



## *Truongsonia* (Arecaceae: Arecoideae: Truongsonieae)—a new palm genus and tribe from Vietnam

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### Abstract

A genus and species of palm from the Truong Son Range in Vietnam, *Truongsonia leongkietii*, is described as new to science. Phylogenomic analysis strongly supports the placement of the new taxon in subfamily Arecoideae as sister to the African endemic tribe Podococceae, which comprises a single genus *Podococcus*. A new tribe Truongsonieae is also described to accommodate *Truongsonia* in the current phylogenetic classification of palms. *Truongsonia* is a dwarf, acaulescent, clump-forming palm bearing entire, bifid leaves with a fibre-like extension of the rachis through the sinus of the two lobes of the leaf. The interfoliar inflorescence is exerted on a long peduncle with 3–4 tightly sheathing peduncular bracts and rachillae presented at the apex only. The ovary is triovulate-tricarpellate, but fruits are single-seeded. *Truongsonia* is Critically Endangered, with surveys locating only 10–15 plants in the wild. Swift conservation action is required to secure the future of this remarkable and phylogenetically isolated lineage of palms.

**Key words:** Quang Ngai, Truong Son Range, *Podococcus*

### Introduction

Vietnam is located on the eastern part of the Indochinese Peninsula and has a remarkable range of habitats spreading over a total natural land area of 331,212 km<sup>2</sup>. The flora of Vietnam comprises approximately 12,000–13,500 vascular plant species and is rich in endemic taxa (Averyanov *et al.* 2003, Luu-dam *et al.* 2023, POWO 2023). Despite the high species diversity, it is still under-sampled (Rudbeck *et al.* 2022), with only 43 collections per 100 km<sup>2</sup> (Middleton *et al.* 2019) and uneven collecting patterns (Wen *et al.* 2020). During the past decade, many new taxa of vascular plants have been discovered in Vietnam including endemic genera of Annonaceae (Chaowasku *et al.* 2018), Araceae, (Lý *et al.* 2017), Gesneriaceae (Middleton *et al.* 2014, Wen *et al.* 2020), Poaceae (Tran *et al.* 2013, Tong *et al.* 2020) and Orchidaceae (Averyanov *et al.* 2022). The mountainous areas of Quảng Ngãi Province, which is located in the South Central coastal region of Vietnam on the eastern slope of the Truong Son Range (Dãy Trường Sơn or Annamite Range), have been the scene of many recent discoveries of endemic species and genera in families such as Annonaceae, Araceae, Arecaceae, Asparagaceae, Begoniaceae, Fagaceae and Zingiberaceae (e.g. Leong-Škorničková *et al.* 2011, Henderson and Nguyễn 2019, Lý 2016, 2017, Lý and Tillich 2016, Lý *et al.* 2017, 2018, 2021, 2022, Nguyen *et al.* 2022).

Here, we report a further discovery from this region from the mountains of Quang Ngãi Province that was made by the first author in 2020. During this field work, an unusual dwarf, acaulescent, arecoid palm with entire-bifid leaf blades, slender monoecious inflorescences and bright red, oblong-ellipsoid fruits was found. The palm could not be identified

using field guides for the region (Henderson 2009, Henderson & Nguyễn 2019), nor did it match any known palm genus reported in standard monographic treatments of palms (Baker & Dransfield 2016, Dransfield *et al.* 2008). We were unable to match the palm to any specimen in the herbaria at K, HN, NY, P or VNM (herbarium acronyms in Thiers 2023).

To address the problematic identification of this palm, we drew on ongoing, large-scale phylogenomic studies of the palm family (*e.g.* Bellot *et al.* 2020, Kuhnhäuser *et al.* 2021) based on targeted sequence capture of ca. 1,000 nuclear genes (Loiseau *et al.* 2019). Lý sent leaf samples of two individuals (*Lý-1521* and *Lý-1525*) to Bellot and Eiserhardt for DNA sequencing. Due to highly surprising initial findings, sequencing was repeated three times, twice by Eiserhardt at Aarhus University and once by Bellot at the Royal Botanic Gardens, Kew, to rule out suspicion of contamination or technical error. These findings demonstrated unequivocally that the palm does not belong to tribe Areceae, the major lineage that dominates the arecoid palm flora of the Indo-Pacific region. Instead, it is strongly supported as a member of the POS clade (Baker *et al.* 2011, Baker and Dransfield 2016), which comprises two African endemic tribes (Podococceae and Sclerospermeae) and tribe Oranieae, which ranges from Madagascar to New Guinea. The POS clade is strongly supported by molecular evidence, but is notable for the lack of obvious morphological similarities uniting the three tribes. This paradox is further accentuated by the inclusion of the Vietnamese palm, which cannot reasonably be accommodated within the limits of the tribes or genera of the POS clade. Thus, here we describe this palm as a new genus, *Truongsonia*, and species, *T. lecongkietii*, and erect a new tribe Truongsonieae to place it in the established phylogenetic classification of the palm family (Baker & Dransfield 2016).

## Materials and Methods

Measurements of the plant and its parts were made mainly from herbarium specimens, with some additional measurements made from living or spirit-preserved samples. Examination of herbarium specimens was carried out at K, NY, and VNM. Botanical terms used here mainly follow Dransfield *et al.* 2008. The conservation status of the plant was assessed following the IUCN Red list Categories and Criteria version 15.1 (IUCN 2012).

To determine the phylogenetic placement of *Truongsonia*, we sampled one representative species from all tribes of Arecoideae and all species of *Podococcus*. We generated target sequence capture data using the PhyloPalm probe set (Loiseau *et al.* 2019), following the laboratory and analysis workflows described by Kuhnhäuser *et al.* (2021). We inferred a multispecies coalescent summary tree from these data with ASTRAL (Zhang *et al.* 2018) from 913 maximum likelihood nuclear gene trees computed using RAxML (Stamatakis 2014).

## Taxonomic treatment

### *Truongsonieae* W.J.Baker, S.Bellot, J.Dransf. & Eiserhardt, *trib. nov.*

Type:—*Truongsonia* A.J.Hend., N.S.Lý, W.J.Baker, S.Bellot, J.Dransf. & Eiserhardt

Diminutive, acaulescent, clustering, unarmed, monoecious, pleoanthic palm; stem subterranean or surface-level, showing saxophone growth; leaves entire-bifid, with very shallow apical splits; sheaths open to the base, with dry fibrous ligules; rachis extending beyond the lamina into a fine, free fibre; inflorescence interfoliar, bisexual, branched to one order, peduncle elongate, much longer than rachis, bearing a prophyll and 3–4 slender, tightly sheathing peduncular bracts, disintegrating, the distalmost peduncular bract drying and splitting distally to form a cowl-like or pendulous limb; flowers borne in triads, inserted superficially in a shallow dimple in the rachilla surface; staminate sepals imbricate, staminate petals valvate, stamens biseriate; pistillate perianth imbricate; gynoeceum trilocular, triovulate, fruit ellipsoid-oblong, stigmatic remains basal; seeds 1, endosperm homogeneous, embryo lateral.

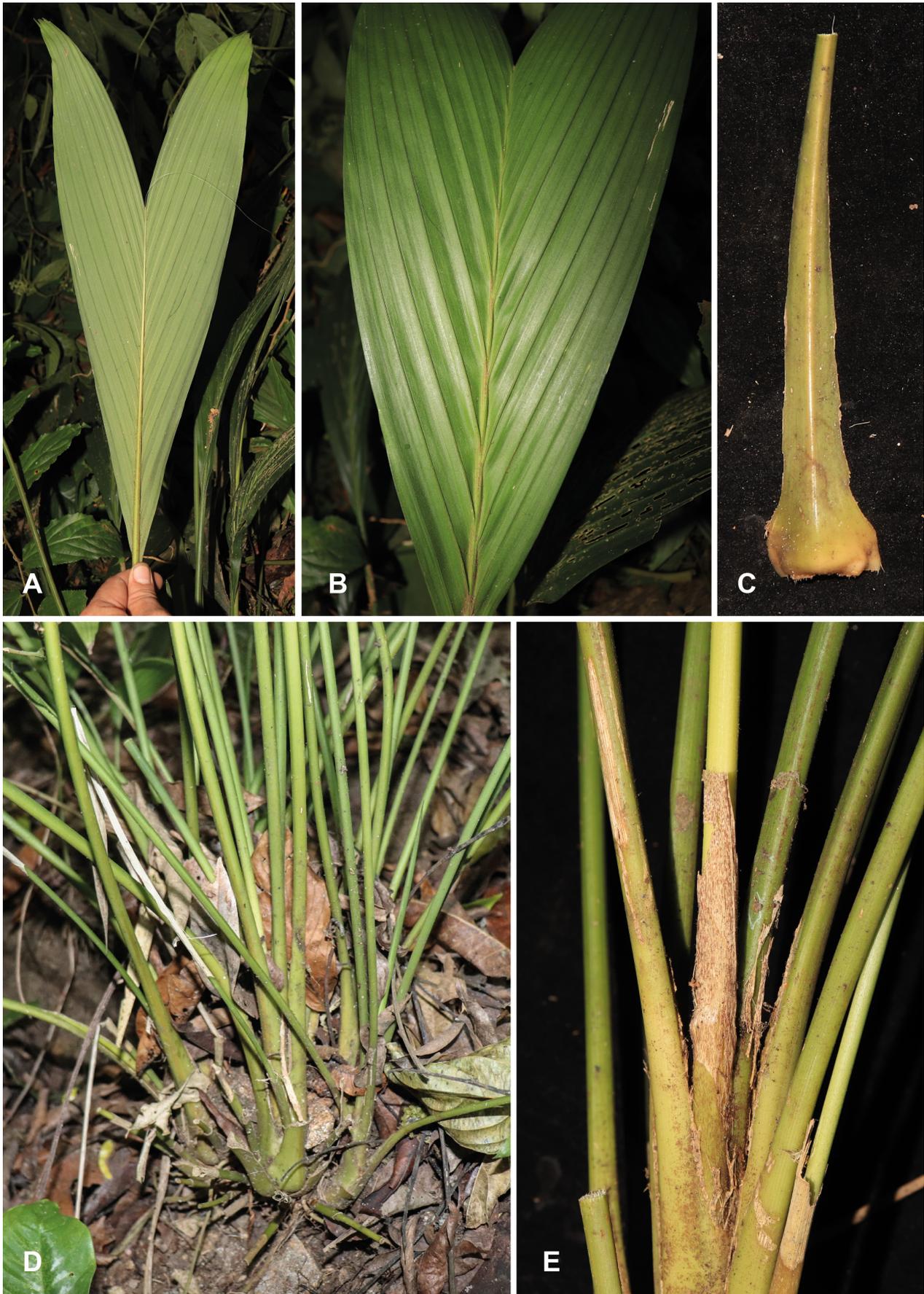
### *Truongsonia* A.J.Hend., N.S.Lý, W.J.Baker, S.Bellot, J.Dransf., & Eiserhardt, *gen. nov.*

Type:—*Truongsonia lecongkietii* N.S.Lý, W.J.Baker & A.J.Hend.

See description under species.



**FIGURE 1.** *Truongsonia lecongkietii*. Habit. A, B. Habit in the wild. C. Uprooted plant showing stem with saxophone growth. Photos: N.S. Lý.



**FIGURE 2.** *Truongsonia lecongkietii*. Vegetative morphology. A. Leaf, abaxial surface, showing fibre-like extension of the rachis through the sinus of the two leaf lobes. B. Leaf, adaxial surface. C. Leaf sheath, abaxial surface. D. Base of clump. E. Petioles, showing dry, fibrous, disintegrating ligules. Photos: N.S. Lý.

*Truongsonia lecongkietii* N.S.Lý, W.J.Baker & A.J.Hend., *sp. nov.* Type:—VIETNAM. Quang Ngai Province: Tra Bong district, precise locality withheld, primary tropical evergreen forests, elev. 640 m asl., 14 May 2020, *Ngọc-Sâm Lý*, *Lý-1521* (holotype: VNM!, isotype: NY!)

Diminutive, acaulescent, clustering (rarely solitary), unarmed, monoecious, pleoanthic palm to 1 m. **Stems** forming dense clumps, 10–15 cm long, 1.5–2 cm diameter, positively geotropic, “saxophone” type (Tomlinson 1990), subterranean or horizontal, brown, densely covered with stout roots, with short and obscure internodes 2–5 mm long. **Leaves** 9–15 in crown, reduplicate, not exceeding 1 m; sheaths 10–15 cm long, splitting open to the base, persistent, smooth, yellowish-brown, with caducous indumentum of brown, matted, fimbriate hairs, with flimsy, early disintegrating ligules 2.5–6 cm long, ligules bearing linear, brown hairs; petioles 50–66 cm long, smooth, with caducous indumentum as sheath, shallowly channeled, green adaxially, paler green abaxially; rachises 20–44 cm long, with scattered, brown indumentum ad- and abaxially, with a filamentous, distal extension beyond the leaf blade to 40 cm long; leaf blades entire-bifid, (14.5–)19–77 cm long, 10–12.4 cm wide at the apex of rachis, attenuate at the base, bifid for 22–31 cm at the apex, green adaxially, glaucous-green with scattered, caducous indumentum abaxially, glabrous adaxially, with 6–10 main veins on each side of rachis, prominent adaxially, corresponding to lamina plications, leaf apices with splits 6–15 mm deep. **Inflorescences** 40–43 cm long, interfoliar, slender, erect initially, protandrous, branched to 1 order; prophylls 2.0–2.5 cm long, ca. 0.7 cm wide, tightly sheathing, bicarinate, truncate, opening and eroding apically; peduncles 26–31 cm long; peduncular bracts 3–4, tubular, slender, tightly sheathing, the proximal splitting and disintegrating apically, the distalmost peduncular bract to at least 33 cm long, splitting distally for one third its length to form a ca. 18 mm wide cowl over the rachillae before drying and becoming pendulous, light green, with scattered indumentum; rachises 2–8 cm long; rachillae 5–10, 11–16 cm long, 0.5–1.0 mm diameter at anthesis, 1.0–1.4 mm diameter in fruit, radiating from the rachis at anthesis, subtended by minute rachis bracts, puberulous, sometimes with scattered, long, brown hairs; flowers in triads proximally, paired or solitary staminate distally, alternately to spirally arranged along the rachillae, each borne superficially in a shallow recess in the rachilla, pale yellow at anthesis, subtended by minute rachilla bracts; floral bracteoles minute; staminate flowers sessile, obovoid, asymmetric, 2–2.5 mm long, 1.5–1.8 mm wide; sepals 3, not united, imbricate, 1–1.2 mm long, 0.7–0.8 mm wide (in bud prior to anthesis), ovate, cucullate, keeled at the base abaxially, tanniferous along distal margin; petals 3, united in lower third, valvate, 2–2.5 mm long, 0.8–1.6 mm wide, obovate, cucullate; stamens 6, biseriate, united at base, outer, antesealous whorl presented below the inner, antepetalous whorl; outer filaments ca. 0.5 mm long, inner filaments ca. 1 mm long; anthers 0.6–0.7 mm long, 0.6–0.7 mm wide, globose, connective black-brown, dorsifixed, latrorse; pistillodes 0.6 mm long, 0.6 mm wide, conical, trilobed; pistillate flowers sessile, subglobose, 1.5–1.7 mm long, 1.5–1.6 mm wide (in bud prior to anthesis); sepals 3, not united, imbricate, 0.7–1.0 mm long, 1.3–1.5 mm wide, broadly triangular, cucullate, keeled at the base abaxially, tanniferous along distal margin; petals 3, not united, imbricate, 1.3–1.5 mm long, 1.4–1.6 mm wide, broadly ovate, cucullate; ovary triovulate-tricarpellate, ovoid, ca. 1.5 mm long, ca. 1 mm wide, stigmas tightly adpressed (in material seen), trilete, with 3 locules at base, each containing 1 ovule; staminodes not seen; **fruits** 17.9–18.2 mm long, 7.5–8.4 mm diameter, oblong-ellipsoid, smooth, bright red, with basal stigmatic residue; mesocarp 1.3 mm thick; seeds 1 per fruit, 14.5–14.7 mm long, 5.8–6.1 mm diameter, oblong, basally attached; endosperm homogeneous; embryo lateral. (Figs. 1–5).

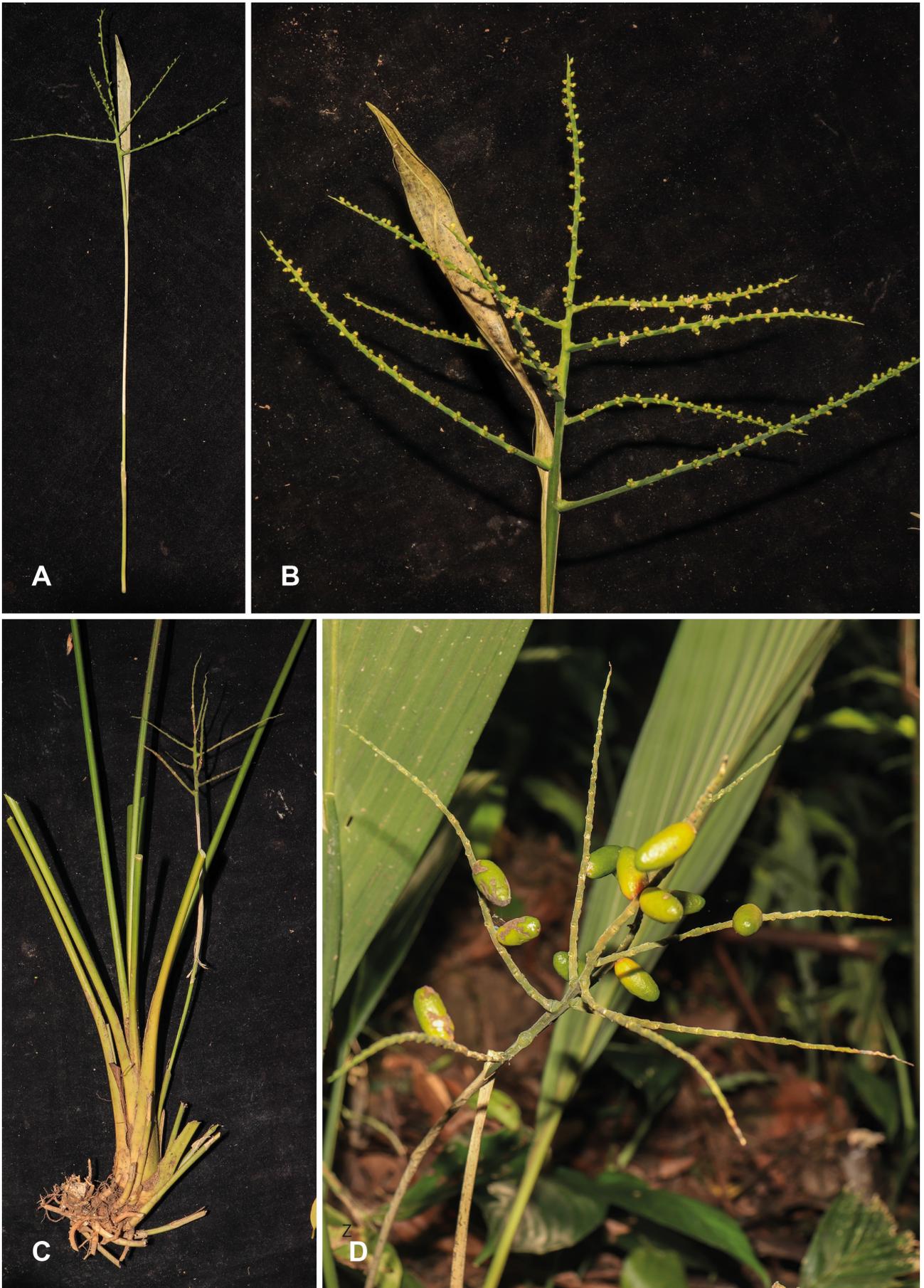
**Distribution:**—VIETNAM. Central Vietnam, Truong Son Range (Dãy Trường Sơn), Quang Ngai Province: Tra Bong district. Known only from the type locality, where a small population of 10–15 plants were seen scattered in less than 500 ha of forest.

**Habitat and phenology:**—This species grows in moist, shady, understory vegetation on steep slopes near streams in primary, evergreen, broad-leaf forest at about 600–700 m elevation. *Truongsonia* has been observed in flower and fruit in May.

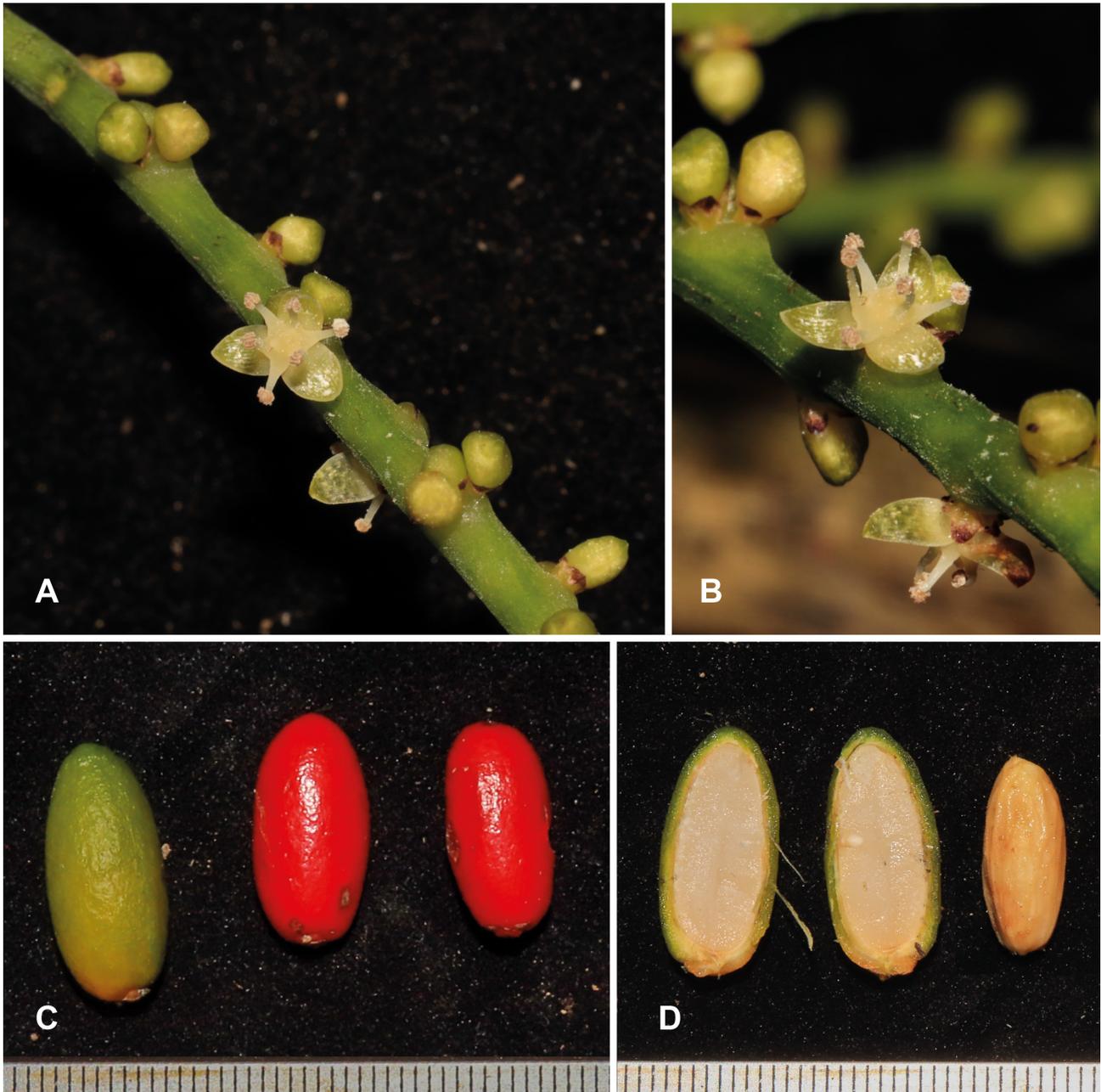
**Vernacular names (Vietnamese language):**—Cau lê công kiệt (coined here).

**Uses:**—None recorded. The new species has potential as an ornamental plant due to its small habit and beautiful leaf shape.

**Conservation status:**—Critically Endangered (CR B1B2ab(i-v), D; IUCN 2012). The extremely small population size of this species immediately qualifies it for the highest extinction risk. Although this species is under the protection of the local authority and the Department of Forest Protection of Tra Bong District, Quảng Ngãi province, its habitat is frequently disturbed by human activities such as harvesting of non-timber forest products, logging and clearing of the forest for *Acacia* plantations. Further exploration of adjacent areas is necessary to understand the extent and population sizes of this species better.



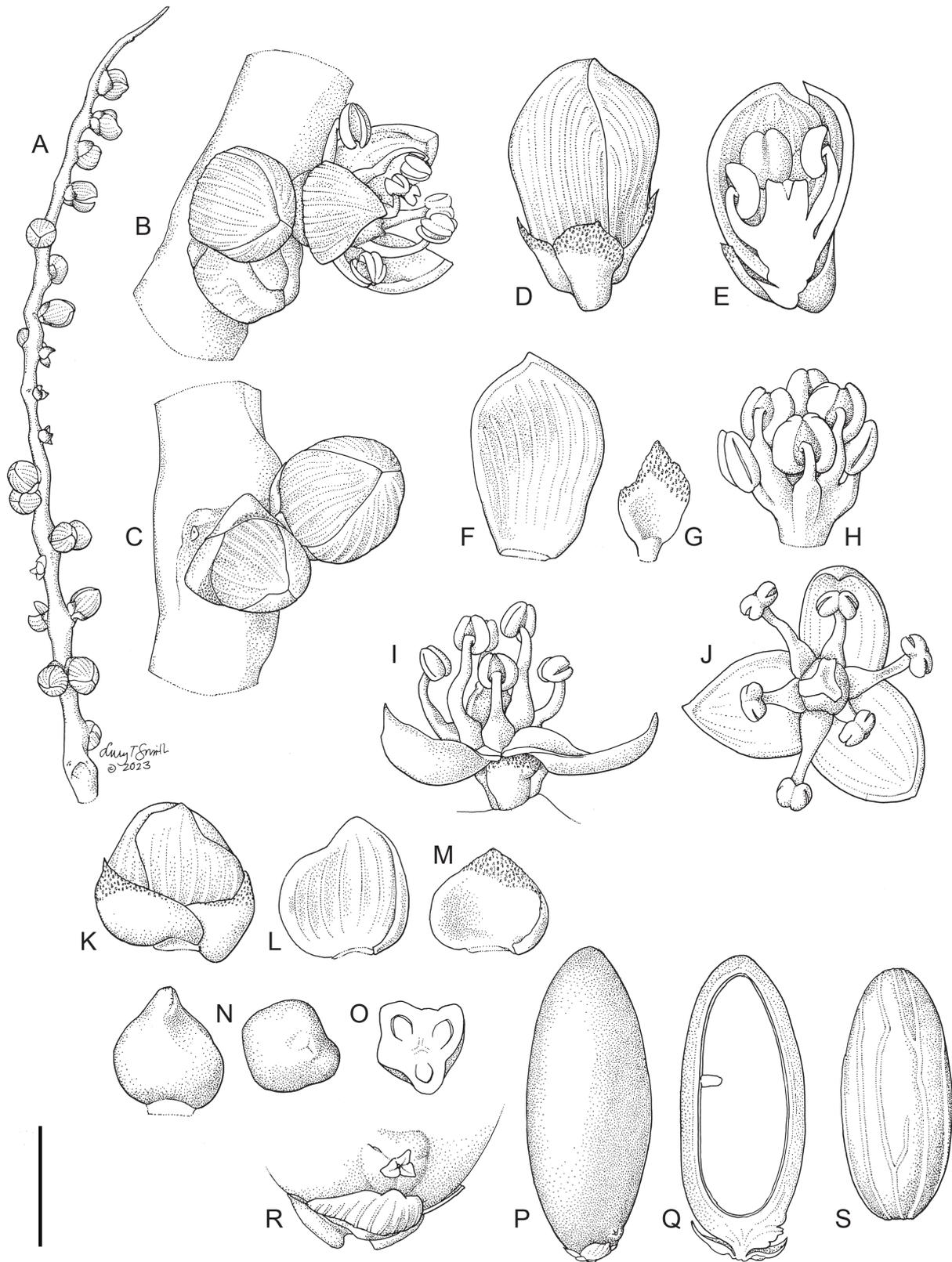
**FIGURE 3.** *Truongsonia lecongkietii*. Inflorescence morphology. A. Entire inflorescence. B. Distal part of inflorescence showing rachillae and peduncular bract. C. Base of plant showing insertion of inflorescence. D. Rachillae bearing young fruit. Photos: N.S. Lý.



**FIGURE 4.** *Truongsonia leongkiettii*. Flowers and fruit. A. Rachilla with floral triads and open staminate flowers. B. Open staminate flower. C, D. Fruit whole and in section (ruler with mm scale). Photos: N.S. Lý.

**Etymology:**—The genus name is derived from the Truong Son Range, Dãy Trường Sơn, in Vietnamese. The species is named for Associate Professor Lê Công Kiệt, University of Natural Science, Vietnam National University in Ho Chi Minh City, in honour of his long-time contribution to Vietnamese botany.

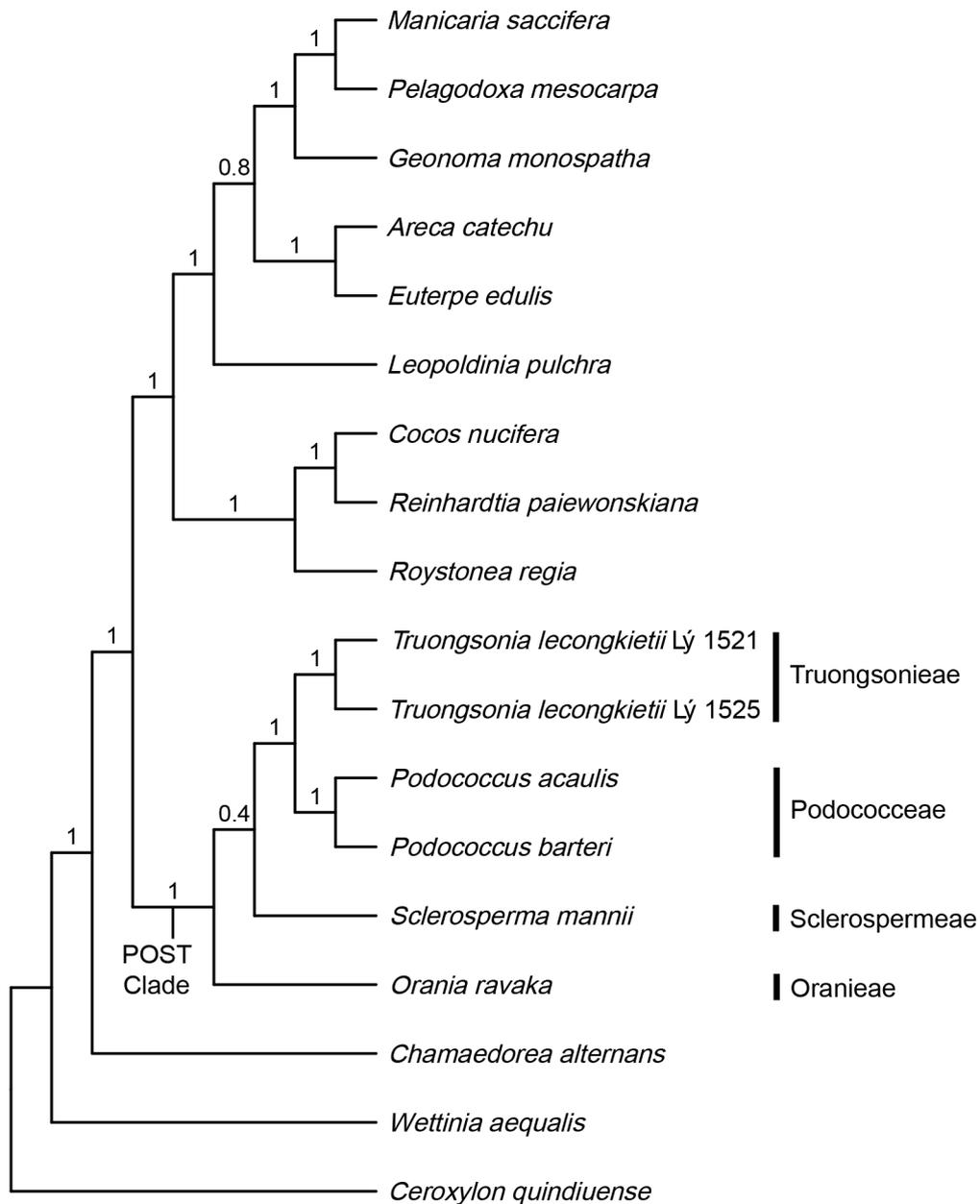
**Specimens examined:**—VIETNAM. Quang Ngai Province: Tra Bong district, precise locality withheld, elev. 640 m asl., 14 May 2020, *Ngọc-Sâm Lý*, *Lý-1521* (holotype: VNM!, isotype: NY!), elev. 618 m, 15 May 2020, *Ngọc-Sâm Lý*, *Lý-1525* (K!), elev. 687 m, 15 May 2020, *Ngọc-Sâm Lý*, *Lý-1527* (P!).



**FIGURE 5.** *Truongsonia leongkietii*. A. Rachilla. B. Floral triad with one open staminate flower. C. Floral triad, one staminate flower removed. D. Staminate flower bud. E. Open staminate flower bud in longitudinal section. F. Staminate petal. G. Staminate sepal. H. Androecium. I, J. Staminate flower in two views. K. Pistillate flower bud. L. Pistillate petal. M. Pistillate sepal. N. Gynoeceum in two views. O. Ovary in transverse section, showing 3 locules, each with 1 ovule. P, Q. Fruit whole and in longitudinal section, showing lateral embryo. R. Detail of basal stigmatic remains on fruit. S. Seed. Scale bar: A, P, Q, S = 7 mm; B, C, I, J = 1.6 mm; D–H, K–O = 1.25 mm, R = 2.5 mm. All from *Ngọc-Sâm Lý, Lý-1521* (NY). Drawn by Lucy T. Smith.

## Discussion

Of the 23 native palm genera recorded from Vietnam (Henderson & Nguyễn 2019), only four belong to subfamily Arecoideae, all of which fall within tribe Areceae (*Areca* L., *Nenga* H.Wendl. & Drude, *Oncosperma* Blume, *Pinanga* Blume). Only one additional arecoid tribe, Oranieae (*Orania* Zipp.), occurs in the broader mainland Asia region. In general habit, *Truongsonia* compares plausibly with tribe Areceae, and its inflorescence architecture is superficially similar to some Areceae species (e.g. *Heterospatha elegans* (Becc.) Becc.). However, it is immediately distinguished from Areceae by its trilocular, triovulate ovary (pseudomonomerous in Areceae) and its numerous peduncular bracts in the inflorescence (solitary or absent in Areceae). Tribe Oranieae comprises moderate to massive tree palms, which have little in common with *Truongsonia* other than the triovulate-tricarpellate ovaries. Several superficial similarities exist between *Truongsonia* and members of largely neotropical tribe Chamaedoreae (especially some species of *Chamaedorea*), such as habit, inflorescence architecture and bracts, and floral morphology, but these characters are not upheld by the overwhelming evidence from DNA sequence data.



**FIGURE 6.** Phylogenetic relationships of *Truongsonia* and other Arecoideae. Numbers indicate local posterior probabilities for each branch (maximal support = 1). The tree was rooted on subfamily Ceroxyloideae (*Ceroxylon quindiuense*).

*Truongsonia* is strongly supported as sister to *Podococcus* (Fig. 6), the sole genus of tribe Podococceae, which is restricted to equatorial West African rainforest between the Niger Delta and the Congo River (Dransfield *et al.* 2008, van Valkenburg & Sunderland 2008). The two species of *Podococcus* are stemless to small tree palms of the forest understorey with pinnate leaves and rhomboid, praemorse leaflets with venation radiating from the base. Their inflorescences are interfoliar and spicate with densely arranged triads borne in deep pits, the flowers emerging from the pits on stalks, later forming stalked fruit with 1–3 seeds. *Podococcus* and *Truongsonia* share only few morphological similarities: they are both genera of dwarf palms, with similar prophylls and peduncular bracts in both structure and number, six biseriate stamens in the staminate flower, the outer whorl shorter than the inner, and triovulate-tricarpellate ovaries. Their fruits are also somewhat similar in their shape and stigmatic remains located at or near the base, the seeds containing homogeneous endosperm and lateral embryos. We considered including *Truongsonia* within *Podococcus*, which would have been compatible with the phylogenetic topology, but decided against this as it would create a generic delimitation so heterogeneous as to be impractical for users. For consistency with the prevailing palm classification (Baker & Dransfield 2016), a tribe for *Truongsonia*, Truongsonieae, is also required, necessitating the revision of the broader informal POS clade name to the POST clade.

The discovery of a highly distinctive Vietnamese endemic that is sister to an African endemic seems at first biogeographically paradoxical. However, it is consistent with earlier reconstructions of the historical biogeography of the palm family (Baker & Couvreur 2013a, 2013b). These indicate that the ancestor of the POST (as POS) clade originated by expansion of earlier arecoid ancestral lineages from South America into Eurasia in the Palaeocene. The crown group dispersed into Africa by the middle of the Eocene, accounting for the presence of Podococceae and Sclerospermeae there. This analysis was undertaken long before the discovery of *Truongsonia*, the distribution of which would have impinged on the biogeographic reconstruction. We predict that a comparable study adjusted to include *Truongsonia* would likely show that the presence of the genus in Vietnam reflects the early history of the POS clade in Eurasia, which then expanded into the Africa, the Indian Ocean and the Malesian Archipelago on multiple occasions.

*Truongsonia* appears to be exceptionally rare in the wild, with only a few plants located in a single forest location. Based on current information, we assess the species to be Critically Endangered (IUCN 2012). The evolutionary and biogeographic distinctness of the genus only serves to further heighten concern for its future. Further exploration to ascertain the full extent of persisting *Truongsonia* populations and the threats that they face is urgently required to establish the scale of the need for conservation intervention.

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