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A new species and taxonomic notes on the genus *Combretum* (Combretaceae) in Thailand

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ABSTRACT

A new species of *Combretum*, *C. pendulum*, is described and illustrated. Taxonomic notes on typifications for *C. apetalum* and *C. winitii*, and synonymisations for *C. alatum* and *C. quadratum* are presented. A key to Thai *Combretum* species is also provided.

KEYWORDS: conservation, new combinations, *Quisqualis*, synonymisation, typification.

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INTRODUCTION

Combretum Loefl., the largest genus of the family Combretaceae, belongs to subfamily Combretoideae, tribe Combreteae DC., subtribe Combretinae Exell & Stace, and comprises about 255 species with a centre of diversity in Africa, but also extending to tropical Asia and northern Australia (Stace, 2007, 2010; POWO, 2021). The genus was divided into three subgenera by Exell & Stace (1966), namely *Combretum*, *Cacoucia* (Aubl.) Exell & Stace and *Apetalanthum* Exell & Stace, based on the presence or absence of peltate scales, combretaceous and glandular hairs, and petal characteristics. In addition, the genus has long been suggested to include *Quisqualis* L. and this concept was accepted by several authors including Jongkind (1991, 1995), Stace (2007, 2010), Maurin *et al.* (2010, 2020) and Turner (2020). Consequently, three Thai *Quisqualis* species were transferred to *Combretum*, i.e., *C. caudatum* (Craib) O.Maurin & Boatwr., *C. densiflorum* (Wall. ex Planch. & Miq.) I.M.Turner and *C. prostratum* (Craib) O.Maurin & Boatwr. In addition, the widespread species *C. indicum* (L.) DeFilipps, previously known as *Quisqualis indica* L., was also accepted.

In Thailand, 23 taxa of *Combretum* and five taxa of *Quisqualis* were reported by Craib (1931). Subsequently, Nanakorn (1986) included 19 species and two subspecies in his account of the genus *Combretum* in Thailand. While working on the account of Combretaceae for the Flora of Thailand by the first author, relevant taxonomic literature and voucher specimens were studied. Specimens from the herbaria AAU, BK, BKF and QBG were examined under a microscope, and specimen images from ABD, CAL, E, K, K-W, L, NY, P, SING and TCD were studied. All cited type specimens, or the relevant high-resolution images, were also seen. Non-glandular trichomes were investigated under a light microscope (LM), description of scales and stalked glands were based on Stace (1973, 1980). In this contribution, we present a new species based on new collections, lectotypification of two names as required following the International Code of Nomenclature (ICN, Turland *et al.*, 2018), two names are synonymized and taxonomic notes on *C. apetalum* Wall. ex Kurz based on new collections are provided. In total, 25 taxa (23 species) have now been recorded for Thailand.

NEW SPECIES

Combretum pendulum Patthar. & Poopath, **sp. nov.**

Similar to *Combretum punctatum* Blume in having yellow to ferruginous scales densely arranged on lower leaf surface but differs in its unbranched and longer inflorescences (28–40 cm long) (vs capitate or elongate spikes, 2–10 cm long), shallowly lobed

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calyx (vs triangular), red petals (vs white or pale yellow). Type: Thailand, Trat Province, Muang District, Ban Tha Sen, 200 m alt, 22 Mar. 2018, *M. Poopath, S. Yooprasert, S. Jirakorn & S. Kaitongsuk 2123* (holotype **BKF** [226668!]; isotypes **K!**, **SING!**). Figs. 1–2.

Woody climber to 20 m; stem to 5 cm in diam.; branchlets sparsely covered with ferruginous scales without hairs. *Scales* transparent white, yellow to ferruginous, complex, circular or slightly undulate at the margin, with equally large number of tangential and radial walls, 180–300 μm in diam., scattered to overlapping on young branches, leaves and inflorescences. *Leaves* opposite or subopposite, elliptic, 9–14 × 4.5–7.5 cm; apex cuspidate or acuminate to ca 1 cm long; base rounded or broadly acute, sometimes slightly unequal; margins entire; coriaceous, upper surface sparsely covered with whitish scales, lower surface densely covered with ferruginous scales; midvein prominent, yellowish on upper surface, brownish, distinct on lower surface; secondary veins 5(–6) on each side; young leaves reddish brown, scales contiguous, ferruginous; petioles 5–12 mm long, scales sparse to contiguous. *Inflorescences* axillary, lax, simple spikes, 28–40 cm long; axis densely scaly; bracts linear, 2–3 × 0.5 mm. *Flowers* 4-merous; flower buds spherical, rounded at apex. *Upper receptacle* campanulate, 5–6 mm long, broaden from the base, distally wide at the middle, slightly curved inward, outside sparsely covered with scales. *Lower receptacle* pedicel-like, 2–3 mm long, densely ferruginous scales, overlapping. *Petals* 4, red, elliptic, apex ± acuminate, glabrous, emerging from calyx segments, 1–1.2 mm long. *Stamens* 8, arranged in one row; filaments reddish, 4.8–5.5 mm long; anthers versatile, pale yellow, tinged reddish at base, ca 1 mm long. *Ring disk* thick, 1–1.2 mm long, densely pubescent. *Ovary* inferior, 1-locular; ovules 3, ellipsoid, ca 0.4 mm; style glabrous, slightly emerging from calyx lobes, 7–8 mm long; stigma obscure. *Fruit* 4-winged, suborbicular in outline, (3.5–)4–4.5 cm in diam., rounded to retuse at apex, tapering or broadly cuneate at base; stipe thick, 1–1.5 mm long, scales sparse or contiguous; wings 1.7–2 cm broad, chartaceous, reddish and yellowish green at base when young, reddish to brownish when dry, sparsely scaly.

Thailand.— SOUTH-EASTERN: Trat [Trat to Khlong Yai, 13 Mar. 2009, *Maknoi 3093* (**QBG** [53812]); along Khlong Yai-Hat Lek Road, 13 Mar. 2014, *Maknoi 6752* (**BKF**, **QBG** [76206]; Muang, Ban Tha Sen, 200 m alt, 22 Mar. 2018, *Poopath et al. 2123* (**BKF** [226668], **K**, **SING**)].

Distribution.— Endemic.

Ecology.— Near streams in open areas, evergreen forest, sandstone bedrock; to ca 200 m alt.

Vernacular.— Sakae sai (สะแกสาย) (suggested here).

Etymology.— The specific epithet refers to the long pendulous inflorescences.

Provisional conservation assessment.— This species known from three collections in the same province. It has relatively small extent of occurrence (EOO of 33.176 km^2) and its area of occupancy is also rather small (AOO of 12 km^2). It occurs in an area at risk of human activities and disturbance because of expanding roadsides and fruit orchards, therefore we propose to treat this species as CR B1ab(iii) (IUCN, 2019).

TAXONOMIC NOTES

Combretum apetalum Wall. ex Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 46(2): 55, in clavi, 56. 1877; Kurz, Forest Fl. Burma 1: 460. 1877. Type: Myanmar, Prome, *Wallich Cat. No. 3990* pro parte (**K-W** [K001117846, image!], lectotype designated here; isolectotype **CAL** [CAL0000068488, images!].

Notes.— 1. According to Wallich's numerical list (Wallich, 1828–1849), *Wall. Cat. No. 3990* were collected in 1826 within four localities: Prome [Pyay], Yenangheum [Yehangyaung], Segaen [Sagaing] and Ava [Inwa]. The same catalogue number and collected localities were also shown in the protologue of *Combretum apetalum* (Kurz, 1877). There are nine sheets of 11 specimens deposited under *Wall. Cat. No. 3990* and *3990* parte at **CAL** [CAL0000068488, CAL0000068489], **G** [G00390404, G00390405], **K** [K000786619, K000786620], **K-W** [K001117843, K001117844, K001117845, K001117846] and **M** [M0146613]. These specimens can be separated based upon the locality indicated on the original collecting tickets as follows: CAL0000068488 and K001117846 from Prome; CAL0000068489 and K001117845 from Sagaen; K001117843 from Ava; and K001117844 from Yenangheum. For the other five specimens, their localities are unclear due a lack of original collecting tickets. Therefore, the first six specimens

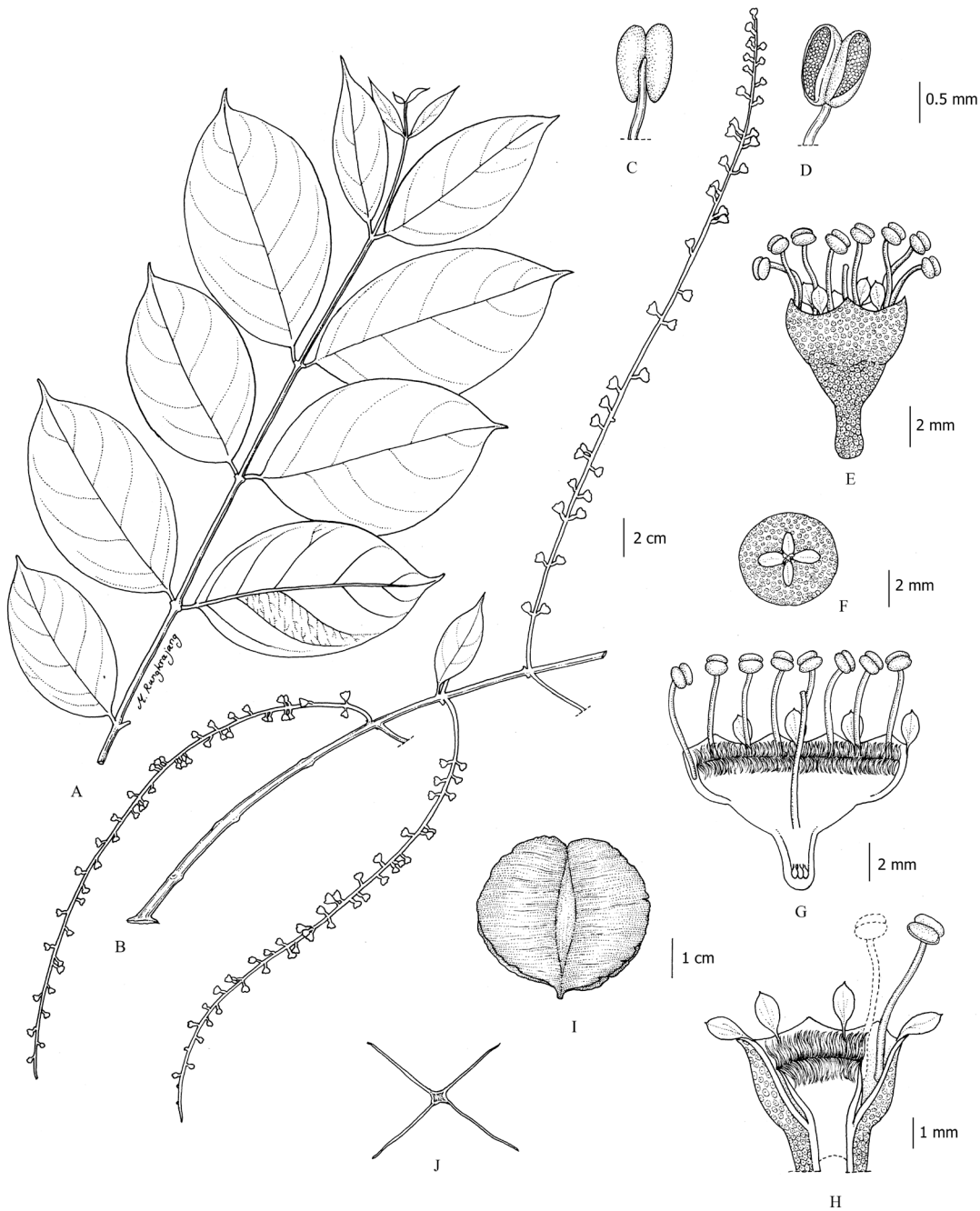

Figure 1. *Combretum pendulum* Patthar. & Poopath: A. Leafy branch; B. inflorescence branches; C–D. anther; E. flower, side view; F. flower bud, top view; G. dissected flower; H. disk, as continuous ring; I–J. fruit, side view and cross section. All from *Poopath et al. 2123* (**BKF**). Drawn by Mahsarahka Rungkrajang.

Figure 2. *Combretum pendulum* Patthar. & Poopath: A. inflorescence branches; B. infructescence branch; C. flowers; D–E. scale on abaxial surface of lamina. All from *Poopath et al. 2123* (**BKF**). A–C. Photos by Sawita Yooprasert, D–E. by Kesanee Kuaphu and Anuwat Sarapan.

are considered for lectotype selection. Among these specimens, the specimen K001117846 is designated here as a lectotype for *C. apetalum* due to its complete characters providing both vegetative and mature reproductive parts; CAL0000068488 is then an isolectotype.

2. The type designation for *Combretum apetalum* has been proposed several times. Nanakorn (1986) indicated *Wallich 1396/1–1827* (not seen) deposited at **G** as a type for *C. apetalum*, however this catalogue number could not be found in Wallich's Numerical list (Wallich, 1828–1849). Even though, the adjacent number of *Wallich 1396* is listed, it has been identified as *Convolvulus asclepiadeus* Wall. (a synonym of *Convolvulus parviflorus* Roxb.). Subsequently, Gangopadhyay & Chakrabarty (1997) proposed *Kurz 1898*, **CAL** [CAL0000012381, image!] collected from Pegu, Myanmar as a lectotype of this species (isolectotypes **CAL** [CAL0000012382, image!], **L** [L.2500222, image!]), and indicated *Wallich 3990* (**K-W**, without barcode) as a syntype. However, Kurz's material should not be considered for lectotypification as it is not an original material (following Article 9.3 of Shenzhen Code, Turland *et al.*, 2018) because it was not mentioned in the protologue (Kurz, 1877). Therefore, *Kurz 1898* was excluded from type materials here.

3. Exell & Stace (1966) established subgen. *Apetalanthum* Exell & Stace with a single species, *Combretum apetalum*, based on the absence of petals and the presence of stalked glands and scales on leaves. The species was also treated in Stace (1973, 2007) and Nanakorn (1986). In our study, recent collections from South-Western Thailand, Phetchaburi Province (*Poopath et al. 2586*, **BKF**, **K**) clearly belong to *C. apetalum* but have flowers with small subulate petals (ca 0.3 mm long) that easily fall off (Figs. 3–4); therefore, we conclude that petals can be present in *C. apetalum*.

Combretum punctatum Blume, Bijdr.: 640. 1826. Type: Java, G. Parang, no date, *C.L. Blume s.n.* (lectotype **L** [L.0844301], designated by Turner 2020; isolectotype **NY** [NY00245961, image!]).

var. **punctatum**

— *Combretum quadratum* Craib, Bull. Misc. Inform. Kew 1929: 114. 1929, **syn. nov.** Type: Thailand, Nakhon Ratchasima [as Korat], Khao Laem [as Kao Lem], ca 1,300 m, 12 Jan. 1925, *A.F.G. Kerr 9950* (lectotype *NY* [NY00245953, image!], designated by Gangopadhyay & Chakrabarty (1997: 317); isolectotypes **ABD** (image!), **BK** [257796!], **BM** [BM000947098, image!], **K** [K000786595, image!], **P** [P01901317, image!], **TCD** [TCD0016730, image!]).

Notes.— Gangopadhyay & Chakrabarty (1997) recognized *Combretum quadratum* Craib as a synonym of *C. quadrangulare* Kurz based upon examining a single specimen from **NY** [NY00245953] due to its single branch and six separate fruits mounted on the herbarium sheet. However, duplicates of *Kerr 9950* are also found at **ABD**, **BK**, **BM**, **K**, **P** and **TCD**. We examined these specimens which better exhibited a complete range of characters than the sheet NY00245953. Characters observed included the leaves with sparsely to densely arranged scales on both surfaces; infuctescences comprised of lax compound spikes, usually grouped at the branchlet apices giving an appearance of leafy panicles, fruits very condensed along the fruit-bearing portion of the spikes, forming a subcapitate arrangement, 0.5–1 cm long. These characters all indicate that the specimens, and therefore *C. quadratum* clearly belongs as a synonym of *C. punctatum* var. *punctatum*.

var. **squamosum** (Roxb. ex G.Don) M.Gangop. & Chakrab., J. Econ. Taxon. Bot. 17: 68. 1993.— *Combretum squamosum* Roxb. ex G.Don, Trans. Linn. Soc. 15: 419. 1827. Type: 'India Orientalis', *Roxburgh s.n.*, 'in herb. Linn. Soc.' (not traced).

— *Combretum alatum* Craib, Bull. Misc. Inform. Kew 1930: 162. 1930, **syn. nov.** Type: Thailand, Chiang Mai, Mae Rim, 24 Oct. 1922, *A.F.G. Kerr 6440* (lectotype **NY** [00245952, image!], designated by Gangopadhyay & Chakrabarty (1997: 301), isolectotypes **ABD** (image!), **BK** [257795!], **BM** [BM000947048, image!], **K** [K000786594, image!]).

Notes.— Gangopadhyay & Chakrabarty (1997) cited only *Kerr 6440* from **NY** (microfiche) as the type for *Combretum alatum* in their study of Combretaceae of the Indian Subcontinent. In the present study, the specimens *Kerr 6440* at **ABD**, **BK**, **BM** and **K** have inflorescences with leafy bracts and are axillary to terminal, subcapitate to elongate up to ca 2 cm long, and clearly best assigned to *C. punctatum* var. *squamosum*.

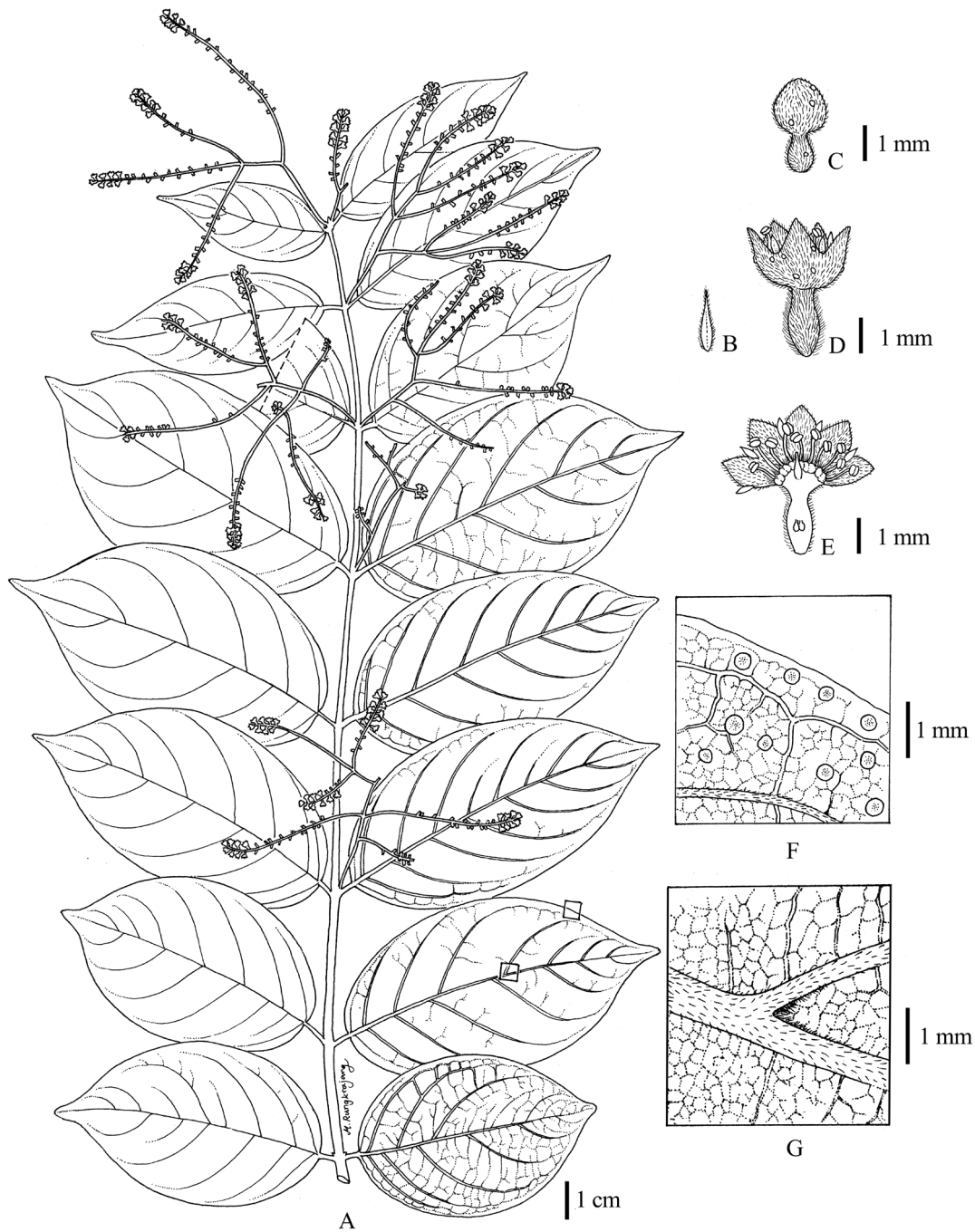

Figure 3. *Combretum apetalum* Wall. ex Kurz: A. flowering branch; B. bract; C. flower bud; D. flower; E. dissected flower; F. enlarged scales on abaxial leaf margin; G. enlarged hairs between midvein and secondary vein on abaxial leaf surface. All from *Poopath et al. 2586* (**BKF**). Drawn by Mahsarahka Rungkrajang.

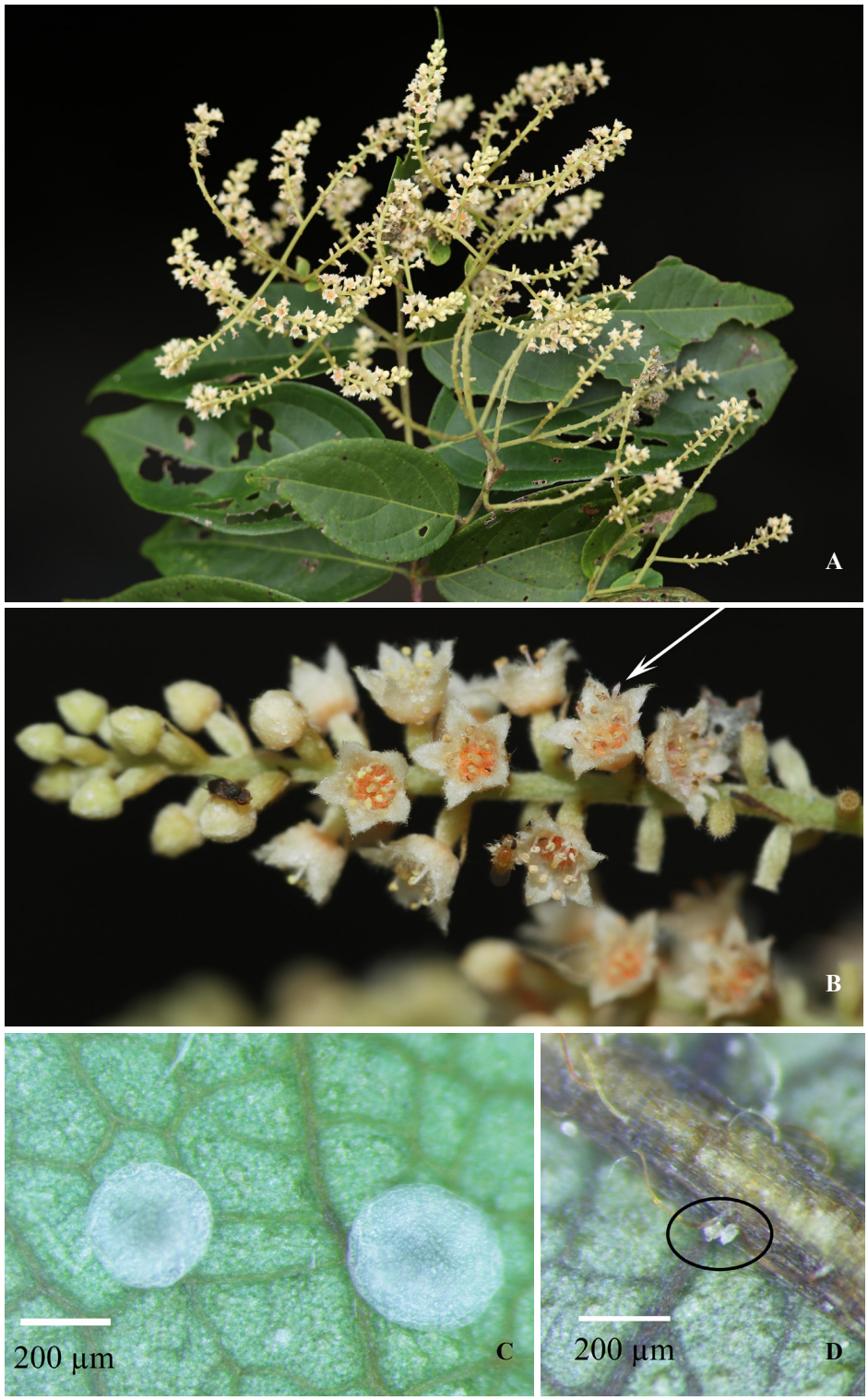

Figure 4. *Combretum apetalum* Wall. ex Kurz: A. flowering branches; B. part of inflorescence and petal (arrow); C. scales; D. stalked glands (circle). All from *Poopath et al. 2586* (**BKF**). Photos A–B. by Preecha Karaket, C–D. by Kanchana Pruesapan.

Combretum winitii Craib, Bull. Misc. Inform. Kew 1930: 164. 1930. Type: Lamphun (as Lampun), Raheng, Mae Kao (as Me Kaw), 270 m, near stream in deciduous forest, 23 July 1915, *Winit 376* (lectotype **K** [K000786587, image!]; isolectotypes **ABD** (image!), **BK** [257798!], **BKF** [089028!], first-step lectotype designated by Nanakorn (1986: 159; no herbarium cited) and second-step lectotype designated here).

Notes.— 1. According to Cambridge University Press (1934), Craib was working at Kew during his revision of Siamese plants. The specimen of *Winit 376* at **K** has selected here as a lectotype. This is because it has a detailed annotation and identification written by Craib attached on the sheet and, in addition, it has the largest fruits with conspicuously densely linear subulate hairs.

2. *Combretum winitii* Craib is distinguished by being densely pilose or tomentose on the lower leaf surfaces and the fruits with linear-subulate processes 1–2(–3) mm long, which is similar to *C. flagrocarpum* C.B.Clarke from Nepal, Sikkim, N India to Myanmar. Only three collections, *Winit 181* (**BM**, a syntype), *376* (**ABD**, **BK**, **BKF**, **K**) and *Sanchai 637* (**BK**) were observed in the present study, and we retain the species *C. winitii* in Thailand, but flowering material is needed to confirm the relationship to *C. flagrocarpum*.

KEY TO THE THAI *COMBRETUM* SPECIES

(Species numbers referring to the upcoming Flora of Thailand treatment)

1. Flowers 5-merous. Fruits 5-winged or 5-ridged
  2. Calyx tube 1.5–10 cm long. Corolla red, white, or pink. Stamens not or scarcely exserted from calyx tube. Style partly adnate to inside of calyx tube
    3. Calyx tube 5–10 cm long; upper receptacle 5–8 cm long. Petals 1–2.4 cm long **8. C. indicum**
    3. Calyx tube 1.5–2.5 cm long; upper receptacle 1–2 cm long. Petals 0.3–0.5 cm long
      4. Calyx lobes apex cuspidate; cusp filiform, 1–3 mm long **6. C. densiflorum**
      4. Calyx lobes with an apical cusp up to 1 mm long
        5. Bracts large, ca 1 cm long. Petals obovate. Stamens arranged in 2 series **3. C. caudatum**
        5. Bracts small, ca 0.2 cm long. Petals obovate-oblong to lanceolate. Stamens arranged in 2 series with the lower 5 stamens arranged in different level **16. C. prostratum**
  2. Calyx tube less than 1.5 cm long. Corolla white, cream, yellow, green, pink, purple or brownish. Stamens usually exserted from calyx tube. Style not adnate to inside of calyx tube
    6. Scales and stalked glands present. Petals glabrous, caducous **2. C. apetalum**
    6. Stalked glands present, without scales. Petals pubescent, persistent
      7. Leaves opposite or verticillate, usually 2–3(–4) per node. Inflorescences simple spikes, densely elongate **22. C. trifoliatum** Vent.
      7. Leaves opposite or subopposite. Inflorescences compound spikes, panicle or fascicles
        8. Leaves with tertiary veins dense, parallel, perpendicular. Calyx distally cupular. Stamens not exceeding the petals, arranged in 1 series (same level) **19. C. roxburghii** Spreng.
        8. Leaves with tertiary veins reticulate. Calyx tube distally funnelform. Stamens exceeding the petals, arranged in 2 series
          9. Leaves with tufted hairs in axils of lateral veins on lower surface. Inflorescences simple spikes, in fascicles. Style glabrous. Fruits with stipe up to 1 cm long **5. C. deciduum** Collett & Hemsl.
          9. Leaves without tufted hairs in axils of lateral veins on lower surface. Inflorescences in densely compound spikes, usually crowded at branchlet apex and forming a dense leafy panicle. Style puberulous. Fruits with stipe up to 2 mm long **13. C. pilosum** Roxb. ex G.Don

1. Flowers 4-merous. Fruits 4-winged or 4-ridged
  10. Low shrub, erect shrub or tree
    11. Low shrub up to 40 cm tall. Leaves alternate or subopposite, usually less than 5 cm long, scales scattered **10. C. nanum** Buch-Ham. ex D.Don
    11. Shrub or tree. Leaves opposite, usually longer than 5 cm long, scales overlapping **18. C. quadrangulare**
  10. Straggling shrub or woody climber
    12. Leaves with sparse to dense indumentum of transparent white to yellow or ferruginous, peltate scales, usually without hairs
      13. Branchlets, petioles, flowers and fruit usually with densely overlapping scales
        14. Inflorescences axillary, lax, simple, spikes 28–40 cm long. Petals red **12. C. pendulum**
        14. Inflorescences axillary to terminal, panicles elongate up to 10 cm long, or ± capitate spikes. Petals pale green, whitish to yellow
          15. Leaves elliptic or ovate, apex acuminate or subacute; young branches not winged or decurrent. Inflorescences axillary and spicate, often branched, without forming leafy panicles **15. C. procursum** Craib
          15. Leaves elliptic to oblong, apex cuspidate or abruptly caudate; young branches ± narrow winged or decurrent. Inflorescences usually compound spikes, grouped at branchlet apex and forming leafy panicles **17. C. punctatum**

16. Inflorescences capitate or subcapitate spikes **17.1 C. punctatum** var. **punctatum**
16. Inflorescences elongate panicles **17.2 C. punctatum** var. **squamosum**
13. Branchlets, petioles, flowers and fruits with scales not overlapping
17. Inflorescences simple elongate spikes, cylindric or compound spikes forming a panicle
18. Leaves axils of lateral veins with small rounded pits or pocket glands on lower surface. Inflorescences broadly cylindric spike. Flower infundibuliform **9. C. latifolium** Blume
18. Leaves axils of lateral veins without pits or pocket glands on lower surface. Inflorescences narrow spike or compound spike forming a panicle. Flowers campanuliform or cupuliform
19. Leaves ovate, broadly elliptic to ovate-oblong, midrib glabrous on both sides. Petals linear, ca 1 mm long. Fruit oblong to ellipsoid **1. C. acuminatum** Roxb.
19. Leaves elliptic, pubescent at base of midrib on lower surface. Petals elliptic with claw, ca 2 mm long. Fruit ovoid-ellipsoid **21. C. tetralophum** C.B.Clarke
17. Inflorescences dichasially compound spike, flower-bearing part of spike very condensed and becoming obconic to hemispheric (capitate or subcapitate) **20. C. sundaicum** Miq.
12. Leaves with indumentum of sparse white, yellow, reddish to brownish, peltate scales, or stalked glands, usually also with simple hairs
20. Branchlets, inflorescences and fruits with papillose or shortly stalked glandular hairs. Fruits narrowly oblong or narrowly ovoid **11. C. nigrescens** King
20. Branchlets, inflorescences and fruits with scales, without stalked glandular hairs. Fruits ovoid, orbicular, ellipsoid
21. Leaves pilose or tomentose, not only on veins. Fruits with densely linear-subulate processes **23. C. winitii**
21. Leaves glabrous or sparsely pubescent or on veins only. Fruits without linear-subulate processes
22. Leaves opposite or ternate; scales reddish **4. C. chinense** Roxb. ex G.Don
22. Leaves opposite, rarely ternate; scales yellow, golden yellow, orange or brownish red
23. Leaves apex apiculate. Branchlets drying whitish. Inflorescences puberulous, transparent yellow or brown scales **14. C. porterianum** (C.B.Clarke) Wall. ex Craib
23. Leaves apex acute to acuminate. Branchlets drying greyish brown. Inflorescences pubescent, with conspicuous golden yellow, orange or brownish-red scales **7. C. griffithii** Van Heurck & Müll.Arg.
24. Leaves glabrous or sparsely pubescent on midvein; scales golden yellow **7.1 C. griffithii** var. **griffithii**
24. Leaves pilose, glabrescent with age but remaining pilose on veins; scales golden yellow to orange red **7.2 C. griffithii** var. **yunnanense** (Exell) Turland & C.Chen

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