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Eleven species of *Thrixspermum* (Orchidaceae: Vandeae: Aeridinae) newly recorded from Thailand

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ABSTRACT: Eleven species of *Thrixspermum* are newly recorded from Thailand. Four belong to sect. *Thrixspermum*: *T. crassilabre* (South-Western floristic region), *T. lampongense* (Eastern floristic region), *T. latisaccatum* (Peninsular), and *T. tortum* (Peninsular); and seven to sect. *Dendrocolla*: *T. anceps* (Peninsular), *T. bromeliforme* (of unknown provenance), *T. duplocallosum* (Peninsular), *T. merapohense* (Peninsular), *T. pardale* (Peninsular), *T. patkaiense* (Eastern), and *T. pulchellum* (Peninsular). Descriptions, photographs, and notes on distribution, ecology, phenology, vernacular names, and recognition are provided. Three names are lectotypified. Five species are considered to be uncommon in the wild: *T. anceps*, *T. crassilabre*, *T. duplocallosum*, *T. patkaiense*, *T. tortum*; and *T. bromeliforme* is known from cultivation and suspected to originate in Krabi Province, Peninsular Thailand.

KEY WORDS: floristic regions, Indo-China, Indonesia, Malesia, Section *Dendrocolla*, Section *Thrixspermum*, taxonomy.

INTRODUCTION

Thrixspermum Lour. is a tropical Asian and western Pacific orchid genus. It is currently the second largest in the subtribe Aeridinae (tribe Vandeae, subfamily Epidendroideae) with c. 198 accepted taxa (Pridgeon *et al.,* 2014; Chase *et al.,* 2015; POWO, 2024). Most species are epiphytes, but some are terrestrials or lithophytes, and all have ephemeral flowers, usually with a spurred or saccate lip. The greatest species diversity is found in Borneo (55 species) and Sumatra (40 species), but 20 species have previously been recorded from Thailand (Seidenfaden 1988, Toolmal *et al.,* 2022, 2023) and after this report the total number of species is 31. Fieldwork and herbarium studies by the first author have revealed 11 new species records for Thailand: four in sect. *Thrixspermum*: *T. crassilabre*, *T. lampongense*, *T. latisaccatum*, and *T. tortum*, distinguished by the bilaterally flattened rachis with distichous floral bracts; and seven in sect. *Dendrocolla*: *T. anceps*, *T. bromeliforme*, *T. duplocallosum*, *T. merapohense*, *T. pardale*, *T. patkaiense*, and *T. pulchellum*, characterised by the usually swollen rachis with quaquaversal floral bracts. To facilitate the recognition of these species in Thailand, we provide brief descriptions, photographs, and data on distribution, ecology, phenology, vernacular names, specimens examined and notes. Lectotypification are made for *Thrixspermum pardale*, *T. pulchellum* and *T. album*. We also include diagnostic characters to distinguish from morphologically similar species (Table 1). In the interests of conservation, we do not provide exact localities here.

MATERIALS AND METHODS

Field trips were made with help from local experts and orchid enthusiasts in natural habitats throughout Thailand. Herbarium specimens were examined in AAU, AMES, BK, BKF, BCU, BM, C, CMU, CMUB, E, K, KEP, L, NY, P, QBG, PSU, SAN, SING, TTM and from the online databases of BSD, CAL, LE and PE (herbarium acronyms follow Thiers, continuously updated). Plant collections and annotations were made following standard practice (Davies *et al.,* 2023). Living plants were collected with written permission from the Department of National Parks, Wildlife, and Plant Conservation, Bangkok (letter Tor Sor 0907.4/13890 on 20 July 2021) and cultivated at an evaporative cooling greenhouse in Queen Sirikit Botanic Garden, Chiang Mai, Thailand for further investigation and documentation. Voucher specimens were collected and photographed from this living collection and preserved by fixing in 70% ethanol (Davies *et al.,* 2023) and deposited at the Thai Traditional Medicine Herbarium (TTM), Forest Herbarium (BKF) and Queen Sirikit Botanic Garden (QBG). Colour photographs with scale bars were created using a Nikon D7100 with Nikon 18–105 mm VR DX, Tamron SP AF 70–300 f/4–5.6 Di VC USD and AF-S Micro NIKKOR 60 mm f/2.8G ED lenses, including habitat, plant habit, stem, roots, leaves, inflorescences, flowers, and dissected floral parts. The descriptions were made using a stereo microscope (Leica EZ4W) at the Thai Traditional Medicine Herbarium. Photographs of dissected floral

Table 1. Morphological diagnostic characters of eleven new recorded species of ***Thrixspermum*** (Orchidaceae) in Thailand

species	sections	key characters to distinguish from allied species in Thailand
T. anceps	*Dendrocolla*	Stem subscandent (22–75 cm long or longer) with ancipitous sheathing base, sepals and petals white to pale yellow, lip with orange blotches, mid-lobe broadly triangular, c. 4 × 3 mm, concave, apex slightly thicken (c. 0.5 mm), entire, rounded, with capitate hairs, the lip between the lateral lobes with large rectangular callus.
T. bromeliforme	*Dendrocolla*	Inflorescences much longer than leaves (in mature stage), up to 20 cm long, floral bracts with caudate apex, sepals and petals yellow, lip with large purplish red blotches, spur narrowly conical, 3 × 2.5–3.0 mm, apex blunt, distinctly 2-lobed, lateral lobes ovate (2.5–3.5 mm wide), apex rounded, mid-lobe broadly triangular (3.0–4.5 mm wide), with long capitate hairs on both surfaces.
T. duplocallosum	*Dendrocolla*	Stem short, c. 4 cm long, with c. 9 cm long inflorescences, sepals and petals white, lip with orange blotches, lateral lobes broadly ovate to suborbicular, 2 × 3 mm, rounded, undulate margins, mid-lobe glabrous, the lip between the lateral lobes with large reddish brown callus, spur with linear appendage inside on the back wall.
T. merapohense	*Dendrocolla*	Inflorescences 4–11 cm long, rachis 0.5–2.5 cm long, floral bracts fused to the rachis more than haft of its length, sepals and petals pale yellow, lip marked with reddish brown lines, lateral lobes broadly obovate to suborbicular, c. 4 × 3 mm, apex rounded, mid-lobe oblong to linear (2.5–3 mm long), flatten, with capitate hairs on both surfaces.
T. pardale	*Dendrocolla*	Stem 5–25 cm long, leaves narrowly oblong to linear, 4–7 × 0.5–0.9 cm, dorsiventrally flattened, inflorescences up to 9 cm long, equal or shorter than leaves (in mature stage), floral bracts decurved, sepals and petals pale yellow, with large dark purplish red spots, mid-lobe and lateral lobes with long simple hairs.
T. patkaiense	*Dendrocolla*	Stem short, 1–3 cm long, leaves conduplicate with sharply acute apex, sepals and petals yellow, lip marked with longitudinal purplish red stripes, lateral lobes obovate, mid-lobe 0.5–0.8 mm long, with an orange band along the apical margins, covered with long capitate hairs on both surfaces.
T. pulchellum	*Dendrocolla*	Leaves narrowly oblong to oblanceolate, 1.5–7.0 × 0.4–1.0 cm, with acute lobes, inflorescences up to 11 cm long, much longer than leaves (in mature stage), sepals and petals white, lip with brownish orange spots, lateral lobes narrowly triangular, c. 5–6 × 2.0 mm, falcate, apex obtuse, with capitate hairs, mid-lobe broadly triangular, 1.0–1.5 × 3.5–4.0 mm, apex rounded, with capitate hairs.
T. crassilabre	*Thrixspermum*	Sepals and petals yellow, lip white with purplish red spots, lateral lobes narrowly triangular (1.5–2.0 mm wide), falcate, with sharply acute apex, mid-lobe relatively thickened in apical part (c. 3 mm) and glabrous.
T. lampongense	*Thrixspermum*	Sepals and petals pale yellow, lip with reddish brown spots, except the mid-lobe apex, spur broadly conical, c. 3 × 3 mm, lateral lobes narrowly triangular to oblong, 5–8 × 3–4 mm, apical margins with longer hairs, apex truncate, mid-lobe cylindrical, c. 8 × 4 mm, convex in apical part (c. 6 mm long), with scabrid.
T. latisaccatum	*Thrixspermum*	Sepals and petals pale yellow, recurved, lip with reddish brown spots and blotches except the mid-lob apex, spur shallowly broad saccate, 3–4 × 4–5 mm, lateral lobes ovate to broadly triangular, c. 5 × 2.5–3 mm, apex obtuse, with scabrid, mid-lobe cylindrical, c. 7 × 4 mm, convex in apical part (c. 5 mm long), with scabrid.
T. tortum	*Thrixspermum*	Stem subscandent, bilaterally flattened rachis, sepals and petals yellow, 80–85 mm long, linear, tapering towards the apex, lip with reddish brown blotches, mid-lobe narrowly cylindrical, 7 × 3 mm, depressed at the basal part (c. 3 mm long), convex in apical part (c. 4 mm long), scabrid.

parts from living material were measured using ImageJ bundled with 64-bit Java 1.8.0/172 as additional sources for the description. Terminology used for the descriptions follows Beentje (2016). Protologues and relevant taxonomic literature and checking with specimens (e.g. Seidenfaden, 1988; Seidenfaden, 1992; Seidenfaden and Wood, 1992; Comber 1990; Comber, 2001; Suarez, 2009; O'Byrne *et al.,* 2015; Gogoi, 2022) was reviewed to confirm identifications. Global distributions follow POWO (2024), unless indicated otherwise.

NEWLY RECORDED SPECIES

1. Thrixspermum anceps (Blume) Rchb.f., Xenia Orchid. 2: 122. 1868. —*Dendrocolla anceps* Blume, Bijdr. Fl. Ned. Ind.: 286. 1825. —*Aerides anceps* (Blume) Lindl., Gen. Sp. Orchid. Pl.: 242. 1833. —*Sarcochilus anceps* (Blume) Rchb.f., Ann. Bot. Syst. 6(4): 500. 1863. ***Type***: Indonesia, Java, Salak, *Blume s.n.* (L0062443! holotype).

Section ***Dendrocolla*, Fig. 1**

Stem subscandent, 20 cm long. *Leaves* with ancipitous sheathing base, elliptic, oblong to lanceolate or oblanceolate, 2.5–4 × 1.1–1.8 cm. *Flowers* 1.3–1.5 cm across; sepals and petals creamy white, lip with yellowish to orangish brown blotches. *Dorsal sepal* elliptic, 5 × 3 mm, obtuse. *Lateral sepals* broadly ovate, 5 × 3 mm, obtuse. *Petals* broadly obovate, 4.5 × 3 mm, obtuse. *Lip* 3-lobed, 4 × 3 mm; spur broadly conical, 2 × 2 mm, 2-lobed, with capitate hairs; lateral lobes triangular, slightly falcate, 3 × 2 mm, acute; mid-lobe broadly triangular, 1 × 2 mm, with capitate hairs, rounded.

Distribution. Thailand, Cambodia (Kew cult. leg. Schuiteman), Malaysia (Peninsular), Indonesia (Java and Sumatra).

Thailand. Nakhon Si Thammarat (Khao Nan) (Fig. 3). Flowering. March.

Habitat and ecology. Epiphyte in lower montane forest at 1,200 m elevation. Uncommon in the wild.

Vernacular. Ta khap lueai khao nan (ตะขาบเลื้อยเขานัน) (proposed here).

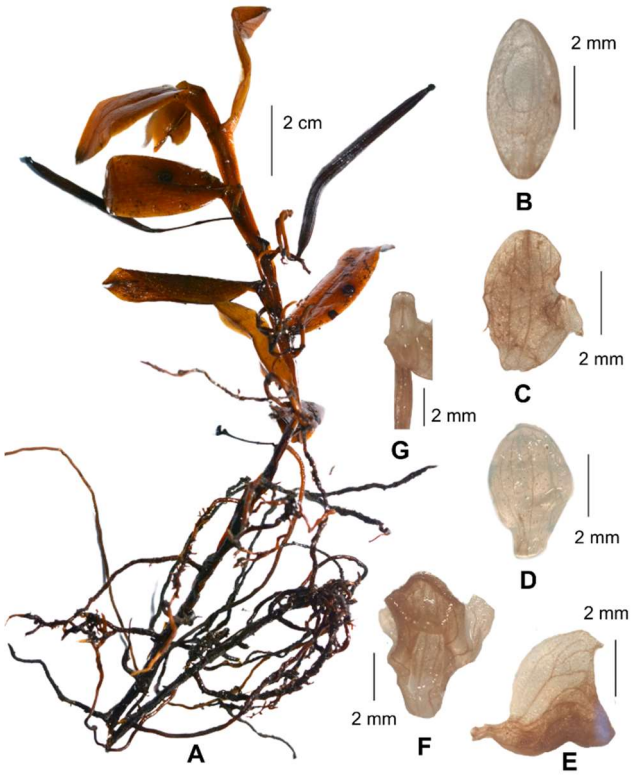

Fig. 1. *Thrixspermum anceps*: A. Plant habit. **B.** Dorsal sepal. **C.** Lateral sepal **D.** Petal. **E.** Lip (lateral view). **F.** Lip (adaxial view). **G.** Column & column-foot with pedicel (ventral view). All photographed by Nopparut Toolmal. All from spirit collection of *Chantanaorrapint et al., 15*, PSU A00081.

Specimen examined. THAILAND. Peninsular: Nakhon Si Thammarat Province, Nopphitum District, Khao Nan National Park, 11 March 2008, *Chantanaorrapint et al., 15* (PSU A00081).

Notes. *Thrixspermum anceps* may be recognised by the elongated, subscandent stem with ancipitous leaf sheaths. In other species, the stems are usually patent and shorter and only slightly bilaterally compressed, without ancipitous leaf sheaths.

2. *Thrixspermum bromeliforme* W.Suarez, Austral. Orchid Rev. 74(3): 33. 2009. ***Type***: Philippines, Luzon, Laguna, Siniloan, *WS 773441* (NSW holotype - digital image!). Section ***Dendrocolla*, Fig. 2**

Stem patent, 7–13 cm long. *Leaves* elliptic to oblong, 5–8 × 0.8–1.5 cm. *Flowers* 1.7–2.0 cm across; sepals and petals pale yellow, lip white with purplish red spots. *Dorsal sepal* obovate to oblanceolate, 9–11 × 3.5–4 mm, acute. *Lateral sepals* obovate, 9–11 × 5 mm, acute. *Petals* obovate to oblanceolate, 8.5–10 × 3.5 mm, acute. *Lip* 3-lobed, 7–8 × 2.5–3.0 mm; spur narrowly conical, 3 × 2.5–3.0 mm, 2-lobed, with capitate hairs; lateral lobes ovate, 5–6 × 2.5–3.0 mm, rounded; mid-lobe broadly triangular, 1.0 × 3–4.5 mm, with capitate hairs, obtuse.

Distribution. Thailand and Philippines.

Thailand. Distribution not known (see notes below).

Flowering. March and December.

Habitat and ecology. Habitat data are not available.

Vernacular. Ueang ta khap lai sue kan yao (เอื้องตะขาบลายเสือก้านยาว) (proposed here).

Specimens examined. THAILAND. Northern: Chiang Mai Province, Queen Sirikit Botanic Garden (*QSBG cult. OR-2020-43*), 17 August 2020, *Toolmal & Tanming 17082003* (TTM 0006414), JJ botanical Nursery, 26 December 2020, *Toolmal et al., 26122001* (TTM 0006396).

Notes. *Thrixspermum bromeliforme* is recognised by the combination of yellow sepals and petals that are attenuate at the base, a lip with large purplish red markings, and long capitate hairs covering the lip adaxially and along the margins. It was originally described from a cultivated plant in Luzon, Philippines, by Suarez (2009) without locality data and was presumed to be endemic to the country. In Thailand, specimens were collected from the Orchid Nursery at Queen Sirikit Botanic Garden and a private nursery, both in Chiang Mai Province, northern Thailand. Unfortunately, locality data were not available for these specimens either, so that the distribution and ecology of this species remain unknown. However, the nursery owner mentioned that it was brought from Krabi Province, Peninsular Thailand, which has habitats similar to that of tropical rain forests with the original provenance from the Philippines. Therefore, we assume that this species can occur at that site, and more data is needed to confirm its occurrence in Thailand reasonably.

3. *Thrixspermum crassilabre* (King & Pantl.) Ormerod, Orchid Memories: 59. 2004. —*Saccolabium crassilabre* King & Pantl., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 66: 593. 1897. —*Gastrochilus crassilabris* (King & Pantl.) Garay, Bot. Mus. Leafl. 23: 179. 1972. ***Type***: India, Meghalaya, Khasia Hill, icon. *Pantling 628* (CAL holotype - digital image!).

Section ***Dendrocolla*, Fig. 4**

Thrixspermum indicum Vik.Kumar, D.Verma & A.N.Rao, Phytotaxa 292(1): 79. 2017. ***Type***: India, Meghalaya, East Jaintia Hills, Tuber village, 12 July 2014, *Kumar & Verma 113138* (BSD000009600 holotype - digital image!).

Stem patent, 5 cm long. *Leaves* elliptic or oblong to linear, 10–15 × 1.5–2.0 cm. *Flowers* 2 cm across; sepals and petals yellow, lip white with purplish spots. *Dorsal sepal* elliptic to lanceolate, 10 × 4.5 mm, acute. *Lateral sepals* broadly ovate, 10 × 5.5 mm, acute. *Petals* narrowly oblanceolate, 9 × 2 mm, acute. *Lip* 3-lobed, 6 × 3.5–4.0, glabrous; spur broadly conical, 3 × 2.5 mm, 2-lobed, with clavate hairs; lateral lobes narrowly triangular, falcate, 5 × 1.5 mm, acute; mid-lobe short, rounded, 1.5 × 4 mm, conspicuously thickened (3 mm), apex emarginate.

Distribution. India and Thailand.

Thailand. Phetchaburi (Kaeng Krachan) (Fig. 3).

Flowering. June, July, and August.

Habitat and ecology. Epiphyte in lower montane forest, at 900 m elevation. Uncommon in the wild.

Vernacular. Ta khap India (ตะขาบอินเดีย) (proposed here).

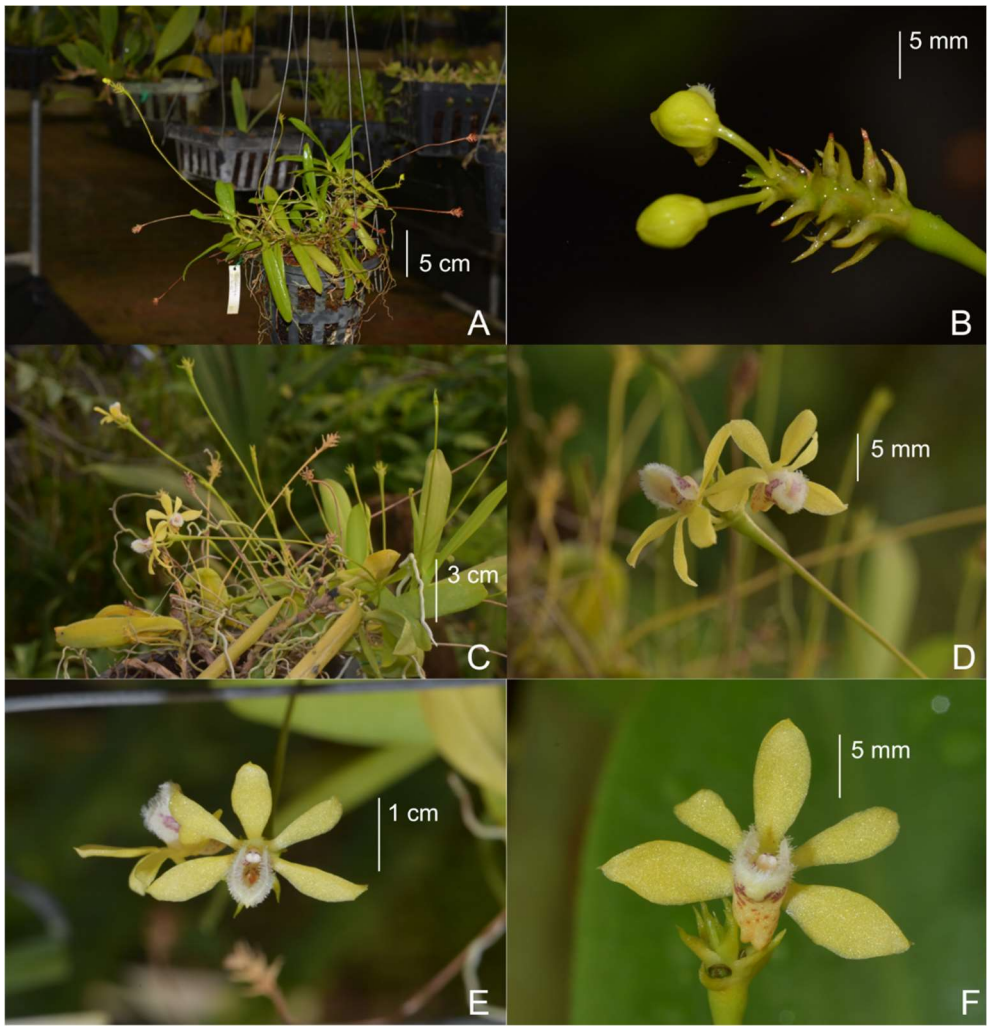

Fig. 2. ***Thrixspermum bromeliforme*: A.** Plant habit. **B.** Rachis with floral bracts and flowers in bud. **C.** Plant habit with many inflorescences and flowers. **D.** Flowers (oblique view). **E.** Flower (front view). **F.** Flower (ventral view). Photographed by Nopparut Toolmal (**A & B.** Cultivation, QSBG) and the late Wattana Tanming (**C–F.** Cultivation, QSBG). All from living collection of *Toolmal & Tanming 17082003*, TTM 0006414.

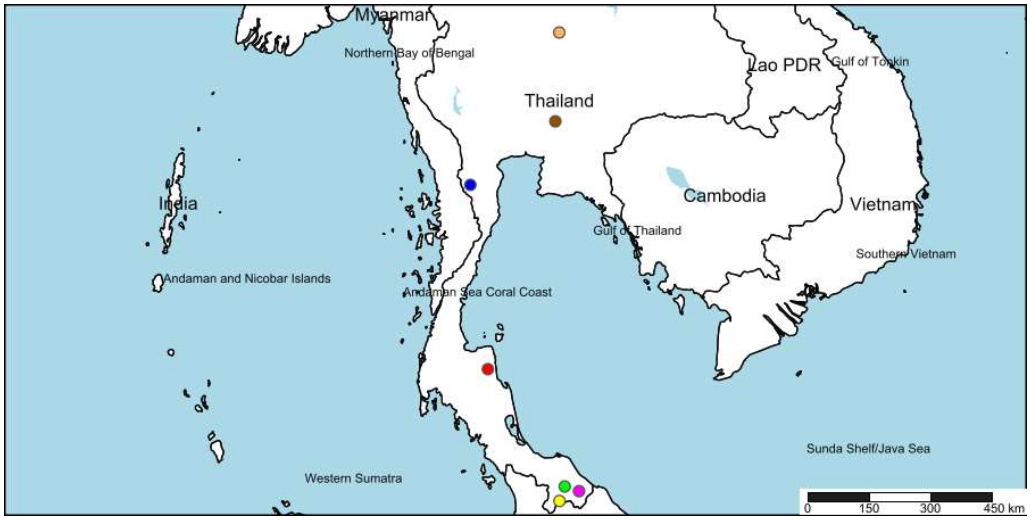

Fig. 3. Distribution map of *Thrixspermum* in Thailand: ***Thrixspermum anceps*** (red), ***T. crassilabre*** (blue), ***T. duplocallosum*** (yellow), ***T. lampongense*** (brown), ***T. pardale*** (green), ***T. patkaiense*** (orange) and ***T. tortum*** (pink).

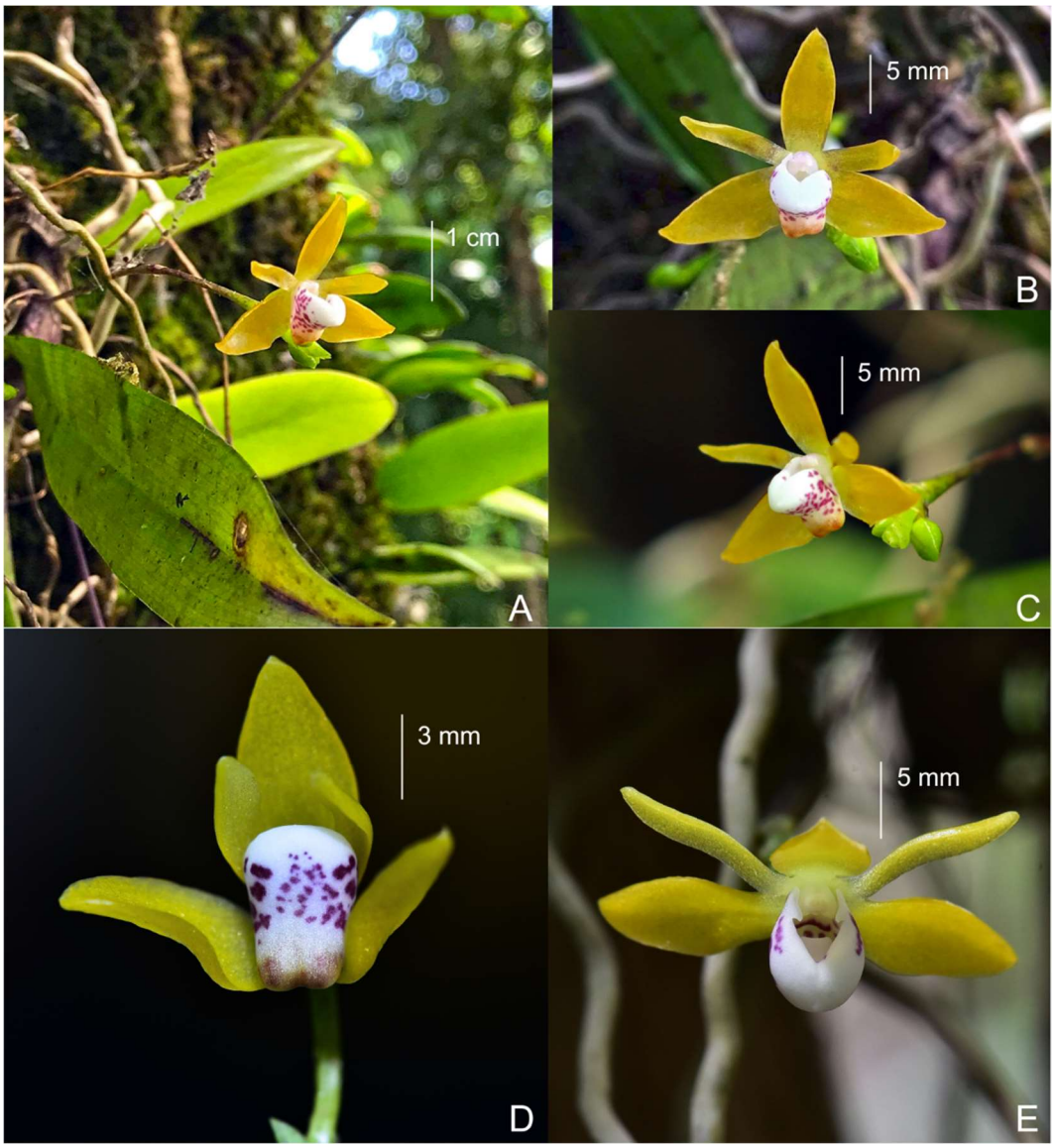

Fig. 4. ***Thrixspermum crassilabre*: A.** Inflorescence with flower. **B.** Flower (front view). **C.** Flower (lateral view). **D.** Flower (ventral view). **E.** Flower (front view, close-up). Photographed by Chukiat Nualsri (**A–C.** In situ: Kaeng Krachan National Park) and Sirichai Ruksue (**D & E.** In situ: Kaeng Krachan National Park). All from living collection of *Raksue 171*, TTM 0006415.

Specimen examined. THAILAND. South-Western: Phetchaburi Province, Kaeng Krachan National Park, 12 July 2021, *Raksue 171* (TTM 0006415).

Notes. *Thrixspermum crassilabre* is easily recognised by the yellow sepals and petals, white, glabrous lip with purplish spots, small, narrowly triangular, falcate lateral lobes and distinctly thickened mid-lobe.

4. *Thrixspermum duplocallosum* Holttum, Gard. Bull. Singapore 11: 290. 1947. ***Type***: Malaysia, Pahang, Cameron Highlands, *Holttum s.n.* (SING0046925! holotype). Section ***Dendrocolla*, Fig. 5**

Stem patent, 4 cm long. *Leaves* elliptic or oblong to lanceolate, 5 × 1.4 cm. *Flowers* 10 mm across; sepals and petals creamy white, lip with reddish brown patches. *Dorsal sepal* elliptic to oblanceolate, 8 × 3.5 mm, obtuse. *Lateral sepals* elliptic, 8 × 3.5 mm, obtuse. *Petals* narrowly oblanceolate, 7.5 × 3 mm, obtuse. *Lip* 3-lobed, 5 × 3 mm; spur broadly conical, 2 × 2 mm, with linear appendage (2 × 0.5 mm) on the backwall, covered with pilose hairs along the entrance, 2-lobed; lateral lobes broadly ovate to suborbicular, 2 × 3 mm, rounded, undulate margins; mid-lobe broadly ovate, 1.5 × 1.5 mm, acute; a little below the mid-lobe with large reddish-brown callus.

Distribution. Thailand and Malaysia (Peninsular).

Thailand. Yala (Betong) (Fig. 3).

Flowering. February.

Habitat and ecology. Epiphyte in lower montane forest, at 1,540 m elevation. Uncommon in the wild.

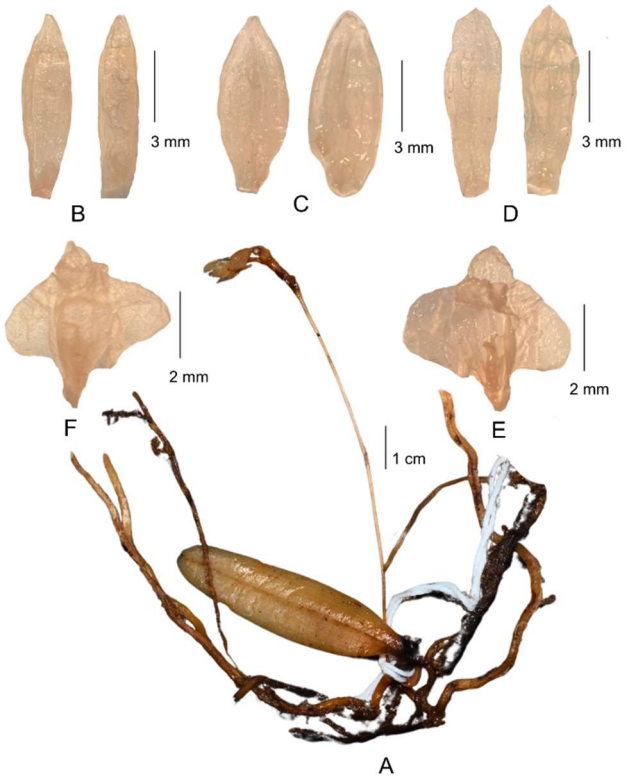

Fig. 5. ***Thrixspermum duplocallosum*: A.** Habit. **B.** Dorsal sepals (left: adaxial view; right: abaxial view). **C.** Lateral sepals (left: adaxial view; right: abaxial view). **D.** Petals (left: adaxial view; right: abaxial view). **E.** Lip (adaxial view). **F.** Lip (abaxial view). All photographed by Nopparut Toolmal. All from spirit collection of *Niyomdham et al. 6089*, BKF s.n.

Vernacular. Ta khap khao pak som (*ตะขาบขาวปากส้ม*) (proposed here).

Specimen examined. THAILAND. Peninsular: Yala Province, Betong District, Sankalakhiri Mountains, 23 February 2000, *Niyomdham et al., 6089* (BKF s.n.).

Notes. *Thrixspermum duplocallosum* is characterised by the white sepals and petals with orangish lip, a little below the mid-lobe with a large reddish-brown callus, the spur with a linear appendage on the back wall and covered with pilose hairs along the entrance. It was originally described from the Cameron Highlands, Pahang, Malaysia. The Thai specimen cited above had been misidentified as *T. ridleyanum* (a synonym of *T. clavatum*) because they share white flowers and are similar in vegetative morphology.

5. *Thrixspermum lampongense* J.J.Sm., Bull. Jard. Bot. Buitenzorg, sér. 2, 25: 89. 1917. ***Type***: Indonesia, Sumatra, Lampung, Menggala, *Gusdorf, liv. pl. cult. in Hort. Bog: sub n. 85, 106 and 151* (L1540237! syntype).

Section ***Thrixspermum*, Fig. 6**

Stem patent, 14–30 cm long. *Leaves* elliptic to oblong, 3–14 × 1.2–3.2 cm. *Flowers* 5.5 cm across; sepals and petals pale yellow, lip white with reddish brown spots, except the mid-lobe-apex. *Dorsal sepal* linear, 30–43 × 3.0–3.5 mm, acuminate. *Lateral sepals* similar, 30–45 × 3–4 mm, acuminate. *Petals* similar, 30–40 × 1.5–2.0 mm, acuminate. *Lip* 3-lobed, 8–13 × 3–4 mm; spur broadly conical, 3 × 3 mm, obtuse, with simple hairs; lateral lobes narrowly triangular to oblong, falcate, 5–8 × 3–4 mm, apex truncate and erose; mid-lobe broadly cylindrical, 8 × 4 mm, obtuse, scabrid.

Distribution. Thailand, Malaysia (Peninsular), and Indonesia (Sumatra).

Thailand. Nakhon Ratchasima (Khao Yai) (Fig. 3).

Flowering. April, August, and December.

Habitat and ecology. Epiphyte in dry evergreen forest, at 640–700 m elevation. Locally common.

Vernacular. Maeng mum lueang pak khao (*แมงมุมเหลืองปากขาว*) (proposed here).

Specimens examined. Northern: Chiang Mai Province, Mae Rim District, Queen Sirikit Botanic Garden (Orchid Nursery, in cult., unknown locality), 06 August 2020, *Toolmal & Tanming 06082001* (QBG 127675); ibid., *06082002*, (QBG 127676); ibid., *06082006* (QBG 127680); ibid., *06082007* (QBG 127681), ibid., 29 December 2020, *29122003* (TTM 0006401); ibid., *29122004* (TTM 0006402).

Notes. *Thrixspermum lampongense* may be recognised by the combination of pale yellow sepals and petals, lip with reddish brown spots, except the mid-lobe, truncate lateral-lobes, cylindrical, scabrid mid-lobe with a 6 mm long convex apical part. It was originally described from Menggala, Lampung, Sumatra, Indonesia, by Smith (1917) and later recorded from Peninsular Malaysia. Specimens without locality data were collected from the Orchid Nursery at Queen Sirikit Botanic Garden, Chiang Mai Province, northern Thailand. However, we are able to confirm its natural occurrence based on photographs taken in Khao Yai National Park, Nakhon Ratchasima Province, Eastern Thailand, by Saksan Kaitongsuk in 2021 and Radamanee Khruaklang in 2023.

6. *Thrixspermum latisaccatum* J.J.Sm., Bull. Jard. Bot. Buitenzorg, sér. 3, 2: 111. 1920. ***Type***: Indonesia, Sumatra, Mentawai Island, *Hansen cult. s.n.* (L.1540239! probable holotype). Section ***Thrixspermum*, Fig. 7**

Stem patent, 3–10 cm long. *Leaves* oblong or oblong to oblanceolate, 5–13 × 1.2–3.8 cm. *Flowers* 8 cm across; sepals and petals pale yellow, lip with reddish brown spots. *Dorsal sepal* linear, 38–43 × 3–4 mm, acuminate. *Lateral sepals* similar, 38–43 × 3.5–5 mm, acuminate. *Petals* similar, 35–4 × 2–2.5 mm, acuminate. *Lip* 3-lobed, 10 × 4–5 mm; spur broadly conical, 3–4 × 4–5 mm, 5-lobed, inside covered with simple hairs (0.3 mm long); lateral lobes ovate to broadly triangular, subfalcate, 5 × 2.5–3 mm, obtuse; mid-lobe cylindrical, 7 × 4 mm, obtuse.

Distribution. Thailand, Malaysia (Peninsular and Borneo), and Indonesia (Sumatra).

Thailand. Peninsular: Ranong (Muang Lan), Surat Thani, (Khun Thale Lake), Phangnga (Krasom, T. Mapraw), Krabi (Khap Thong Tai), Trang (Khao Pap Pa), Songkhla (Ton Sa Taw, Ton Nga Chang) (Fig. 9).

Flowering. All year round.

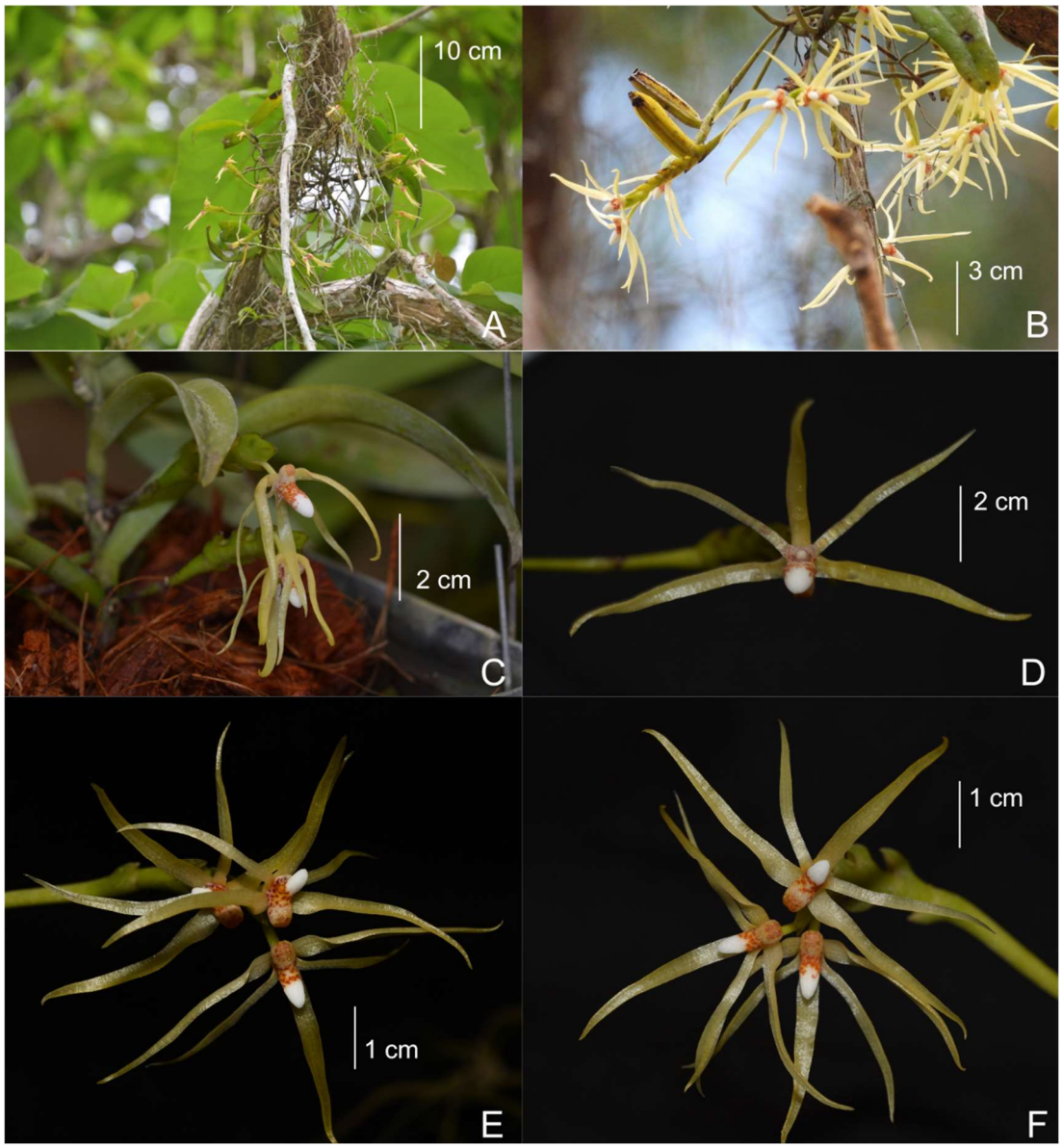

Fig. 6. ***Thrixspermum lampongense*: A.** Habit. **B.** Inflorescences with flowers and fruits. **C.** Flowers (oblique view). **D.** Flower (front view). **E.** Flowers (lateral view). **F.** Flowers (ventral view). Photographed by Saksan Kaitongsuk (A. In situ: Khao Yai National Park), Radamanee Khruaklang (**B.** In situ: Khao Yai National Park) and Nopparut Toolmal (**D–F.** Cultivation, QSBG). **D–F.** from living collection of *Toolmal & Tanming 29122003*, TTM 0006401.

Habitat and ecology. Epiphyte in dry evergreen forest between 100–450 m elevation. Locally common.

Vernacular. Ueang maeng mum lueang kleep muan (*เอื้องแมงมุมเหลืองกลีบม้วน*) (proposed here).

Specimens examined. Peninsular: Ranong Province, Muang Lan, 11 January 1966, *Seidenfaden & Smitinand GT 6188* (C 8324, 8311, Seidenfaden 1988: 153 as *T. centipeda*), Surat Thani Province, Bandon, Khun Thale Lake, 13 January 1935, *Seidenfaden 2373* (K 12640, Seidenfaden 1988: 153 as *T. centipeda*), Phangnga Province, Krasom, 12 September 1983, *Seidenfaden & Smitinand GT 9333* (C 8334, 8286, 8335, Seidenfaden 1988: 153 as *T. centipeda*), T. Mapraw, 20 February 1929, *Seidenfaden & Smitinand GT 1813* (C 8317, Seidenfaden 1988: 153 as *T. centipeda*), Krabi Province, Khap Thong Tai, 07 August 1982, *Seidenfaden & Smitinand GT 6254* (C 8348, Seidenfaden 1988: 153 as *T. centipeda*), Trang Province, Khao Pap Pa, 09 August 1974, *Kai Larsen & Supee S. Larsen 33153* (AAU 8/75-57), Seidenfaden 1988: 153 as *T. centipeda*), Songkhla Province, Ton Sa Taw Waterfall, 26 August 1995, *Larsen et al., 46041* (AAU s.n.), Hat Yai District, Thung Tam Sao Subdistrict, Ton Nga Chang Wildlife Sanctuary, 21 August 1992, *Niyomdham 3045* (BKF s.n.), 21 December 1985, *Maxwell 85-1149* (PSU 0006398), 08 October 2013, *Rojchana–umpawan 61* (BKF s.n.), 17 October 2020, *Toolmal et al., 17102001* (TTM 0006364).

Notes. *Thrixspermum latisaccatum* is recognised by the combination of recurved, pale yellow sepals and petals, the scabrid, shallowly and broadly saccate lip with dense reddish spots, and the cylindrical mid-lobe which is slightly concave in the basal part only. Previously, this species was often misidentified as *T. centipeda*, as were other, similar species in Thailand (Toolmal *et al*., 2023).

Fig. 7. *Thrixspermum latisaccatum*: A. Habit. **B.** Inflorescences with flowers. **C.** Flowers (oblique view). **D.** Flower (lateral view). **E.** Flower (adaxial view, close-up). Photographed by Nopparut Toolmal (A. In situ: Ton Nga Chang Wildlife Sanctuary) and the late Wattana Tanming (B–E. Cultivation, QSBG). B–E. from living collection of *Toolmal et al. 17102001*, TTM 0006364.

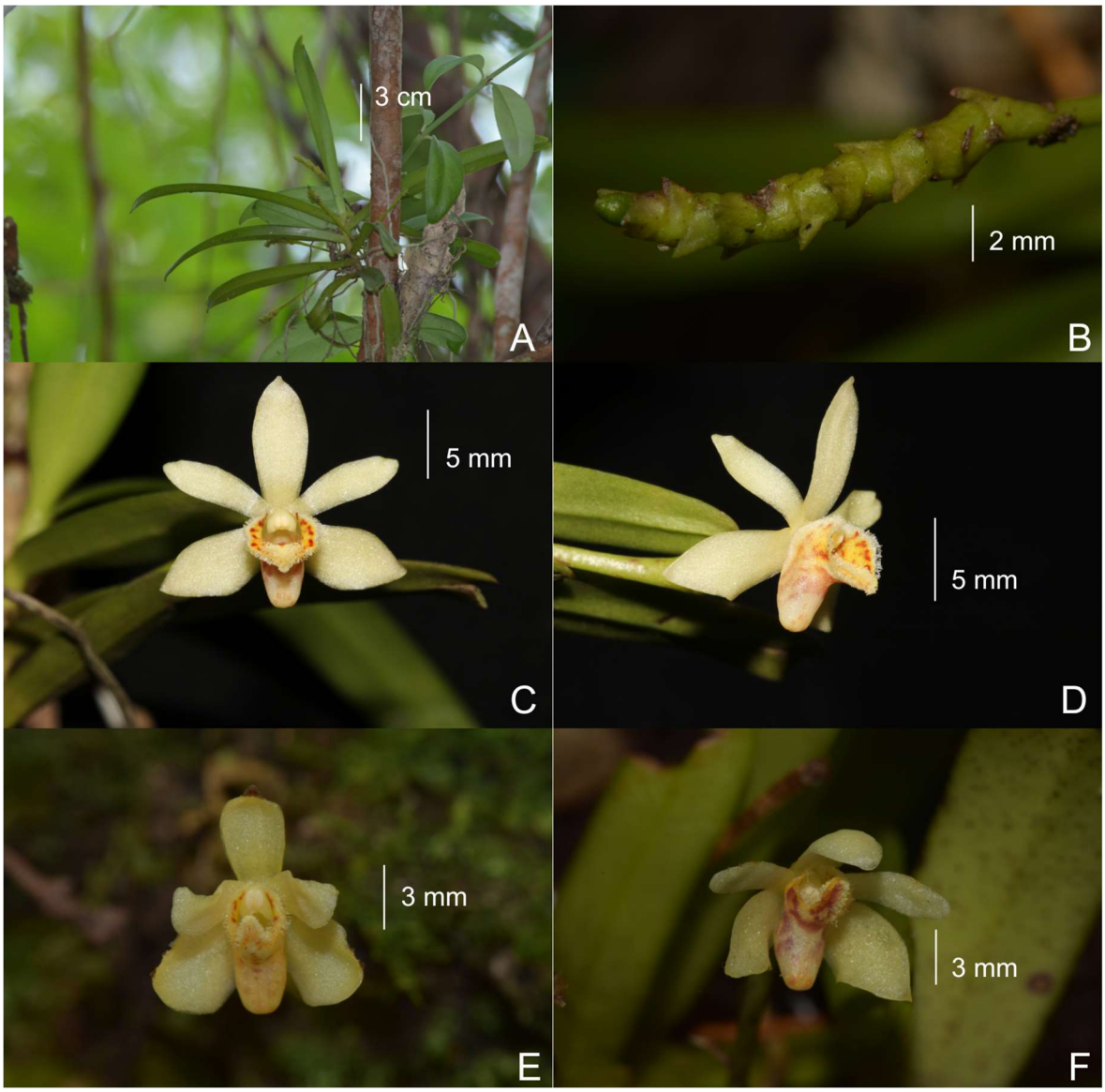

Fig. 8. ***Thrixspermum merapohense*: A.** Habit. **B.** Rachis with floral bracts. **C.** Flower (front view). **D.** Flower (lateral view). **E.** Flower (ventral view). **F.** Flower (oblique view). Photographed by Nopparut Toolmal (**A–B.** In situ: Thung Khai Botanical Garden) and the late Wattana Tanming (**C–F.** Cultivation, QSBG). **A–B. & E–B.** from living collection of *Toolmal et al. 10112001*, TTM 0006377. **E–E.** from living collection of *Toolmal et al. 14082003*, TTM 0006353.

7. *Thrixspermum merapohense* P.O'Byrne & P.T.Ong, Malesian Orchid J. 15: 84. 2015. ***Type***: Malaysia, Peninsular, Pahang, Lipis, Merapoh, Gua Gunting, Phg 116 Tukang Gunting, *Ong FRI75473* (KEP270788! holotype; KEPSC6600! isotype).

Section ***Dendrocolla*, Fig. 8**

Stem patent, 7–13 cm long. *Leaves* elliptic or oblong to linear, 4–10 × 0.6–1.4 cm. *Flowers* 1.5–1.8 cm across; sepals and petals pale yellow, lip with reddish brown blotches. *Dorsal sepal* elliptic to oblanceolate, 8.5–11 × 3.5–4.5 mm, obtuse. *Lateral sepals* broadly ovate, 8.5–11 × 4.5–5.0 mm, obtuse. *Petals* narrowly oblanceolate, 8–10 × 3 mm, obtuse. *Lip* 3-lobed, 7–9 × 3 mm; spur broadly conical, 2.5–3 × 2.5–3 mm, obtuse, with orangish rounded warts, and capitate hairs; lateral lobes broadly obovate, 4 × 3 mm, rounded; mid-lobe oblong to linear, 2.5–3 × 3 mm, flatten, obtuse, with capitate hairs on both surfaces.

Distribution. Thailand and Malaysia (Peninsular and Borneo).

Thailand. Chumphon (Tha Sae), Surat Thani (Bang Bao Forest), Nakhon Si Thammarat (Khao Luang), Trang (Thung Khai), Satun (Ban Valai) (Fig. 9).

Flowering. All year round.

Habitat and ecology. Epiphyte in peat swamp forest, at 30 m elevation. Locally common.

Vernacular. Ueang ta khap lin yao (*เอื้องตะขาบลิ้นยาว*) (proposed here).

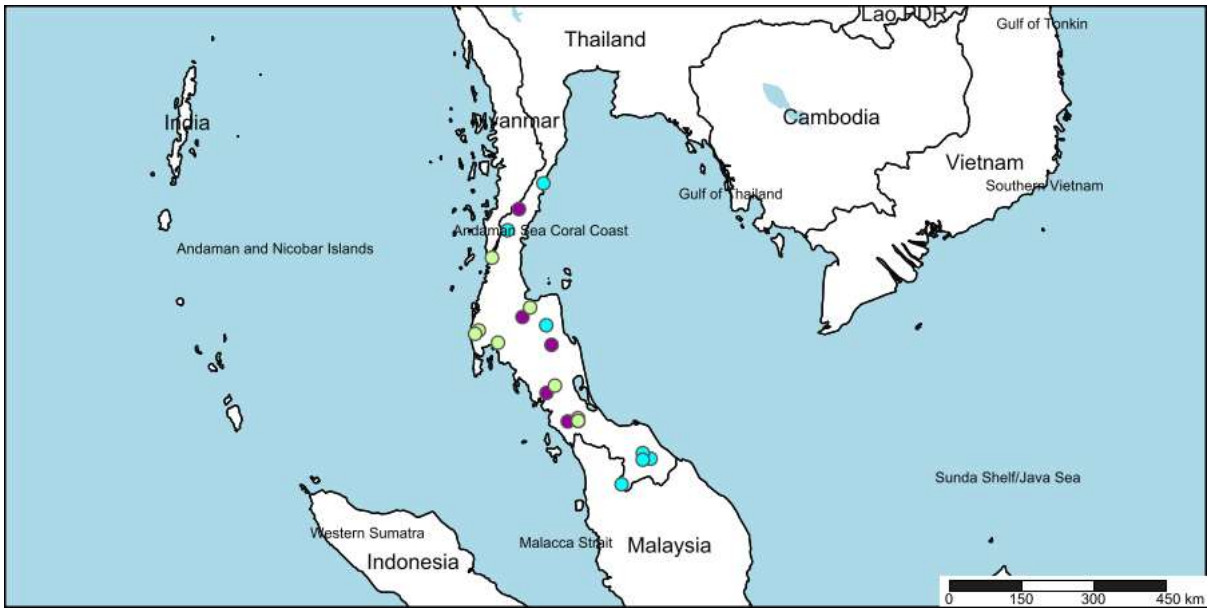

Fig. 9. Distribution map of ***Thrixspermum latisaccatum*** (light green), ***T. merapohense*** (purple) and ***T. pulchellum*** (light blue) in Thailand.

Specimens examined. THAILAND. Peninsular: Chumphon Province, Tha Sae District, 09 April 1968, *Chermsirivathana & Kasem 1254* (BK 256123), Surat Thani Province, Bang Bao forest, 09 April 1968, *Smitinand s.n.* (BKF 8485), Nakhon Si Thammarat Province, Khao Luang National Park, 23 August 1995, *Larsen et al., 45891* (AAU s.n.), Trang Province, 25 October 1993, *Larsen et al., 44013* (AAU 6/73-93), Yan Ta Khao District, Thung Khai Subdistrict, Thung Khai Botanical Garden, 15 June 2015, *Po-iam 5* (BKF s.n.), 30 November 2020, *Toolmal et al., 30112001* (TTM 0006405), 10 November 2020, *Toolmal et al., 10112001* (TTM 0006377), Satun Province, Ban Udai, 02 January 1928, *Kerr 0475* (BK 256115, C s.n., Seidenfaden 1988: 162 as *T. trichoglottis*); Unknown locality: (plant brought from botanical shop in Trat Province), 14 August 2020, *Toolmal et al., 14082003* (TTM 0006353).

Notes. *Thrixspermum merapohense* is recognised by the combination of pale yellow sepals and petals, the lip marked with reddish brown, the broadly obovate lateral-lobes, and the oblong to linear mid-lobe with capitate hairs. It was originally described from Peninsular Malaysia. Specimens have been collected from many sites in southern Thailand, but were often misidentified as *T. trichoglottis* because they share pale yellow sepals and petals, and a lip with capitate hairs.

8. *Thrixspermum pardale* (Ridl.) Schltr., Orchis 5: 56. 1911. —*Sarcochilus pardalis* Ridl., Trans. Linn. Soc. London, Bot. 3: 371. 1893. —*Dendrocolla pardalis* (Ridl.) Ridl., J. Linn. Soc., Bot. 32: 382. 1896. ***Type***: Malaysia, Peninsular, Pahang, *Ridley 2365* (K000891305! lectotype, here selected). Section ***Dendrocolla*, Fig. 10**

Stem patent, 5–10 cm long. *Leaves* narrowly oblong to linear, 4–7 × 0.5–0.9 cm. *Flowers* 1.5 cm across; sepals and petals pale yellow with dark purplish red spots. *Dorsal sepal* obovate, 7–8 × 3.5–4.0 mm, obtuse. *Lateral sepals* broadly ovate, 8 × 4.5–5.0 mm, obtuse. *Petals* oblanceolate, 7 × 3.2–3.5 mm, obtuse. *Lip* 3-lobed, 7 × 3.5–4.0 mm; spur narrowly conical, 3.0–3.5 × 2.0–2.5 mm, 2-lobed, with orangish rounded warts and simple hairs; lateral lobes broadly triangular, 5.0–5.5 × 3.0–3.5 mm, obtuse, with simple hairs along apical margins; mid-lobe rounded, 0.2 × 3 mm, with simple hairs.

Distribution. Thailand, Malaysia (Peninsular and Borneo), and Indonesia (Sumatra).

Thailand. Narathiwat (Ban Sana Tong) (Fig. 3).

Flowering. June and October.

Habitat and ecology. Epiphyte in secondary peat swamp forest and evergreen forest, between 10–600 m elevation. Locally common.

Vernacular. Ueang sue dao noi (***เอื้องเสือดาวน้อย***) (proposed here).

Specimens examined. THAILAND. Peninsular: Narathiwat Province, Muang Narathiwat District, Manang Tayo Subdistrict, Ban Sana Tong, 27 October 2018, *Hyeepasu 1* (BKF s.n.), 22 May 2021, *Toolmal et al., 22052101* (TTM 0006413), ibid., 27 March 2021, *27032103* (TTM 0006411).

Notes. *Thrixspermum pardale* is recognised by the combination of pale yellow sepals and petals with numerous large dark purplish red spots, and the lip mid-lobe and lateral lobes with conspicuous long white hairs. It was originally described from Peninsular Malaysia. It was first photographed by Sarawutwinai Ratthawit in 2018 from Narathiwat Province, Peninsular Thailand and later collected by Sahae Hyeepasu in the same year.

9. *Thrixspermum patkaiense* K.Gogoi, Lankesteriana 22: 10. 2022. ***Type***: India, Assam, Tinsukia District, Dehing Patkai National Park, *Gogoi 00956* (TOSEHIM holotype - digital image!). Section ***Dendrocolla*, Fig. 11**

Stem patent, 1–3 cm long. *Leaves* narrowly oblong to linear, 10–60 × 6–8 mm. *Flowers* 1.0–1.2 cm across; sepals and petals golden-yellow, lip with purplish red stripes. *Dorsal sepal* obovate, 5.5–6.0 × 3.5 mm, obtuse. *Lateral*

Fig. 10. ***Thrixspermum pardale*****: A.** Habit. **B.** Flower (ventral view). **C.** Flower (front view). **D.** Flower (lateral view). Photographed by Nopparut Toolmal (**A.** In situ: Narathiwat Province) and the late Wattana Tanming (**B–D.** Cultivation, QSBG). All from living collection of *Toolmal et al. 22052101*, TTM 0006413.

sepals broadly ovate, 5.2–6.0 × 4–5 mm, acute. *Petals* oblanceolate, 4.4–4.5 × 1.8–2.0 mm, obtuse. *Lip* 3-lobed, 6.0–7.5 × 3.0–4.4 mm; spur broadly conical, 2.5 × 3.0–4.2 mm, 2-lobed, with orange rounded warts and capitate hairs; lateral lobes broadly ovate, 4.0–5.3 × 2.5–3.5 mm, with capitate hairs, rounded; mid-lobe broadly triangular to rounded, 0.5–0.8 × 3 mm, with capitate hairs, rounded.

Distribution. India, Myanmar (Toolmal *et al.,* 2023), Laos (Toolmal *et al.,* 2023), and Thailand.

Thailand. Chaiyaphum (Phu Khieo) (Fig. 3).

Flowering. April, May, and December.

Habitat and ecology. Epiphytic in mixed deciduous forest and dry evergreen forest, at c. 880 m elevation. Uncommon in the wild.

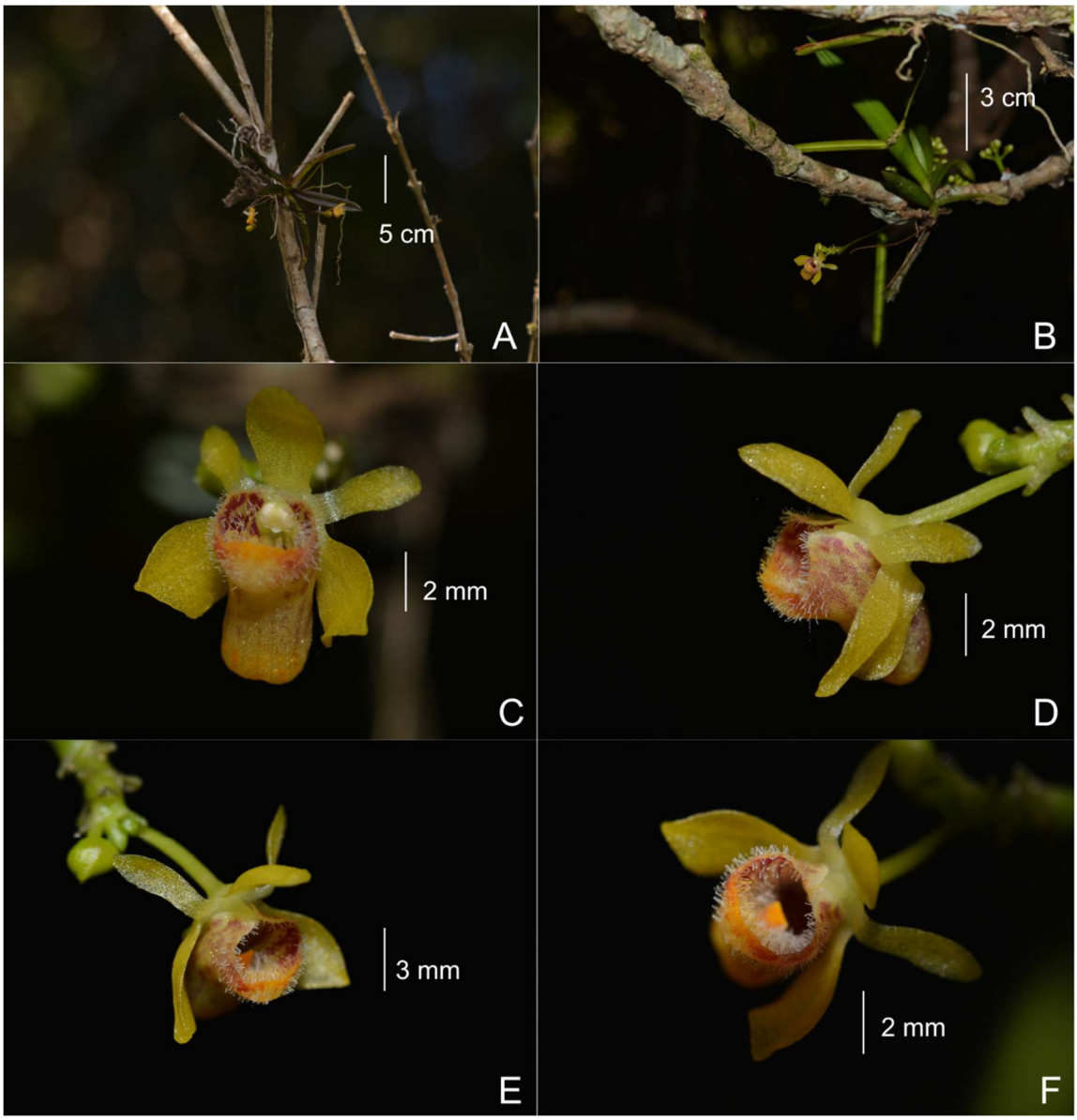

Fig. 11. *Thrixspermum patkaiense*: A. Habit (top view). **B.** Habit (lateral view). **C.** Flower (ventral view). **D.** Flower (lateral view). **E.** Flower (oblique view). **F.** Flower (front view). All photographed by Nopparut Toolmal (In situ: Phu Khieo Wildlife Sanctuary). All from living collection of *Toolmal et al. 07122001*, TTM 0006384.

Vernacular. Ueang ta khap lai sue (***เอื้องตะขาบลายเสือ***) (proposed here).

Specimen examined. THAILAND. Eastern: Chaiyaphum Province, Phu Khieo Wildlife Sanctuary, Thung Kamang, 7 December 2020, *Toolmal et al., 07122001* (TTM 0006384).

Notes.*Thrixspermum patkaiense* may be recognised by the combination of small plant size, yellow sepals and petals, the lip with long capitate hairs and orange warts inside the spur, and the short mid-lobe (less than 1 mm long). It was originally described from India. It was first photographed in Thailand by Chaiwat Tunkpradit in 2020 and a little later by Boonhum Buaphong in 2020 in Phu Khieo Wildlife Sanctuary, Chaiyaphum Province, Eastern Thailand.

10. *Thrixspermum pulchellum* (Thwaites) Schltr., Orchis 5: 57. 1911. —*Cylindrochilus pulchellus* Thwaites, Enum. Pl. Zeyl.: 307. 1861. —*Dendrocolla pulchella* (Thwaites) Thwaites, Enum. Pl. Zeyl.: 430. 1864. —*Sarcochilus pulchellus* (Thwaites) Trimen, Syst. Cat. Fl. Pl. Ceylon: 89. 1885. ***Type***: Sri Lanka, *Thwaites C.P.2354* (K000891314! lectotype, here selected; BM000534620! isolectotype).

Section ***Dendrocolla*, Fig. 12**

Thrixspermum album (Ridl.) Schltr. Orchis 5: 56. 1911. —*Dendrocolla alba* Ridl. in J. Straits Branch Roy. Asiat. Soc. 44: 191. 1905. ***Type***: Malaysia, Pulau Pinang, Seberang Perai Selatan, 1907, *Ridley 14130* (BM000534632! - lectotype, here selected; K! isolectotype).

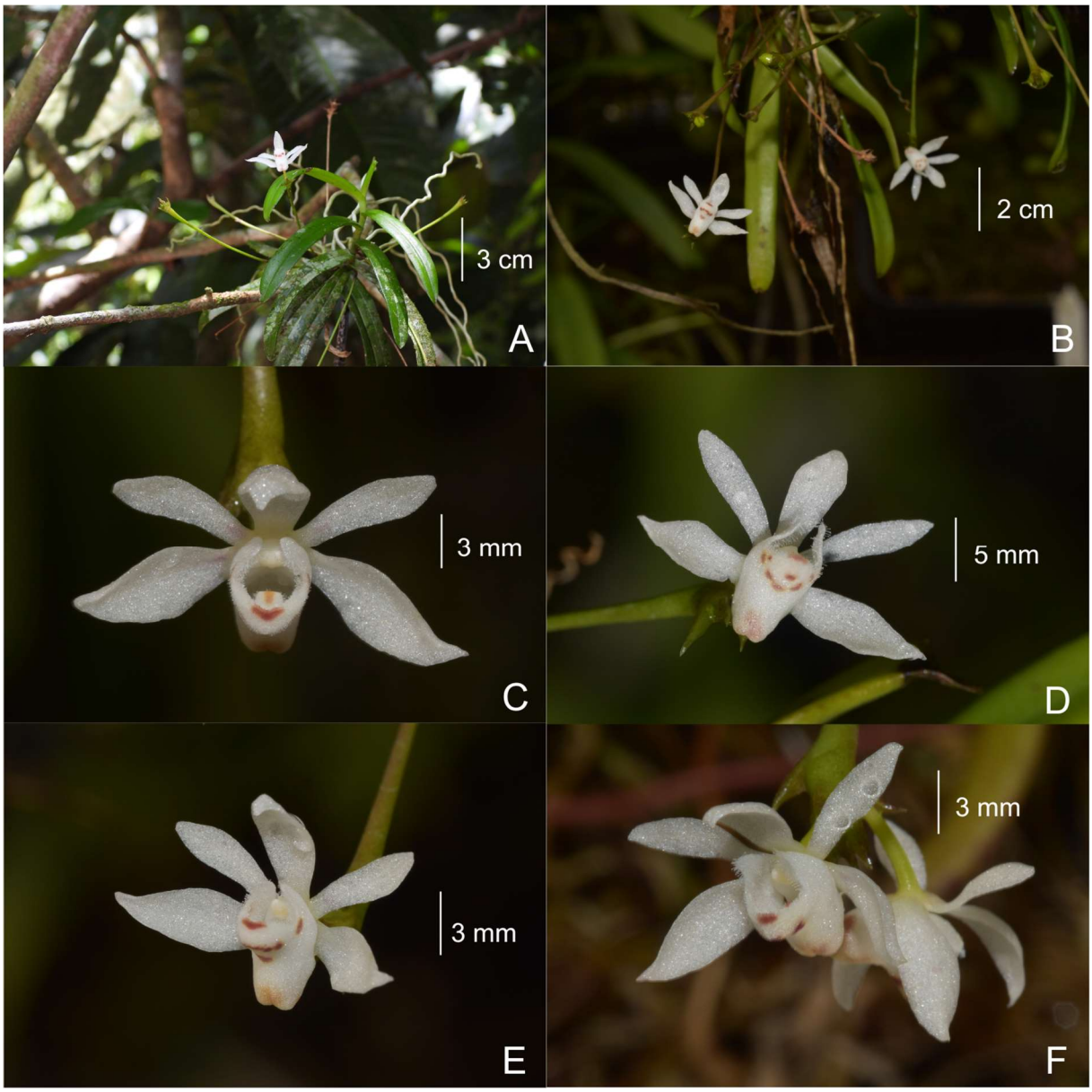

Fig. 12. ***Thrixspermum pulchellum*: A.** Habit. **B.** Inflorescences with flowers. **C.** Flower (front view). **D.** Flower (oblique view). **E–F.** Flower (oblique views). Photographed by Abdulromea Baka (A. In situ: Narathiwat Province) and the late Wattana Tanming (B–F. Cultivation, QSBG). B–F. from living collection of *Toolmal et al. 23032102*, TTM 0006407.

Stem patent, 5–25 cm long. *Leaves* narrowly oblong to oblanceolate, 1.5–7.0 × 0.4–1.0 cm. *Flowers* 1.7–2.0 cm across; sepals and petals white, lip with brownish orange spots. *Dorsal sepal* elliptic to oblanceolate, 9–11 × 3.0–3.5 mm, acute. *Lateral sepals* lanceolate, 9–11 × 3.5 mm, acute. *Petals* oblanceolate, 8–9 × 2.0–2.5 mm, acute. *Lip* 3-lobed, 6–7 × 2.5–3.0 mm; spur narrowly conical, 1.5–2.5 × 2.5 mm, 2-lobed, with orangish rounded warts and capitate hairs; lateral lobes narrowly triangular, falcate, 5–6 × 2.0 mm, obtuse, with capitate hairs; mid-lobe broadly triangular, 1.0–1.5 × 3.5–4.0 mm, with capitate hairs, rounded.

Distribution. Sri Lanka, Thailand, Malaysia (Peninsular), and Indonesia (Java).

Thailand. Chumphon, Nakhon Si Thammarat (Khao Nan), Songkhla (Khuan Khao Wang, Ton Nga Chang), Pattani (Old Sulatan's Gardens), Yala (Betong), Narathiwat (Sukhirin, Muang Narathiwat) (Fig. 9).

Flowering. March, April, May, July, and September.

Habitat and ecology. Epiphytic in tropical evergreen forest, peat swamp forest, secondary forest, plantations, orchards, and on roadside trees, at 10–320 m elevation. Locally common.

Vernacular. Ueang khao Aunchalee (***เอื้องขาวอัญชลี***) (proposed here).

Specimens examined. THAILAND. Peninsular: Chumphon

Province, on the way Chumphon Province to Ranong Province, 16 September 1965, *Phengkhlai 1098* (BKF 42377), Nakhon Si Thammarat Province, 4 May 1928, Wat Kiriwong, *Kerr 0604* (BK 256117, C s.n., K s.n., Seidenfaden 1988: 162 as *T. trichoglottis*), Nopphitum District, Khao Nan National Park, Hong Cave area, 25 September 2010, *Middleton et al., 5539* (BKF 182628), Songkhla Province, Hat Yai District, Kuan Khao Wang Forest Park, 19 July 2018, *Hemrat s.n.* (BKF s.n.), Thung Tam Sao, Ton Nga Chang Wildlife Sanctuary, 22 May 2014, *Rojchana-umpawan 162* (BKF s.n.), Pattani Province, Old Sulatan's Gardens, *Seidenfaden & Smitinand GT 7630* (C 8432, Seidenfaden 1988: 166 as *T. muscaeflorum*), *Seidenfaden & Smitinand GT 7631* (C 9534), Yala Province, Betong District, the route from Betong town to Betong border checkpoint, 23 March 2021, *Toolmal et al., 23032102* (TTM 0006407), Narathiwat Province, Sukhirin District, Longkong plantation, 26 October 2020, *Toolmal et al., 26102002* (TTM 0006370), Muang Narathiwat District, Manang Tayo Subdistrict, Ban Sana Tong Village, 27 March 2021, *Toolmal et al., 27032101* (TTM 0006409), Su-Ngai Kolok District, Pa Semat Subdistrict, Ban Tue Ra, 23 October 2020, *Toolmal & Tanming* 23102002 (TTM 0006367); Unknown locality, 27 January 1927, *Kerr 0357* (BK 256118, Seidenfaden 1988: 162 as *T. trichoglottis*).

Notes. *Thrixspermum pulchellum* is characterised by the narrowly oblong to oblanceolate leaves, white sepals and petals, lip with brownish orange spots, narrowly triangular, falcate lateral-lobes with capitate hairs, and the broadly triangular mid-lobe with capitate hairs and rounded apex. It was originally described from Sri Lanka by Thwaites (1861: 307, as *Cylindrochilus pulchellus*). It has been collected from many areas in southern Thailand. These specimens have previously been misidentified as *T. trichoglottis* and *T. musciflorum* sensu Seidenf. (= *T. alboluteum* Toolmal, Schuit. & Culham) because they occur in similar habitats and share the white to pale yellow sepals and petals.

11. *Thrixspermum tortum* J.J.Sm., Bull. Jard. Bot. Buitenzorg, sér. 2, 13: 40. 1914. ***Type***: Indonesia, Sumatra, Jambi, *Grootings, cult. Hort. Bog s.n.* (possibly at BO, not seen). Section ***Thrixspermum*, Fig. 13**

Stem subscandent, to c. 40 cm long. *Leaves* lanceolate to slightly oblong, 4–8 × 1.6–1.8 cm. *Flowers* 8–10 cm across (not spread); sepals and petals yellow, lip with reddish brown blotches. *Dorsal sepal* linear, 85 × 2.5–4.0 mm, acuminate. *Lateral sepals* similar, 85 × 2.5–5.0 mm, acuminate. *Petals* similar, 80 × 1.5–3.0 mm, acuminate. *Lip* 3-lobed, 13 × 3 mm; spur broadly conical, 4 × 4 mm, obtuse, with simple hairs; lateral lobes narrowly triangular to obovate, falcate, 7 × 3 mm, acute; mid-lobe narrowly cylindrical, 7 × 3 mm, obtuse.

Distribution. Thailand, Malaysia (Borneo), and Indonesia (Sumatra and Java).

Thailand. Narathiwat (Khao Ta We) (Fig. 3).

Flowering. March, April, and May.

Habitat and ecology. Epiphyte in humid evergreen forest and surrounding plantations, at c. 50 m elevation. Uncommon in the wild.

Vernacular. Ueang maeng mum lueai Nara (เอื้องแมงมุมเลื้อยนรา) (proposed here).

Specimen examined. THAILAND. Peninsular: Narathiwat Province, Ra-ngae District, Bo Ngo village (Khao Ta We), 02 April 2022, *Toolmal & Baka 02042201* (TTM 0006429).

Notes. *Thrixspermum tortum* can be recognised by the subscandent stem in combination with long tapering, linear, yellow sepals and petals, and a narrowly cylindrical lip mid-lobe, with the mid-lobe slightly concave only in the basal part. It was originally described from Sumatra. It was first collected in Thailand from Narathiwat Province by Abdulromea Baka in 2023.

DISCUSSION

Thirty-one *Thrixspermum* species are now known from Thailand, 11 of which are newly recorded here. Together with recently described new species (Toolmal *et al.,* 2022, 2023) there has been an increase of 121% in the number of *Thrixspermum* species recorded from Thailand since 2020.

Our studies (Seidenfaden 1988, Toolmal *et al.,* 2022, 2023) suggest that taxonomic accounts for tropical Asian orchids may underestimate the true number of species due to overly broad species concepts, misidentifications, poor herbarium material, ambiguous literature, and lack of access to fresh material. At the same time, we should note that *Thrixspermum* may be an extreme case because of the ephemeral flowers that are difficult to interpret and distinguish using dried material. As a result, species of this genus tend to be both under-collected and hard to identify. There are not many other orchid genera for which availability of fresh material is as essential as it is in *Thrixspermum*.

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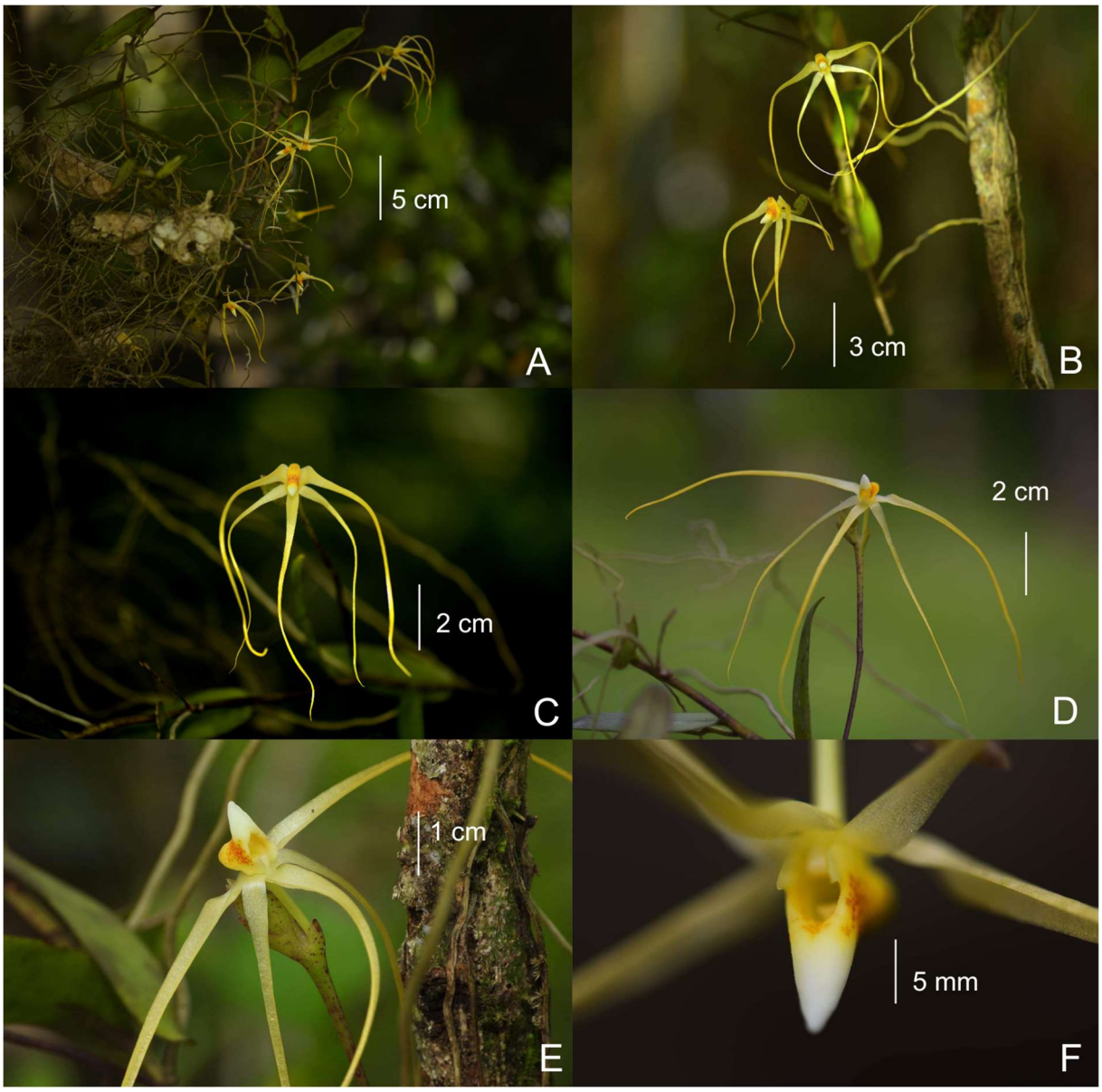

Fig. 13. ***Thrixspermum tortum*****: A.** Habit. **B.** Inflorescences with flowers. **C.** Flower (ventral view). **D.** Flower (oblique view). **E.** Flower (oblique view, closed-up). **F.** Lip (adaxial view, closed-up). All photographed by Abdulromea Baka (In situ: Narathiwat Province). All from living collection of *Toolmal et al. 02042201*, TTM 0006429.

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