robbins* 7934 (BKF), *Smitinand* 8624 (BKF), *Hansen, Seidenfaden & Smitinand* 11372 (BKF, C, E); **SOUTH-WESTERN :** Kanchanaburi, Kao Kuap, *Kerr* 17691 (BK, BM, K), *Kerr* 18079 (BK, BM, E, K); **CENTRAL :** Nakhon Nayok, Khao Khieo, *Kasem* 621 (BK), *Iwatsuki & Fukuoka* 7487 (BKF); **PENINSULAR :** Phangnga, Khao Katakham, *Kerr* 18455 (BK, BKF).

D i s t r i b u t i o n .—India (Assam-type), China (Yunnan), Vietnam, Laos, Cambodia, Malaya (Kedah)

E c o l o g y .—Common in evergreen forest from 300-1,600 m altitude.

7. ***Canscora diffusa*** (Vahl) G. Don, Gen. Syst. 4 : 199. 1837; C. B. Clarke in Hook. f., Fl. Br. Ind. 4 : 103. 1885; P. Dop & Gagnep. in Fl. Gén. I.-C. 4 : 190. 1914; Fletcher & Kerr in Fl. Siam. En. 3 : 66. 1951; Back. & Bakh. f., Fl. Java 2 : 439. 1965.—*Gentiana diffusa* Vahl. Symb. 3 : 47. 1794.—*Exacum diffusum* (Vahl) Willd., Sp. Pl. 1. 2 : 637. 1798.

T h a i l a n d .—NORTHERN : Chiang Mai, Near Takon, *Kerr* 977 (BM, K), Near Mae Kammi, *Kerr* 2378 (BM, E, K), Bank of Mae Ping, *Hosseus* 387 (E, K), Mae Klang between Sop Haat and Taat Noi, *Garrett* 1048 (BKF, E), Chom Thong Right bank of Mae Ping, *Garrett* sheet 1 & sheet 2 1347 (K), Doi Suthep, *Sorensen, Larsen & Hansen* 964 (BKF, C), *Sorensen, Larsen & Hansen* 7027 (C), Doi Phra Kien, *Kasin* 709 (BK), Mae Klang, *Smitinand* 10254 (BK, BKF), Doi Suthep, *Smitinand* 4182 (BKF),



Fig. 5. Map showing the distribution of *Canscora andrographioides* C.B. Clarke. The distribution pattern is highly generalized.

Mae Klang base of Doi Inthanond, *Geesink, Hiepko, Phengkklai* 8081 (BKF, L), Bo-Luang tableland, *Beusekom & Phengkklai* 2513 (BKF, L), Wachirathan Water fall, Doi Inthanond, *Koyama, Phengkklai, Niyomdham, Tamura, Okada* and *Connor* 15530 (BKF) and 15568 (BKF), Mae Hong son, *Niyomdham, Swongtho, Sangkhachand* 160 (BKF), Mae Klang, *Tagawa, Iwatsuki & Fukuoka* 2214 (BKF); SOUTH-WESTERN : Kanchanaburi, Thakhanun, *Kerr* 10531 (ABD, BKF, BM) Sai Yok, *Beusekom, Geesink, Phengkklai & Wongwan* 3902 (K), *Sørensen, Larsen & Hansen* 8591 (C) and 8680 (C).

D i s t r i b u t i o n .—Old world tropic and Australia

E c o l o g y —On damp rock or rocky crevices in stream bed in deciduous forest, from 100-780 m altitude.

2. C O T Y L A N T H E R A

Bl., Bijdr : 707. 1825.

Cotylanthera caerulea Lace, Kew Bull. 1914 : 154; Fletcher & Kerr in Fl. Siam. En. 3 : 64. 1951. **Fig.6**

T h a i l a n d .—EASTERN : Chanthaburi, Grating falls, *Maxwell* 72-454 (BK); SOUTH—WESTERN : Kanchanaburi, Sai Yok, *Marcan* 2426 (ABD, K)

D i s t r i b u t i o n .—Burma (type)

E c o l o g y .—Bamboo forest, at 200 m altitude.

3. E X A C U M

Linn., Sp. Pl. 1 : 112. 1753; Benth. & Hook. f., Gen. Pl. 2 : 803. 1876.

KEY TO SPECIES

1. Calyx-lobes 5. Branches not acutely tetragonous. Anthers erect, equal to the filaments or nearly so. Style nearly as long as ovary.
 2. Leaves narrowly ovate. Calyx-wings 2-2.5 mm broad; lobes acuminate. Capsule oblong **2. E. pteranthum**
 2. Leaves ovate-lanceolate or elliptic-rhombic. Calyx-wings narrow, 1-1.5 mm broad; lobes acute. Capsule globose. **3. E. sutaepense**
1. Calyx-lobes 4. Branches acutely tetragonous. Anthers curved, much longer than filaments. Style 2-3 times longer than ovary **1. E. tetragonum**



Fig. 6. Map showing the distribution of *Cotylanthra caerulea* Lace.
The distribution pattern is highly generalized.

1. **Exacum tetragonum** Roxb., Hort. Beng. 1814 : 10, nomen Fl. Ind. ed. 2.1 : 398. 1832; C. B. Clarke in Hook. f., Fl. Br. Ind. 4 : 95. 1885; Ridl., Fl. Mal. Pen. 2 : 432. 1922; P. Dop & Gagnep. in Fl. Gén. I.- C. 4 : 182. 1914; Fletcher & Kerr in Fl. Siam. En. 3 : 65. 1951. —*E. hamiltonii* G. Don, Gen. Syst. 4 : 212. 1837. —*E. tetrapterum* Meyen ex Griseb. in DC., Prod. 9 : 561. 1845. —*E. sulcatum* C.B. Clarke, J. Linn. Soc. Bot. 14 : 425. 1875. **Fig.7**

Thailand —**NORTHERN** : Chiang Mai, Doi Inthanond, *Bunchuai* 1416 (BKF), Chiang Dao, *Bunchuai* 1367 (BKF), *Put* 307 (ABD, BK, BKF, BM, E, K), Mae Klang, *Kerr* 111 (BK), *Garrett* 1014 (BKF, E, K), *Tagawa, Iwatsuki & Fukuoka* T-2323 (BKF), *Phusomsaeng* 3 (BKF, C), Doi Suthep, *Sørensen, Larsen & Hansen* 6007a (BKF), Lamphun, Mae Kaw, *Winit* 1237 (BKF, K). Sukhothai, *Kasem* 255 (BK). Uttraradit, *Suwatabandhu* s.n. (BK), Lup-Lae, *Suwatabandhu* s.n. (BK). Phitsanulok, *Hosseus* 724 (E, K); **NORTH-EASTERN** : Kalasin, *Suthesorn* 3543 (BK). Phetchabun, *Maxwell* 73-613 (BK). Nakhon Phanom, Ban Han Pon, *Lakshnakara* 986 (BK, K, E). Loei, Phu Kradueng, *Dee* 2, 201, 336 (BKF), Phan Phran Pae, *Smitinand* 1999, 8564 (BKF). Udon Thani, *Pradit* 647 (BK); **EASTERN** : Chaiyaphum, Thungkamang, *Beusekom, Phengkklai, Geesink & Wongwan* 4251 (BKF, K, L). Nakhon Ratchasima, Ta Chang, *Bourke* s.n. (BM, K); **SOUTH-EASTERN** : Prachin Buri, Aranyaprathet, *Put* 1970 (BM, E, K), Sa Kaew *Suwatabandhu* 473 (BK), Ta Phaya, *Sutheson* 156 (BK), *Beusekom, Geesink, Phengkklai & Wongwan* 3639 (K); **SOUTH-WESTERN** : Uthai Thani, Ban Rai, Huy Kha Kaeng, *Maxwell* 76-61 (BK); **PENINSULAR** : Chumphon, Tha Sae, *Kerr* 11625 (BM, E). Phatthalung, *Kerr* 19250 (ABD, BM, E, K). Songkhla, Padang besa, *Kerr* s.n. (BM), *Kerr* 13610 (BM, K). Yala, Bannang star, *Kerr* 7360 (BM, K). Satul, Thung nui, *Smitinand* 7095 (BKF), Thung wa, *Smitinand* 11980 (BKF).

Distribution .—Northern India (Bengal-type), Burma, South China, Indo-China, Malay Peninsula towards Philippines.

Ecology .—In opened grassy forest, up to 600 m altitude.

Vernacular .—Ya liam (หญ้าเหลียม) (Peninsular), Sai pla lai (ไส้ปลาไหล) (North-Eastern).

2. **Exacum pteranthum** Wall. ex Griseb. in DC., Prod. 9 : 47. 1845; C.B. Clarke in Hook. f., Fl. Br. Ind. 4 : 99. 1885; P. Dop & Gagnep. in Fl. Gén. I.- C. 4 : 180. 1914; Fletcher & Kerr in Fl. Siam. En. 3 : 64. 1951. **Fig.8**



Fig. 7. Map showing the distribution of *Exacum tetragonum* Roxb.
The distribution pattern is highly generalized.

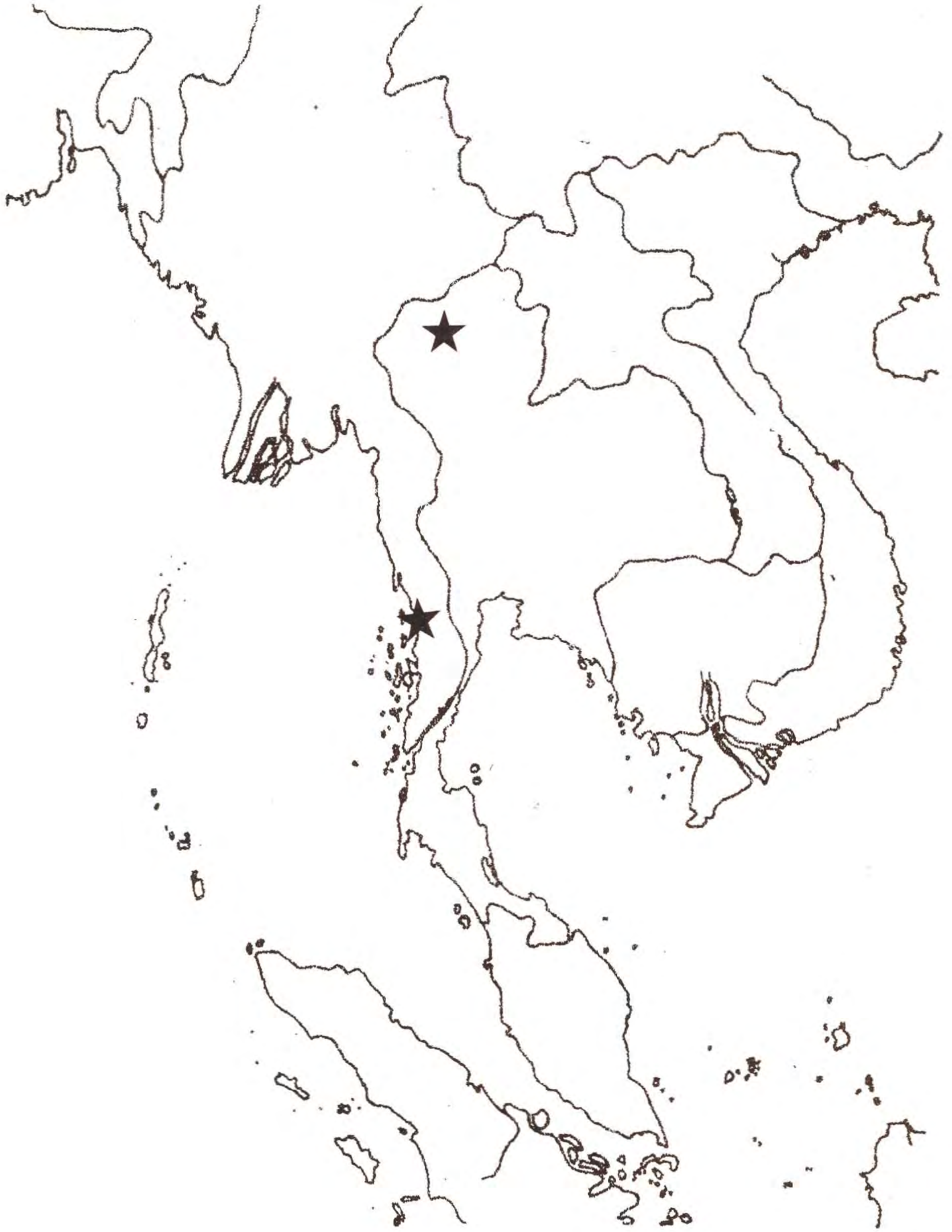


Fig. 8. Map showing the distribution of *Exacum pteranthum* Wall. ex Griseb.
The distribution pattern is highly generalized.



Fig. 9. Map showing the distribution of *Exacum sutaepense* Hosseus.
The distribution pattern is highly generalized.

Thailand .—NORTHERN : Chiang Mai, Mueang Haeng, *Kerr* 6387 (ABD, BK),- Doi Suthep, *Kerr* 1482 (ABD, BM, C, K).

Distribution .—Burma (type, Tavoy).

Ecology .—Open mixed forest, from 700-1300 m altitude.

3. *Exacum sutaepense* Hosseus, Bot. Centralbl., Beih. 28.2 : 426. 1911, nom. nud, ex Craib in Kew Bull. 1914 : 8; P. Don & Gagnep. in Fl. Gén. I.- C. 4 : 180. 1914; Fletcher & Kerr in Fl. Siam. En. 3 : 64. 1951 ("sutaepense"). **Fig.9**

Thailand .—NORTHERN : Chiang Mai, Doi Suthep, *Kerr* 1499 (BM, C, K), *Iwatsuki & Fukuoka* T. 3219 (BKF), *Sørensen, Larsen & Hansen* 5539 (BKF, C), *Smitinand* 3965 (BKF), Doi Angka, *Put* 3311 (ABD, BKF, BM, E, K, BK), Doi Pa Mawn, *Garrett* 486 (ABD, BKF, E, K), Mae Tuen-Mae Sai, *Garrett* 1104 (E,K), Doi Pui, *Beusekom Phengklaï* (BKF, 65977). Ban Yang, Pha Mon, *Murata, Iwatsuki, Phengklaï & Charoenphol* T-15666 (BKF), *Murata, Iwatsuki, Phengklaï & Charoenphol* T-15782 (BKF), Tak, Doi Musor, *Smitinand* 7076 (BKF), SOUTH-WESTERN : Kanchanaburi, Pilog, Thong Pha Phum, *Chermsirivathana* (BK 43714) : PENINSULAR : Phangnga, Khac Po Ta Luang Kaew *Geesink et al* 7618 (BKF), No locality; *Hosseus* 194 (E).

Distribution .—Endemic to Thailand (type, Hosseus 194).

Ecology .—Open grassy ground, 1500-1700 m altitude.

4. MICRORPHIUM

C.B. Clarke, J. Asiat. Soc. Beng. 74, 2 : 88. 1906.

Microrphium pubescens C.B. Clarke, J. Asiat. Soc. Beng. 74, 2 : 88. 1906, Ridl., Fl. Mal. Pen. 2 : 434. 1922; Fletcher & Kerr in Fl. Siam. En. 3 : 68. 1951. **Fig.10**

Thailand .—PENINSULAR : Phangnga, Khao Chaong Lot, *Hansen & Smitinand* 12355 (K, L), *Kerr* 6541, *Put* 4467, *Bunchuai* 1439, *Smitinand & Abbe* 6248, *Anderson & Smitinand* 7312.

Distribution .—Malaya (type)

Ecology . — On limestone rocks near sea.

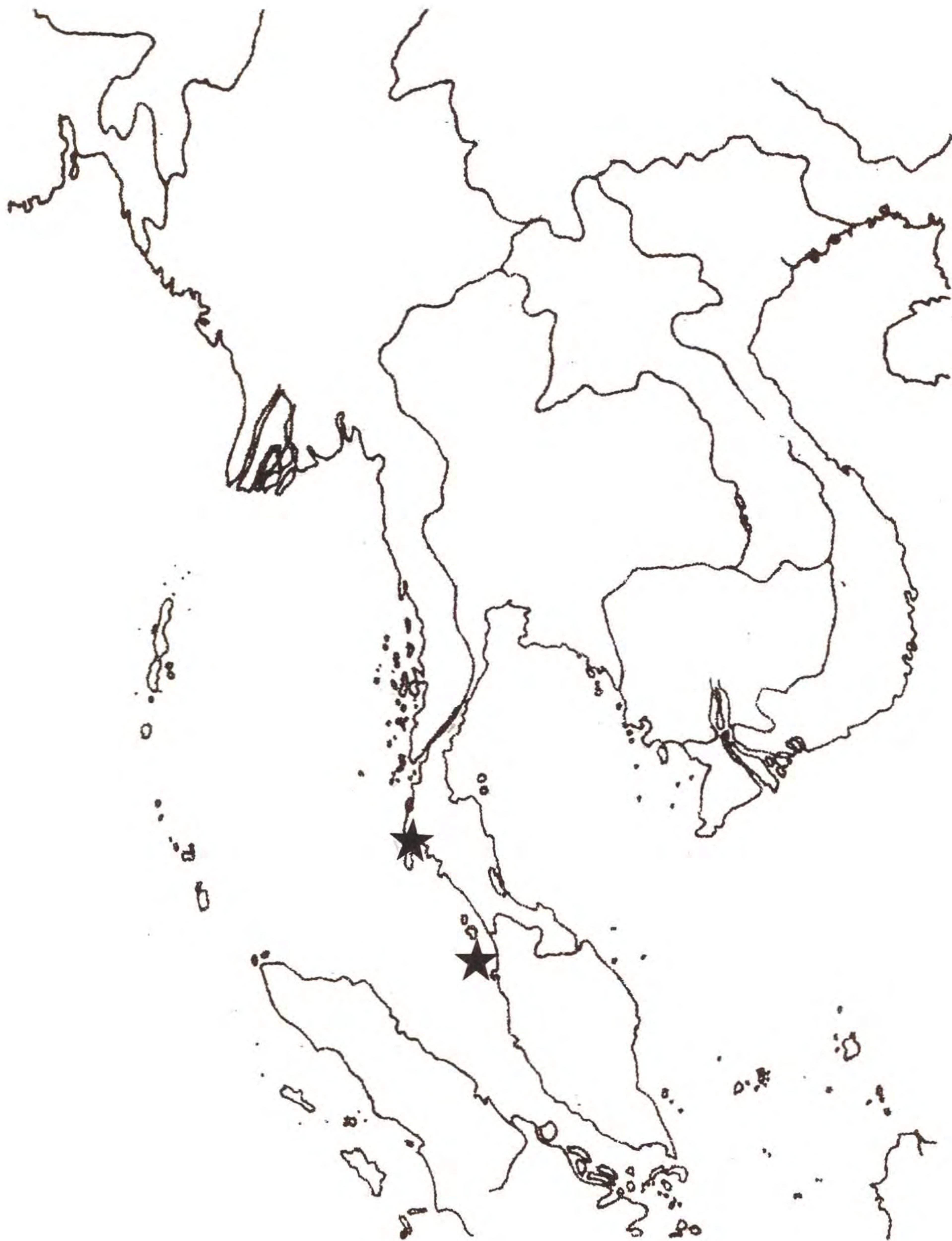


Fig. 10. Map showing the distribution of *Microrhizium pubescens* C.B. Clarke.
The distribution pattern is highly generalized.

5. G E N T I A N A

Linn., Gen. Pl. 3 : 107. 1754.

KEY TO SPECIES

1. Calyx lobes acute
 2. Calyx regular
 3. Calyx lobes shorter than the tube
 4. Calyx tube without wings
 5. Stems indistinct when simple or distinct when branched; leaves either at the basal in rosettes or on the branches
 6. Flowers (sub) sessile. Plicae on corolla obtuse or slightly emarginate-
 7. Root fusiform-napiform. Plicae on corolla obtuse or erose or slightly emarginate **6. *G. napulifera***
 7. Root fibrous. Plicae on corolla acute or obtuse **7. *G. loureirii***
 6. Flowers with pedicel. Plicae on corolla bifid **5. *G. pedicellata***
 5. Stems distinct, simple with leaves in the uppermost part of the stem. Plicae on corolla bifid **4. *G. sp.***
 4. Calyx tube with wings. Stems spreading, moderately branched. Plicae on corolla fimbriate **3. *G. australis***
 3. Calyx lobes (about) equal to the tube
 8. Stems distinct, simple, leaves crowded on the upper part of stem
 9. Disk present. Plicae on corolla acute **9. *G. hesseliana***
 9. Disk absent. Plicae on corolla bifid **10. *G. timida***
 8. Stems indistinct when simple or distinct when branched. Leaves either at the basal in rosettes or on the branches. Plicae on corolla acute **8. *G. lakshnakarae***
 2. Calyx irregular with 3 small linear and 2 large foliaceous lobes. Stems robust, erect, moderately branched **2. *G. crassa***
1. Calyx lobes blunt. Stems robust, erect, simple, or corymb like branched **1. *G. arenicola***

1. *Gentiana arenicola* Kerr, Kew Bull. 1940 : 181; Fletcher & Kerr in Fl. Siam. En. 3 : 68. 1951.

Thailand.—NORTH-EASTERN : Sakon Nakhon, Wanon-niwat, *Kerr* 8493
(BK, BKF, BM, K)

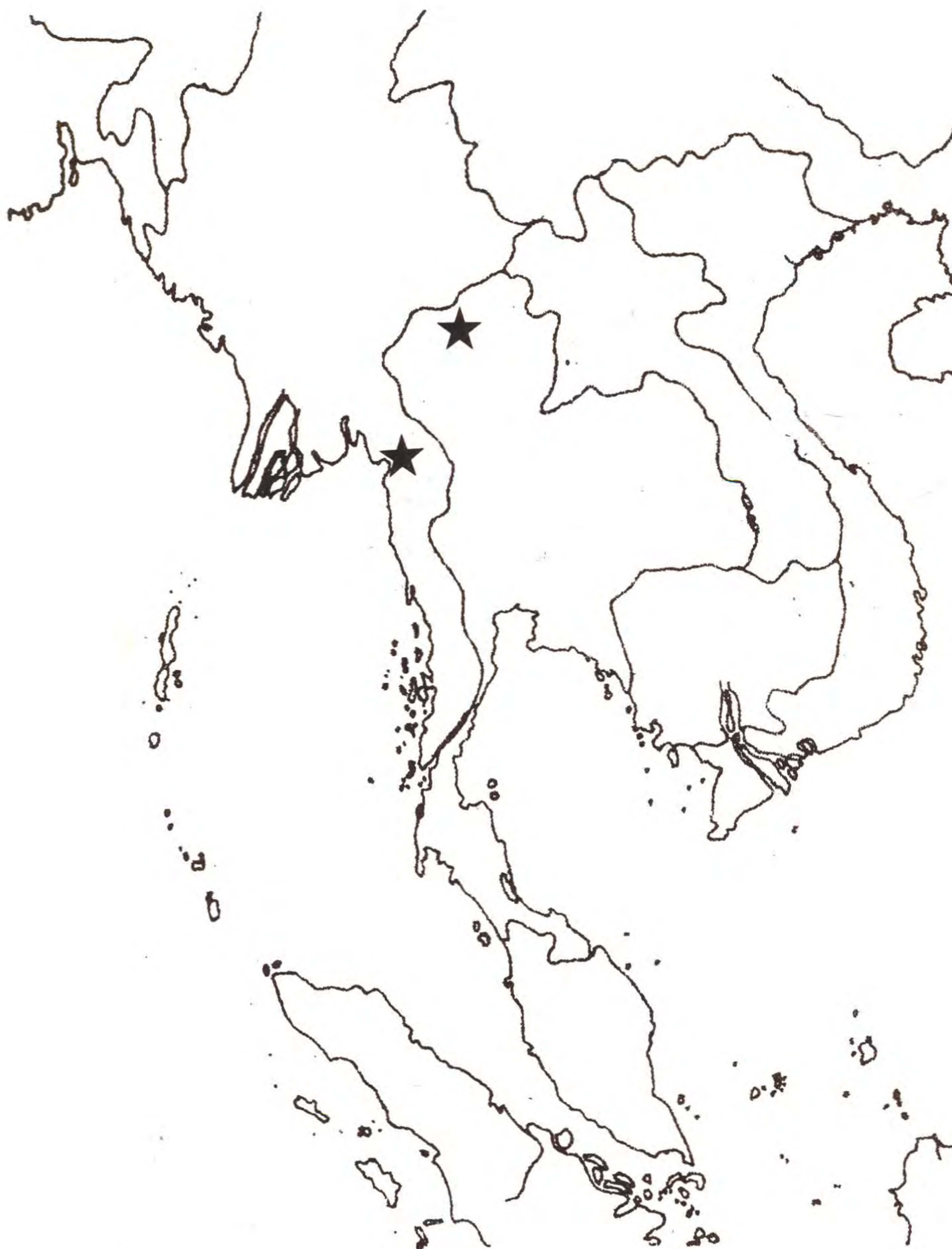


Fig. 11. Map showing the distribution of *Gentiana crasra* Kurz.
The distribution pattern is highly generalized.

D i s t r i b u t i o n . — Endemic to Thailand, *Kerr* 8493 type.

E c o l o g y . — Open grassy deciduous forest, at 200 m altitude.

2. ***Gentiana crassa*** Kurz, J. As. Soc. Beng. 42, 2 : 235. 1873; Hook. f., Fl. Br. Ind. 4 : 114. 1883; Fletcher & Kerr in Fl. Siam. En. 3 : 69. 1951. **Fig.11**

T h a i l a n d . — **NORTHERN** : Chiang Mai, Doi Angka, *Kerr* 5323 (ABD, BK, BKF, K, L), Doi Pha Hom Pok, *Loftnant & Niyomdham* 167 (AAU, BKF).

D i s t r i b u t i o n . — Burma (type), Martaban.

E c o l o g y . — Open ground in dwarf bamboo forest, at 2,100 m altitude.

3. ***Gentiana australis*** Craib, Kew Bull. 1916 : 266; Fletcher & Kerr in Fl. Siam. En. 3 : 69. 1951.

T h a i l a n d . -**NORTHERN** : Chiang Mai, Chiang Dao, *Kerr* 2865 (ABD, BM, E, K), *Hennipman* 3269 (BKF, C, K), *Bunchuai* 1302 (BKF, L), *Smitinand & Abbe* 6231 (BKF, L), *Smitinand, Poore & Robbins* 7869 (BKF), *Smitinand & Anderson* 7319 (BKF), *Tagawa, Iwatsuki & Fukuoka* T-4151 (BKF), *Chanthanamuk* 657 (BK).

D i s t r i b u t i o n . — Endemic to Thailand, Doi Chiang Dao, 1,650 — 1,770 m., *Kerr* 2865 type.

E c o l o g y . -Common on rocky ground, between 1,650-1,770 m altitude.

4. ***Gentiana* sp.**

T h a i l a n d . —**NORTHERN** : Chiang Mai, Chiang Dao, *Kerr* s.n. 4.6 1921 (BM)

D i s t r i b u t i o n . — Chiang Mai, Doi Chiang Dao *Kerr* s.n. (4.6.1921) BM.

E c o l o g y . — Open grassy ground, at 2,000 m altitude.

Note : The species is left without a specific name, since I was unable to identify it. The only 2 specimens studied are incomplete; they resemble to *G. timida*, but smaller in all parts and the calyx is different

5. ***Gentiana pedicellata*** (D. Don) Wight, Ic. Pl. 4, 2(1848) : 1328. -*Ericala pedicellata*-

D. Don, Phil. Mag. 8 : 76. 1836; Trans. Linn. Soc. Lond. 17 : 514. 1837; Burt, Notes Roy. Bot. Gard. Edinb. 26 : 270. 1965. — (*Gentiana pedicellata* Wall. Cat. 4394, - nom. nud.; Fletcher & Kerr in Fl. Siam. En. 3 : 70. 1951 ind. synonym) . — *Ericala procumbens* G. Don, Gen. Syst. 4 : 192. 1837. **Fig.12**



Fig. 12. Map showing the distribution of *Gentiana pedicellata* (D. Don) Wight.
The distribution pattern is highly generalized.

Thailand .—**NORTHERN** : Chiang Mai, Doi Pha Hom Pok, *Kerr* 5176 (BK, BKF, BM, E, K), Doi Hua Mot, *Garrett* 755 (BKF, K), Pang Ton, *Put* 3716 (BK, BM, E, K), Ob Luang, Om Koi, *Beusekom & Phengklai* 1193 (L), Angka, *Sadakorn* 328 (BK), without locality, *Smiles* s.n. (K).

Distribution .—India (type), Assam, Burma, China (Yunnan)

Ecology —Common in evergreen forest at 1,400-1,620 m altitude.

6. ***Gentiana napulifera*** Franch. in Bull. Soc. Bot. Fr. 43 : 488. 1896; Marquand in Kew Bull. 1937 : 173; Fletcher & Kerr in Fl. Siam. En. 3 : 70. 1951. **Fig.13**

Thailand .—**NORTHERN** Chiang Mai, Doi Muan Chang sa, *Kerr* 5415 (ABD, BK, BKF, E, K), Doi Zao, Mae Pai, *Kerr* 5511 (BK, K), Ob Luang, Om Koi, *Beusekom & Phengklai* 1131 (AAU, BKF, C, E, K) : **NORTH-EASTERN** : Phu Kradueng, *Nakkan* 66 (BKF), *Sørensen/Larsen & Hansen* 2387 (AAU, BKF, C, L), *Smitinand* 11464 (BKF), *Koyama, Phengklai, Niyomdham, Tamura, Okada & O'Connor* 15689 (BKF), *Chermsirivathan* 937 (BK), Phetchabun, *Smitinand* 2616 (BKF), *Smitinand* s.n. (BKF).

Distribution .—China (Fukien-type), Yunnan, India (Assam).

Ecology —Open deciduous and open grassy pine forest, between 900-1,200 m altitude.

7. ***Gentiana loureirii*** (G. Don) Griseb. ex DC., Prod. 9 : 108. 1845; N. Kusnezow in Act. Hort. Petrop. 15 : 404. 1896-1904; Dop & Gagnep. in Fl. Gén. I.- C. 4 : 185, fig. 23. 1914; Merrill in Trans. Amer. Phil. Soc. n.s. 24(2) : 310. 1935; Marquand in Kew Bull. 1937 : 176; Fletcher & Kerr in Fl. Siam. En. 3 : 69. 1951. —*Ericala loureirii* G. Don, Gen. Syst. 4 : 192. 1837. —*Gentiana aquatica* (auct. non Linn.) Lour., Fl. Cochin. 1790 : 172. **Fig.14**

Thailand .—**NORTHERN** : Chiang Mai, Doi Pha dam between Hang Dong & Ob Luang, *Larsen, Santisuk & Warnche* 2151 (BKF, L) : **NORTH-EASTERN** : Loei, Phu Kradueng, *Kerr* 8680 (ABD, BK, BKF, BM, E, K), 8697 A (BK), *Smitinand* 4501, 8040, 47609 (BKF), 11464 (K), *Sørensen, Larsen & Hansen* 2343 (AAU, BKF, C, L), *Smitinand & Suvanakes* 345 (BKF), Chiang Khong, Muang On, *Kerr* 20948 (BK),

Distribution .—China (Canton, Kwangtung-type), Laos.

Ecology .—Open grassy ground, from 1,100-1,500 m altitude.

Vernacular .—Khon-nok-yuung (ขนนกกยูง)

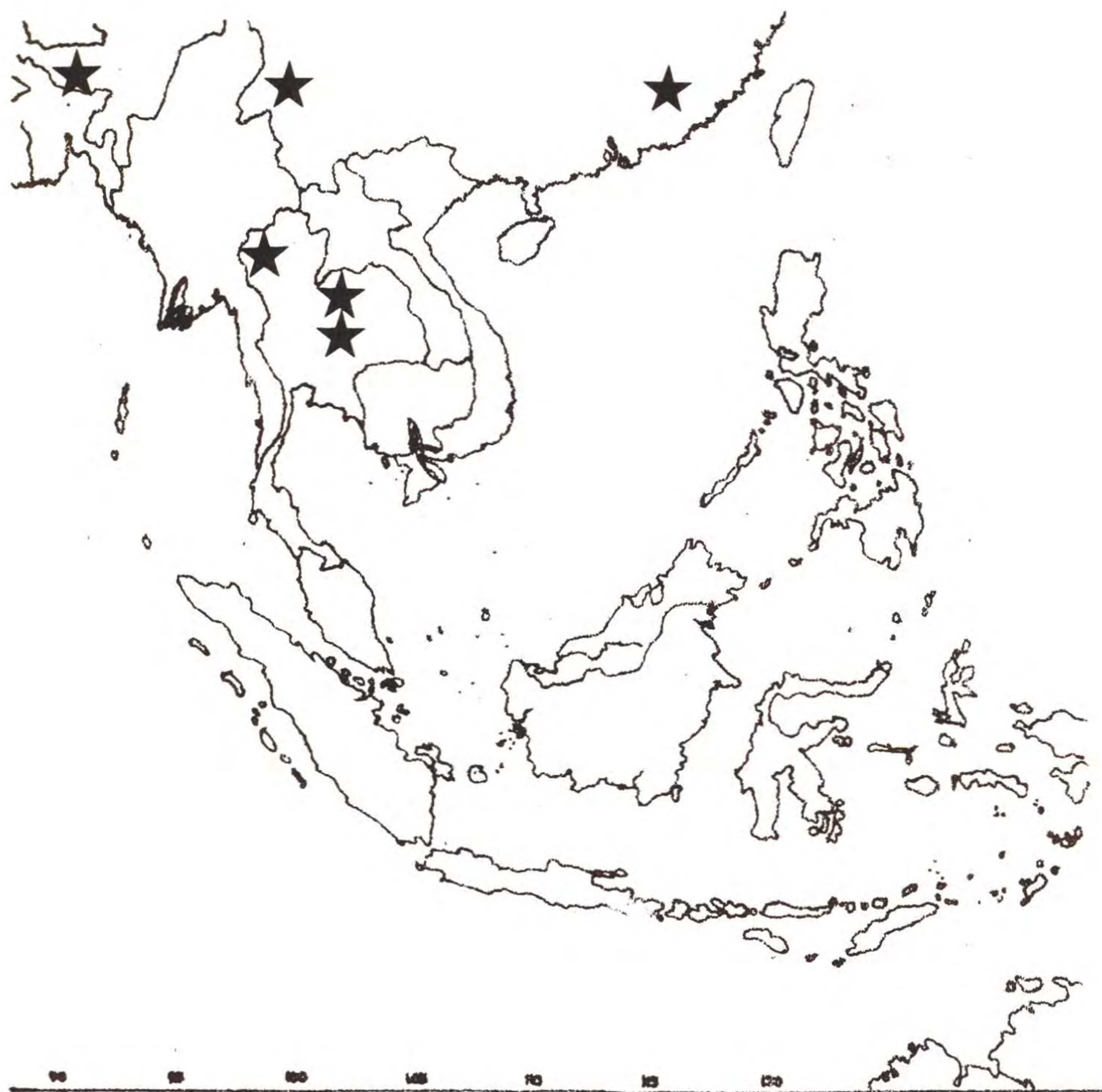


Fig. 13. Map showing the distribution of *Gentiana napulifera* Franch.
The distribution pattern is highly generalized.

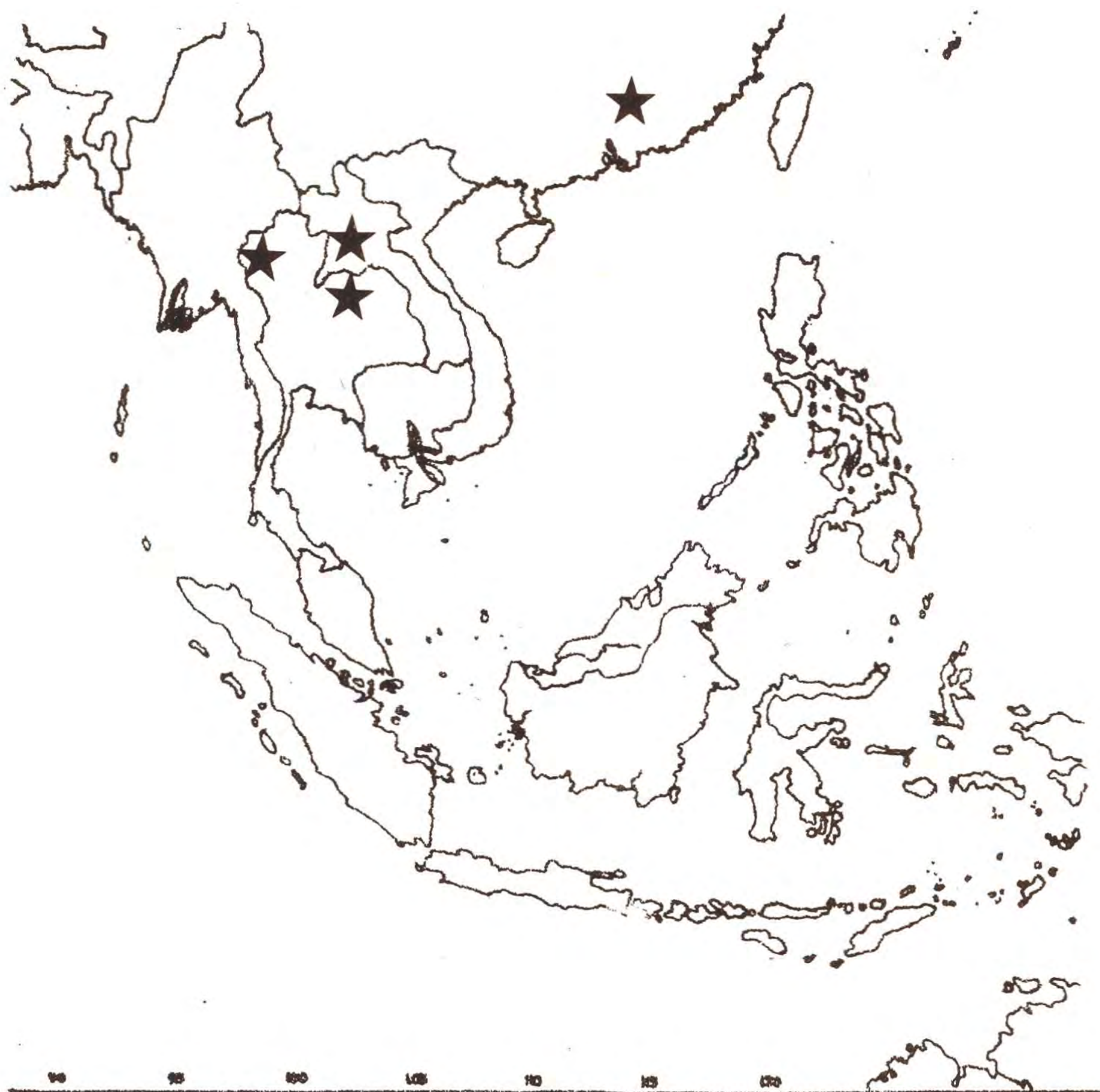


Fig. 14. Map showing the distribution of *Gentiana loureirii* (G. Don) Griseb.
The distribution pattern is highly generalized.

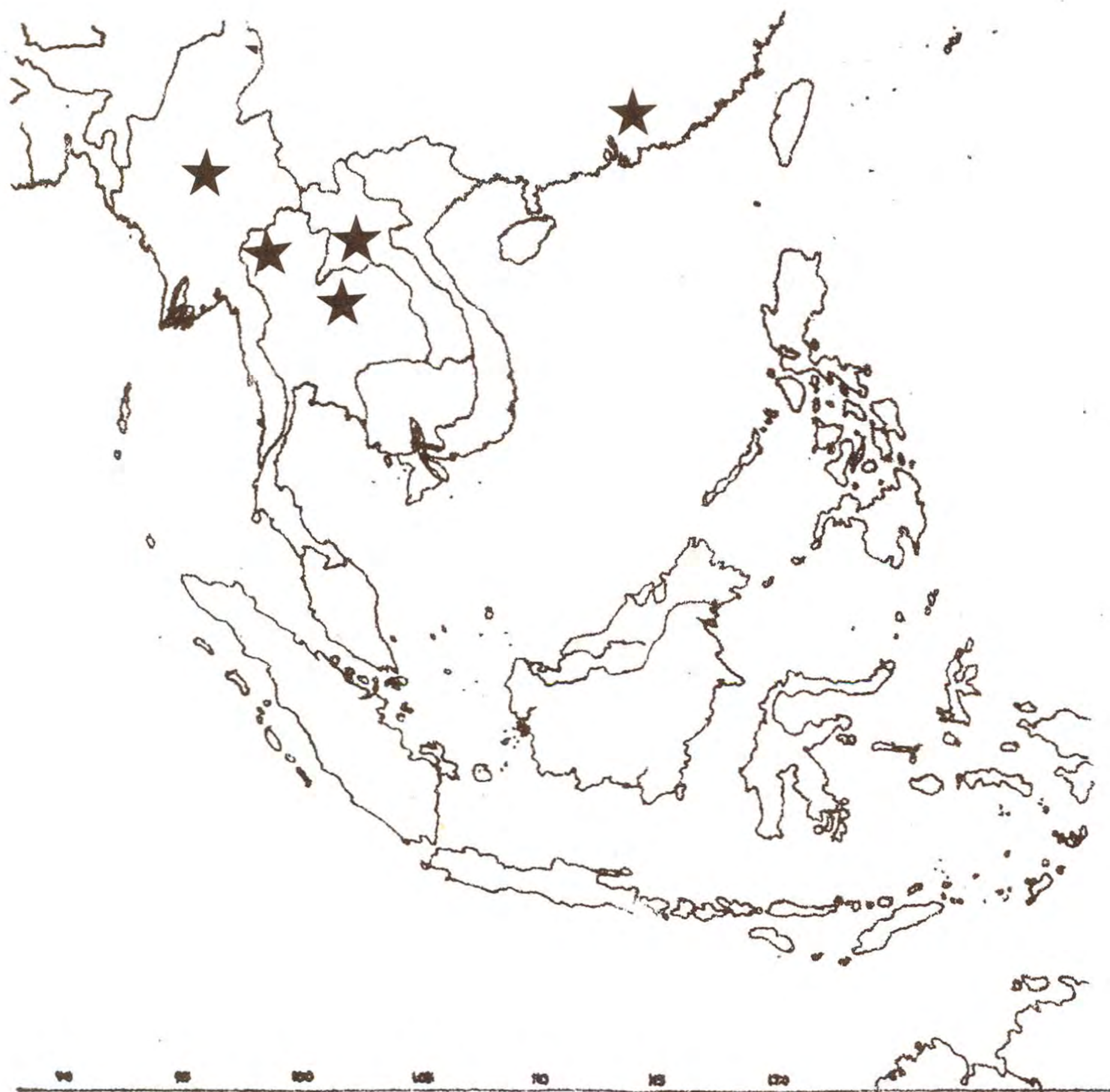


Fig. 15. Map showing the distribution of *Gentiana hesseliana* Hosseus.
The distribution pattern is highly generalized.

8. *Gentiana lakshnakarae* Kerr, Kew Bull. 1940 : 182; Fletcher & Kerr in Fl. Siam. En. 3 : 69. 1951.

Thailand.—NORTH-EASTERN : Loei, Phu Kradueng, *Kerr* 8697 (ABD, BK, BM, K), and 20092 (BM, E), *Hennipman* 3660 (C, K), *Beusekom*, *Phengkklai*, *Geesink & Wongwan* 4495 (K, L), *Abbe and Smitinand* 9411 (BKF), *Charoenphon*, *Larsen & Warnche* 4786 (AAU), *Santisuk* 529 (BKF), *Smitinand* 1075 (BKF), *Tagawa*, *Iwatsuki & Fukuoka* T-811 (BKF), *Amphorn* 20 (BKF), *Nakkan* 9 (BKF) and 53 (BKF), *Lakshnakara* 1392 (BK), *Suwatabandhu* 79 (BK), *Yongboonkerd* 119 (BK), *Chermsirivathana & Boonkerd* 1832 (BK), and 1892 (BK), *Phuu Luang*, *Hennipman* 3566 (BKF, C, K), *Beusekom & Phengkklai* 3104 (L.), *Tagawa*, *Iwatsuki & Fukuoka* T-1226 (BKF), *Bunpheng* 954 (BKF), *Chermsirivathana* 832 (BK), and 1172 (BK)

Distribution.—Endemic to Thailand, *Lakshnakara* 1392 type (BK)

Ecology.—Open pine forest, at 1,200 m altitude.

Vernacular.—Dok Reed (ดอกหรีด)

9. *Gentiana hesseliana* Hoss., Fedde Rep. Nov. Sp. 9 : 465. 1911; P. Dop & Gagnep. in Fl. Gén. I.- C. 4 : 184. 1914; Fletcher & Kerr in Fl. Siam. En. 3 : 69. 1951.

Thailand.—NORTHERN : Chiang Mai, Doi Phahom Pok, *Kerr* 5176 A (ABD, BKF, BK, E, K), Doi Chiang Dao, *Kerr* 2893 (BK, K), Doi Ang Ka, *Garrett*, 637 (E, K), Doi Chaang, *Hansen & Smitinand* 12677 (AAU, BKF, C, E, K, L, P), Doi Khun Huay Pong, *Hansen & Smitinand* 12785 (AAU, BKF, C, E, K, L, P), *Phu Miang*, *Hansen*, *Seidenfaden & Smitinand* 11169 (AAU, BKF, C, L), Doi Inthanond, *Koyama*, *Phengkklai*, *Niyomdham*, *Tamura*, *Okada & O'Connor* 15550 (BKF), *Smitinand* 10312 (BK, BKF),

Distribution.—Burma

Ecology.—Common in evergreen forest and among grass in open savannah, between 1,600- 2,300 m altitude. **Fig.15**

10. *Gentiana timida* Kerr, Kew Bull. 1914 : 182; Fletcher & Kerr in Fl. Siam. En. 3 : 71. 1951.

Thailand.—NORTHERN : Chiang Mai, Doi Suthep, *Kerr* 1579 A & B (K)

Distribution.—Endemic to Thailand, Chiang Mai, Doi Suthep *Kerr* 1579 type.

Ecology.—Among grass in open forest, at 1,500 m altitude.

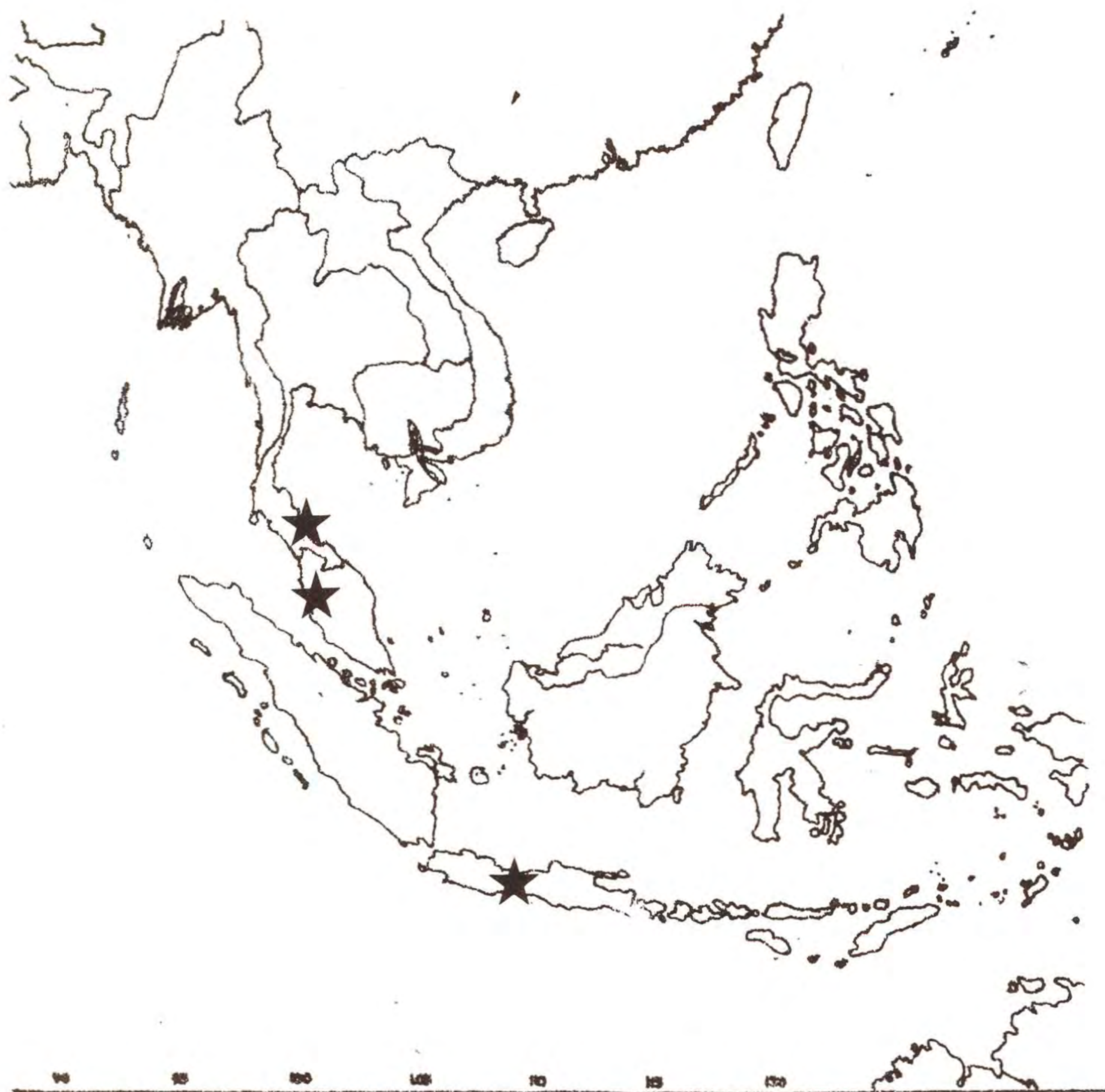


Fig. 16. Map showing the distribution of *Crawfurdia trinervis* (Bl.) Dietr.
The distribution pattern is highly generalized.

6. CRAWFURDIA

Wall., Tent. Fl. Nap.: 63. t. 47, 48. 1826; Benth. & Hook. f., Gen. Pl. 2 : 815. 1876.
-*Tripterospermum* Bl., Bijdr.: 849. 1826; H. Smith, Not. Roy. Bot. Gard. Edinb.
26 : 237-258. 1965.

Crawfurdia trinervis (Bl.) Dietr., Syn. Pl. 2 : 913. 1840; Fletcher & Kerr in Fl. Siam.
En. 3 : 68. 1951. — *Tripterospermum trinerve* Bl., Bijdr. : 845. 1826. **Fig.16**

Thailand.— **PENINSULAR** : Nakhon Si Thammarat, Khao Luang, Kerr 15528
(BK), Smith 751 (BK).

Distribution.— West Malesia, Java (type)

Ecology.— In scrub, at 1,700-1,740 m altitude.

7. SWERTIA

Linn., Sp. Pl. 1 : 266. 1753; Benth. & Hook. f., Gen. Pl. 2 : 816. 1876. — *Agathodes*
D. Don, Trans. Linn. Soc. 17 : 522. 1837. — *Ophelia* D. Don ex G. Don, Gen. Syst.
4 : 178. 1837; D. Don, Trans. Linn. Soc. 17 : 524. 1837.

KEY TO SPECIES

1. Each corolla-lobes with 1 gland at base.
 2. Stem red to pale brown, moderately branched, Nectary scale fimbriate at apex. **1. S. kachinensis**
 2. Stem green, copiously branched. Nectary scale equally short hairy at apex. **2. S. angustifolia**
1. Each corolla lobes with 2 glands at base.
 3. Glands surrounded by 0.7 mm long hairs. Flowers 4-merous, rare 5-merous
 4. Stems copiously branched, pedicel slightly curved upwards. Form of plants not conical **4. S. calcicola**
 4. Stems moderately branched, pedicel not curved, Form of plants conical **5. S. pinetorum**
 3. Glands surrounded by 2 mm long hairs. Flowers 5-merous **3. S. striata**

1. Swertia kachinensis Lace, Kew Bull. 1915 : 404; Fletcher & Kerr in Fl. Siam. En.
3 : 72. 1951. **Fig.17**



Fig. 17. Map showing the distribution of *Swertia kachinensis* Lace.
The distribution pattern is highly generalized.

Thailand.—NORTHERN : Chiang Mai, Doi Suthep, *Kerr* 855 (BM, K), Doi Chiang Dao, *Kerr* 2888 (ABD, BKF, BM, K), *Garrett* 605 (BK, E, K), *Smitinand, Poore & Robbins* 7868 (BKF, E), *Smitinand & Abbe* 6248 (BKF), *Hansen, Seidenfaden & Smitinand* 10879 (L), Doi Ang Khang, *Sadakorn* 282 (BK), 372 (BK), Chang Kien, *Sadakorn* 585 (BK)

Distribution.—Burma (type).

Ecology.—Abundant in open savannah, opened at ridge and grassy forest 1,600-1,850 m altitude.

Vernacular.—Taa ka po (ตากะโป) (Karen).

Uses.—*Garrett* remarks that the Karens boil the complete plant and use the infusion as a febrifuge.

2. *Swertia angustifolia* Ham. ex D. Don, *Prod. Fl. Nepal*. 1825 : 127; C.B. Clarke in *Hook. f., Fl. Br. Ind.* 4 : 125. 1885; *Burkill* in *J. As. Soc. Beng.* n.s. 2 : 373. 1907; P. Dop & Gagnep. in *Fl. Gén. I.-C.* 4 : 188. 1914; *Fletcher & Kerr* in *Fl. Siam. En.* 3 : 71. 1951.—*Ophelia angustifolia* (D. Don) D. Don, *Trans. Linn. Soc.* 17 : 524. 1837.—*Ophelia pulchella* D. Don, *Trans. Linn. Soc.* 17 : 525. 1837, (nom. illeg.).—*Ophelia porrigens* G. Don, *Gen. Syst.* 4 : 178. 1837; *Burt*, *Notes Roy. Bot. Gard. Edinb.* 26 : 271. 1965.—*Swertia pulchella* Ham. ex Clarke in *Hook. f., Fl. Br. Ind.* 4 : 125. 1885 (nom. illeg.).—*Swertia dielsiana* Hoss., *Fedd. Rep. Nov. Sp.* 10 : 63. 1911. **Fig. 18**

Thailand.—NORTHERN : Chiang Mai, Doi Suthep, *Kerr* s.n. *Kerr* 1494 (ABD, BM, K), *Sørensen, Larsen, & Hansen* 6040 (BKF), *Smitinand* 4026 (BKF), Mae Ping, *Kerr* s.n. (BM), *Sangkhachand* 100 (BK), Mae Rim, *Kerr* s.n. (BM), Bo Luang, *Beusekom & Phengklai* 2555 (BKF, L), *Sangkhachand* 161 (BK), *Geesink et al* 4640 (L), Ban Yang, *Lakshnakara* 1455 (BK), *Tagawa, Iwatsuki & Fukuoka* T-2501 (BKF), Sop Aep, *Hennipman* 3342 (BKF), Eastern Flank of Doi Inthanond, near Sop Aep, *Beusekom & Phengklai* 3502 (BKF, L), Doi Inthanond, *Bunchuai* 1439 (BKF, C), *Geesink, Hiepko & Phengklai* 7084 (BKF), Om Koi *Hansen, Seidenfaden & Smitinand* 10809 (BKF), Kong San, *Hansen, Seidenfaden & Smitinand* 10879 (BKF), Mae Sanam, *Hod, Niyomdham & Sawongtho* 78 (BKF), Chiang Dao, *Hennipman* 3279 (BKF), *Bunchuai* 307 (BKF). Chiang Rai, *Iwatsuki, Fukuoka* T-3648 (BKF). *Lamphun Winit* 1232 (BK, BKF); NORTH-EASTERN : Nakhon Ratchasima, Pak Thong Chai, *Kerr* 8059 (BM), *Kerr* 8092 (BK, E, K), *Beusekom, Phengklai, Geesink & Wongwan* 3639 (BKF, K), Loei, Phu Kradueng, *Bunpheng* 368 (BKF), 379 (BKF). Sakon Nakhon, *Suvanakoses* 2014 (BKF). Udon Thani, *Chitpong* 626 (BK). Phetchabun, *Maxwell* 73-623 (BK).



Fig. 18. Map showing the distribution of *Swertia angustifolia* Ham. ex D. Don.
The distribution pattern is highly generalized.

Distribution —India, Nepal, Bhutan, Burma, Cambodia, Laos, Vietnam, China (type).

Ecology .—In light grassy forests from 200-1,000 m altitude.

Vernacular .—Yaa dee khwaai (หญ้าดีควาย) or Yaa dee faen (หญ้าดีเฟน) (Chiang Mai).

3. *Swertia striata* Coll. & Hemsl., J. Linn. Soc. Bot. 28 : 91. 1890; Fletcher & Kerr in Fl. Siam. En. 3 : 73. 1951. **Fig.19**

Thailand .—NORTHERN : Chiang mai, Chiang Dao, *Kerr* 6541 (ABD,BK,BM, E, K), *Put* 4467 (ABD,BKF, K), *Anderson* 7312 (BKF,K), *Smitinand*, *Poore & Robbins* 7865 (BKF), *Fukuoka* T-4355 (BKF), Doi Nom, Chiang Dao, *Phusomsaeng* 53 (BKF).

Distribution .—Burma (type), Shan States.

Ecology .—Common on open rocky slopes, at 1,700-1,800 m altitude.

4. *Swertia calcicola* Kerr, Kew Bull. 1940 : 183; Fletcher & Kerr in Fl. Siam. En. 3 : 72. 1951.

Thailand .—NORTHERN : Chiang Mai, Chiang Dao, *Kerr* 6543 (BK, BM, BKF, E, K), *Murata*, *Iwatsuki & Phengklai* T-15259 (L), *Shimizu*, *Koyama & Na Lampoon* T-10016, Doi Ang Ka, *Garrett* 605 (K), Inthanond Western Flank, *Beusekom & Phengklai* 2374 (BKF, L).

Distribution .—Endemic to Thailand. Doi Chiang Dao (type, *Kerr* 6543).

Ecology .—On limestone rocks at 2,000-2,100 m altitude.

5. *Swertia pinetorum* Kerr, Kew Bull. 1940 : 183; Fletcher & Kerr in Fl. Siam. En. 3 : 72. 1951.

Thailand .—NORTHERN : Chiang Mai, Chom Thong, *Garrett* 619 (ABD, BKF, BM, E, K).

Distribution .—Endemic to Thailand. Chom thong, Doi Dok, *Garrett* 619 type (K).

Ecology .—On open grassy pine forest, above 1,700 m altitude.



Fig. 19. Map showing the distribution of *Swertia striata* Coll. & Hemsl.
The distribution pattern is highly generalized.

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