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Two new species of Araliaceae from the limestone karst of Central Laos

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Abstract

Two new species of Araliaceae, *Heptapleurum karsticola* and *Trevesia laotica*, are described from limestone karst in central Laos. *Heptapleurum karsticola* was found in Khammouane Province, and the second species, *T. laotica*, was found in Bolikhamxai and Khammouane Provinces. Information regarding the distribution, habitat, phenology, vernacular names, preliminary conservation assessment, DNA barcodes, and taxonomic notes compared to other closely related species is provided for each species.

Key words: Apiales, endemic species, flora, Indochina, phylogeny, taxonomy

Introduction

Araliaceae, commonly known as the ginseng family, comprise 46 genera and ca. 1,500 species that are widely distributed across the tropics and subtropics, with a few genera extending into the temperate zones (Wen *et al*. 2001, Plunkett *et al*. 2004, POWO 2025). Members of the family are mostly woody plants, with leaves ranging from simple to palmately or pinnately compound, and characterized by inflorescences usually in compound umbels (rarely racemes or heads), mostly 5-merous flowers with inferior ovaries, and drupaceous fruits containing 2–5 (rarely more) seeds (Philipson 1970, Yi *et al*. 2004). In Laos, 26 species and two varieties in 11 genera are enumerated to date (Newman *et al*. 2017–present).

During our field surveys in the limestone karst of central Laos, including Nam Kading National Protected Area (hereafter called Nam Kading NPA) in Bolikhamxai Province, Nam Sanam-Phou Pha Marn Provincial Protected Area (hereafter called Nam Sanam-Phou Pha Marn PPA) in Khammouane Province, we collected two unknown species of Araliaceae, belonging to *Heptapleurum* Gaertner (1791: 472), and *Trevesia* Visiani (1842: 262). After a careful examination based on taxonomic literature and herbarium specimens of each genus, as well as phylogenetic relationship, they appear to be hitherto undescribed taxa. Thus, we describe them as new species, *Heptapleurum karsticola* Kongx., Tak.Yamam. & Tagane and *Trevesia laotica* Kongx., Soulad. & Tagane as below.

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Materials and Methods

Field surveys and morphological investigation

Nine field surveys were carried out from December 2016 to March 2025 to assess the plant diversity in the previously mentioned protected areas in the two provinces of Bolikhamxai and Khammouane. A total of nine specimens representing two unknown species of Araliaceae were carefully examined to confirm the validity of the new species, and the description of each species was based on these collections. We consulted related species using dry herbarium specimens at FOF, HN, KAG, VNM, as well as digitized images from several online herbaria databases, including the Muséum National d'Histoire Naturelle (https://science.mnhn.fr/), the Kew Data Portal (https://data.kew.org), Natural History Museum Data Portal (https://data.nhm.ac.uk), AAU Herbarium Database (https://sciencemuseerne.dk/herbariet), and the Catalogue des herbier de Genève (https://www.ville-ge.ch/musinfo/bd/cjb/chg/). Also, we referred to relevant literature (Li 1942, Hoo & Tseng 1978, Shang 1997, Wen *et al.* 2001, 2003, 2007, Yi *et al.* 2004, Wen & Lowry 2006, Shang & Lowry 2007, Newman *et al*. 2007, 2017–present, Esser & Jebb 2010, 2019, Tagane *et al.* 2015, 2017, Esser 2018, de Kok 2022).

DNA extraction, sequencing and phylogenetic analysis

The total DNA was extracted from silica dried leaf following Doyle & Doyle (1987). The nuclear ribosomal internal transcribed spacer (ITS) region, primers (51NT and 26S1R) were amplified and sequenced according to published protocols following Clement *et al*. (2004). Purification, labeling and sequencing followed Souvannakhoummane *et al*. (2025).

For the phylogenetic analysis, we sampled taxa closely related to *Heptapleurum* and *Trevesia* within the Asian core Araliaceae (Wen *et al*. 2001) and the Asian Palmate group (Plunkett *et al*. 2004). The data set included six sequences of *Aralia* Linnaeus (1753: 273), *Schefflera* Forster & Forster (1776: 45), eight sequences of *Brassaiopsis* Decaisne & Planchon (1854: 106), three sequences of *Panax* Linnaeus (1753: 1059), two sequences of *Cussonia* Thunberg (1780: 210), *Dendropanax* Decaisne & Planchon (1854: 107), *Heteropanax* Seemann (1866: 297), *Osmoxylon* Miquel (1863: 5), *Raukaua* Seemann (1866: 352), *Tetrapanax* (Koch 1859a: 70) Koch (1859b: 371), and representatives of *Eleutherococcus* Maximowicz (1859: 132), *Harmsiopanax* Warb. (*in* Engler 1897: 166), *Oplopanax* (Torrey & Gray 1840: 648) Miquel (1863: 16), *Seemannaralia* Viguier (1906: 118), *Sinopanax* Li (1949: 231), 21 sequences of *Heptapleurum*, eight sequences of *Heptaphylla* and nine sequences of *Trevesia.* Most sequences were obtained from GenBank and derived from previous phylogenetic studies (Plunkett *et al*. 2004, 2019, Wen *et al*. 2007, Li & Wen 2013, 2014, Valcarcel *et al*. 2014). *Pittosporum illicioides* Makino (1900: 31) of Pittosporaceae was selected as the outgroup following Li & Wen (2014). In total of 72 ITS sequences, including two newly generated sequences, were anylized. Details of each species, vouchers, country of origin and GenBank accession number are shown in Appendix Table S1.

The sequence alignment was performed with MAFFT (Katoh *et al*. 2019), followed by manual checking and editing in Aliview (Larsson 2014). A maximum likelihood tree of ITS was constructed and analyzed using the IQ-TREE web server (Nguyen *et al*. 2015) and employing one-thousand bootstrap pseudo replicates via the ultrafast bootstrap (Hoang *et al*. 2018). Tree was displayed and annotated using Interactive Tree of Life (iTOL) v5 (https://itol.embl.de) (Letunic & Bork 2021).

Results and discussion

From 72 aligned sequences of ITS, which have 665 aligned positions and contain 272 variable characters, 183 of which are parsimony-informative. Maximum likelihood tree based on ITS showed that two new species are located within the clade of the Asian Palmate group of Araliaceae with strong bootstrap support (BS = 100) (Fig. 1).

The sample of *Heptapleurum* from Laos (*Tagane et al. Z1201*) falls within the strongly supported *Heptapleurum* clade (BS = 99). Within the clade, it is placed as sister to a clade including *H. petelotii* (Merrill 1924: 428) Plunkett & Lowry (*in* Lowry & Plunkett 2020: 162), *H. oblongum* (Craib 1930: 421) Plunkett & Lowry (*in* Lowry & Plunkett 2020: 160), *H. arboricola* Hayata (1916: 23), and *H. leucanthum* (Viguier 1909: 358) Y.F. Deng (*in* Ai 2018: 473) (BS = 96); together, *Z1201* and this clade form the sister group to *H. bengalense* (Gamble 1919: 229) Esser (2021: 152) (BS = 100).

The sample of *Trevesia* from Laos (*Tagane et al. Z1168*) falls within the *Trevesia* clade with strong bootstrap support (BS=99). Within this clade, it is recovered as sister to a clade comprising *T. sphaerocarpa* Grushvitzky & Skvortsova (*in* Grushvitzky *et al.* 1984: 1025) and *T. palmata* (Roxb. ex Lindley 1825: t. 894) Visiani (1842: 262) (BS=88); together, these three species form the sister group to *T. sundaica* Miquel (1856: 137) (BS = 99).

Based on these results and their morphology, it is clear that the two species we discovered this time belong to *Heptapleurum* and *Trevesia*, respectively.

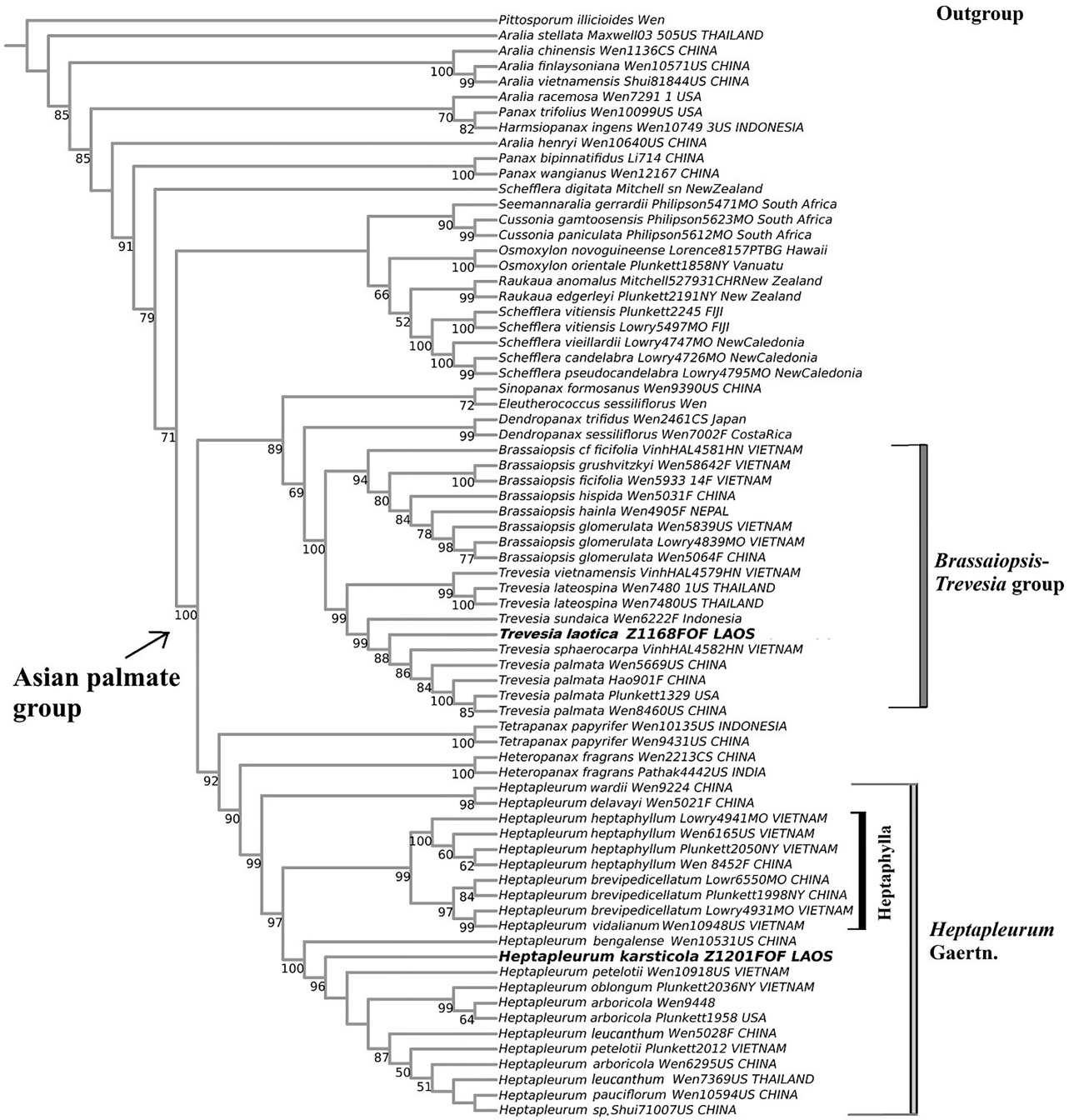

FIGURE 1. ML tree of Asian palmate group and related genera based on the nuclear ribosomal internal transcribed spacer (ITS) regions, including two new species from Laos showing in bold. Numbers on the branches indicate support values, only ≥50 are shown (1000 ultrafast bootstrap replicates).

Taxonomy

Heptapleurum karsticola Kongx., Tak.Yamam. & Tagane, *sp. nov.* (Figs. 2, 3)

TYPE:—LAOS. Khammouane Province, Khounkham District, the Rock Viewpoint at Phou Pha Marn, in limestone karst, 18.17689°N, 104.48409°E, 435 m elev., 19 March 2024, fl. & young fr., *S. Tagane, P. Souladeth, V.S. Dang, T. Yamamoto, K. Souvannakhoummane, N. Tanaka, D. Kongxaisavath, K. Phengmala, A. Sengthonh, Q.B. Nguyen & K. Takahashi Z1201* (holotype: FOF [FOF0007163!], isotypes: KAG [KAG187600!], VNM [VNM00074078!]).

Heptapleurum karsticola is similar to *H. leucanthum* distributed in South-Central to Southeast China, Laos, Thailand, and Vietnam in having pleasant smell when crushed, glabrous leaves with 4–9 leaflets, secondary veins up to 6 pairs, leaflet laminae up to 9 × 2.8 cm, inflorescences with a short main axis of 0.3–2.7 cm long and 4 or 5 stamens, but distinguished by its leaf margin repand, sometimes sparsely serrate near apex (vs. entire in *H. leucanthum*), slightly glaucous lower leaf surface (vs. not glaucous), larger bracts (3–5 mm long vs. ca. 1 mm long), smaller umbels (0.7–1.5 cm in diam. vs. 2–2.5 cm in diam.), and shorter pedicels (2–3.5 mm long vs ca. 6 mm long) (Table 1).

TABLE 1. Morphological comparison between *Heptapleurum karsticola* and *H. leucanthum*. The measurements of the latter species are based on Shang & Lowry (2007) and Esser & Jebb (2019).

Character	*H. karsticola*	*H. leucanthum*
Habit	small shrubs	small shrubs to scandent
Leaf margin	margin slightly repand, sometimes sparsely serrate near apex	entire
Abaxial leaf surface	slightly glaucous	not glaucous
Length of petiolules (cm)	0.2–1.8	0.5–3(–5)
Length of bracts (mm)	3–5	ca. 1
Size of umbels in diam. (cm)	0.7–1.5	2–2.5
Length of pedicels (mm)	2.0–3.5	ca. 6

Small shrubs, up to 4 m tall, deciduous, all parts glabrous; bark smooth, brown to greyish brown, current year twigs green *in vivo*, up to 0.4 cm in diam., with prominent lenticels, old twigs brown to greyish brown, with pleasant smell when crushed. Leaves palmate, alternate; stipules adnate to base of petioles; petiole 3.5–9.5 cm long; leaflets (4–)5(–6), petiolules 0.2–1.8 cm long, laminae uniform in size, elliptic to narrowly elliptic, 3.5–8.5 × 1.1–2.8 cm, slightly glaucous on lower surface *in vivo*, base cuneate to attenuate, margin slightly repand, sometimes sparsely serrate near apex, apex acute to attenuate, midrib prominent on both surfaces, secondary veins 2–6 pairs. Inflorescences terminal, consisting of cymes of umbels, 2–5 umbels per inflorescence, 2.3–7.3 cm long, peduncle 0.3–1.2 cm long; primary axis 0.3–2.7 cm long, with 2–4 lateral branches; bracts broadly triangular, suborbicular to broadly elliptic, 3–5 × 3–7 mm, apex apiculate; umbels 0.7–1.5 cm in diam., with 6–12 flowers. Flowers bisexual, yellow *in vivo*; pedicel 2–3.5 mm long; bracteoles 2.3–4 × 1.2–2.7 mm; calyx cupules obconical, 1.5–2.1 × 1–2.5 mm, calyx lobes (3–)5, minute; petals (4 or)5, ovate-triangular, 1.1–1.8 × 0.7–1.2 mm, apex acute, margin entire, caducous; stamens (4 or)5, filaments 1.3–4 mm long, anthers 0.2–0.5 mm long; ovary (5 or)6-locular, style absent, stigma truncated conical, up to 0.2 mm long. Infructescences up to 2.5 cm long. Fruits on pedicels 3–6 mm long, ellipsoid-oblong, 3–7 mm long, 2–5 mm in diam., smooth, with persistent short stigma.

Additional specimens examined (paratypes):—Khammouane Province: Khounkham District, the Rock Viewpoint at Phou Pha Marn, 18.177497°N, 104.483794°E, 446 m elev., 2 July 2022, young fl. *Souladeth et al. PPM13* (FOF); same locality, 18.17756°N, 104.4848°E, 455 m elev., 19 March 2024, young fr. *Tagane et al. Z1204* (FOF [FOF0007164], KAG [KAG187604, KAG187605], VNM); same locality, same date, fl. & young fr., *Tagane et al. Z1210* (FOF [FOF0007162], KAG [KAG187612], VNM); same locality, 18.1763°N, 104.4842°E, 420 m elev., 9 March 2025, fl. & fr., *Tagane et al. Z2412* (FOF [FOF0009950]; KAG [KAG201134]; VNM).

Distribution:—Laos (Khammouane Province).

Habitat and Phenology:—On open limestone karst, at 420–455 m elev. Flowering and fruiting in March and July.

Etymology:—The specific epithet "*karsticola*" refers to its habitat (limestone karst) of the type locality.

Vernacular name:—Tarng Pha Hom (ຕາງຜາຫອມ; Lao), suggested here. "Tarng" refers to the common name for Araliaceae in Lao in general. "Pha" refers to its habitat of a mountain cliff, and "Hom" refers to a good smell of this species.

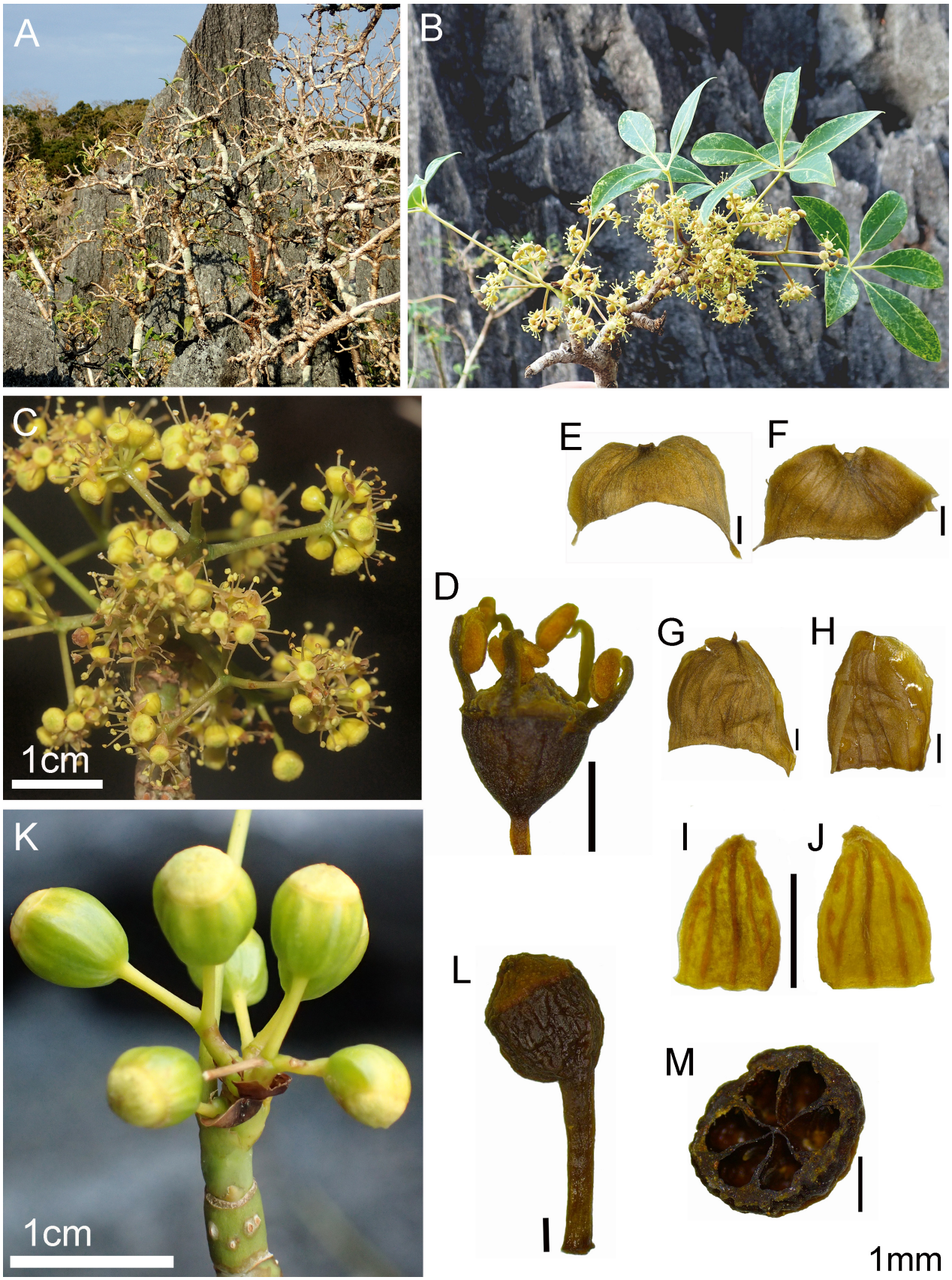

FIGURE 2. *Heptapleurum karsticola* Kongx., Tak.Yamam. & Tagane. A. Habit. B. Flowering twigs. C. Portion of inflorescence. D. Flower. E & F. Bracts, abaxial (left) and adaxial side (right). G & H. Bracteole, abaxial (left) and adaxial side (right). I & J. Petals, abaxial (left) and adaxial side (right). K. Infructescence. L. Young fruit. M. Transverse section of a fruit, showing 6 locules. Photos A, B, E–J and L–M by D. Kongxaisavath., C & K by S. Tagane. Materials E–J from *Tagane et al. Z1201* and L–M from *Tagane et al. Z2412* (FOF). Scale bars C & K =1 cm, D–M = 1 mm.

FIGURE 3. Holotype of *Heptapleurum karsticola* Kongx., Tak.Yamam. & Tagane. (*Tagane et al. Z1201* (FOF0007163)).

GenBank accession no.:—PV821477 (ITS) (sequenced from *Tagane et al. Z1201*).

Preliminary conservation assessment:—Critically Endangered (CR). Currently, only a single population of *Heptapleurum karsticola* is found in a limited area of ca. 200 × 200 m at an open limestone karst along a walking trail within the Nam Sanam-Phou Pha Marn PPA in Khammouane Province, central Laos, where we observed a total of about 30 mature individuals. The similar habitat of the limestone karst is widely distributed in the Phou Hin Phoun NPA, the southern adjacent area of the PPA, and more populations and individuals can be expected to occur. However, some areas have suffered some degree of impact from activities such as limestone mining. Given its scarcity, it is assessed as Critically Endangered (CR) according to IUCN criterion B2a, b(iii), C2a(i, ii) and D (IUCN 2024).

Notes:—The new species is assigned to *Heptapleurum*, a monophyletic genus with 317 species currently accepted (Lowry & Plunkett 2020, POWO 2025) based on morphological characteristics, such as unarmed stems, palmately compound leaves, the leaflets with distinct, usually articulated petiolules, and valvate petals (Esser 2021).

Trevesia laotica Kongx., Soulad. & Tagane, *sp. nov.* (Figs. 4, 5)

TYPE:—LAOS. Khammouane Province, Khounkham District, the Rock Viewpoint at Phou Pha Marn, in evergreen broad-leaved forest on limestone hills, 18.17646°N, 104.48848°E, 453 m elev., 8 March 2025, fl. & fr., *S. Tagane, P. Souladeth, V.S. Dang, T. Vongthavone, A. Sengthong, D. Kongxaisavath, K. Phengmala, T. Yamamoto, H. Toyama, Q.T. Pham & K. Yamazaki Z2365* (holotype: FOF [FOF0009947!, flowers in spirit]; isotypes KAG [KAG201088!]; VNM [VNM00074074!]).

Trevesia laotica is morphologically similar to *T. palmata* but easily distinguished by its leaves (palmately compound in *T. laotica* vs. simple, deeply 5–9-lobed in *T. palmata*), longer filaments (8–9 mm long vs. 4–6 mm long), smaller calyx lobes (0.1–0.5 mm long vs. 1–2 mm), and longer styles on fruits (4–5.5 mm long vs. 2–4 mm long) (Table 2).

TABLE 2. Morphological comparison between *T. laotica* and *T. palmata*. The characters of the latter species are based on Shang & Lowry (2007).

Character	*T. laotica*	*T. palmata*
Height (m)	up to 4	up to 8
Leaf shape	palmately compound with 5–9 leaflets	palmately 5–9-lobed
Size of leaflet blades (cm)	7–41.5 × 1.3–10	60–90
Length of inflorescence (cm)	80	ca. 45
Length of peduncles (cm)	1.5	4–17
Length of calyx lobes (mm)	0.1–0.5	1–2
Number of stamens	7	7–12
Ovary	7-locular	7–12-locular
Diameter of fruits (cm)	2	1–1.8
Length of styles on fruits (mm)	4–5.5	2–4

Trees up to 4 m tall, evergreen. Stems with a few scattered prickles, bark grey to pale green; young branches sparsely to densely covered with ferruginous indumentum. Leaves palmately compound, with 5–9-leaflets; stipules connate to base of petiole, triangular, 0.6–1.1 cm long, sometimes bi-lobed to near the base; petioles 12.5–67.7 cm long, without spines; petiolules 0.3–2.5 cm long; leaflet blades lanceolate, oblong-lanceolate, narrowly oblong-elliptic, 7–41.5 × 1.3–10 cm, upper surface dark greyish brown, glabrous, lower surface yellowish brown, covered with indumentum when young, glabrous when mature, base narrowly attenuate, apex acuminate to caudate, margin serrate, midrib on each lobe prominent on both surfaces, lateral veins prominent on both surfaces. Inflorescences panicle of 1–4 umbels, terminal or axillary, 24 cm long (for solitary), up to 80 cm long (for 4-umbellate) pendulous; peduncle 1.5 cm long, covered with brown indumentum outside, glabrescent; bracts ovate-triangular, 0.6–1.1 × 0.3–0.4 cm, densely covered with brown indumentum outside, glabrous inside, apex acute, margin entire. Flowers 36–42 per umbels; pedicels 1.6–1.7 cm long, covered with brown indumentum, glabrescent; bracteoles narrowly triangular to linear, 1.8–3 mm long, apex cuspidate, densely covered with indumentum outside; calyx campanulate, 0.6–0.7 cm long, 0.5–0.6 cm in diam., sparsely covered with indumentum, calyx rim minutely 7-teethed, lobes 0.1–0.5 mm long; petals 7, often partly connate appearing 5, spread, triangular to ovate-triangular, 7–8 × 3–5.5 mm, glabrous on both surfaces, apex acute; stamens 7, filaments 8–9 mm long, anthers 2–3.8 × 1–2 mm; ovary 7-locular, with 1 or 2 ovules per carpel, style 2.2 mm long, united, conical, glabrous, stigma 7-lobed. Infructescences up to 87 cm long; axis sparsely to densely with

FIGURE 4. *Trevesia laotica* Kongx., Soulad. & Tagane. A. Habit. B. Fruiting branch. C. Trunk. D. Apical part of stem showing base of petioles and stipules. E. Sapling. F. Leaves. G. Portion of lower leaf surface. H. Inflorescence. I, J. Flowers. K. Fruits. L. Fruits dissected to reveal 7 developing seeds. M. Seeds. Photos A, H–J & M from *Tagane et al. Z2365*, B–D, F & G from *Tagane et al. Z1168*, E with no voucher, K & L from *Tagane et al. Z798*, taken by S. Tagane. Scale bars I–J & L–M = 1 cm.

FIGURE 5. Holotype of *Trevesia laotica* Kongx., Soulad. & Tagane (*Tagane et al. Z2365* (FOF0009947)).

brown farinose stellate pubescence. Fruits globose to obovoid-globose, to 2 cm in diam., smooth; fruiting pedicel 1.7–3.5 cm long; style persistent, 4–5.5 mm long, stylopodium persistent. Seeds 4–7, ovoid-ellipsoid, flattened, 1.1–1.5 × 0.7–1.0 × 0.3–0.5 cm.

Additional specimens examined (paratypes):—LAOS. Bolikhamxai Province: Pak Kading District, Ban Nabouay, 18.243472°N, 104.269306°E, 206 m elev., 7 November 2023, fl. buds, *Souladeth et al. Z746* (FOF [FOF0005875], KAG [KAG187164], VNM [VNM00070350]); Pak Kading District, near Ban Naphong, Nam Kading National Protected Area, 18.22257°N, 104.38119°E, 602 m elev., 18 March 2024, fr., *Tagane et al. Z1168* (FOF [FOF0007169, FOF0007170], KAG [KAG187570], VNM [VNM00073014]). Khammouane Province: Khounkham District, Tad Nam Sanam, 18.21963°N, 104.50306°E, 458 m elev., 15 March 2024, fr., *Tagane et al. Z798* (FOF [FOF0005925], KAG [KAG187213, KAG187214], VNM [VNM00070840]).

Distribution:—Laos (Bolikhamxai and Khammouane Provinces).

Habitat and phenology:—In evergreen broad-leaved forest on limestone hill at 200–610 m elev. Flowering in December to March, and fruiting from March to April.

Etymology:—The specific epithet "*laotica*" refers to the country of the type locality.

Vernacular name:—Phak Narm Ton (ຜັກຫນາມຕົ້ນ; Lao), suggested here. "Phak Narm" refers to plants with spines in Lao, and "Ton" refers to the tree habit of this species.

GenBank accession no.:—PV821478 (ITS) (sequenced from *Tagane et al. Z1168*).

Preliminary conservation assessment:—Endangered (EN). Currently, *Trevesia laotica* is known from four localities in limestone areas in Bolikhamxai and Khammouane Provinces of central Laos. We observed 10–30 mature individuals in each location. Based on our specimen records, the Area of Occupancy (AOO) is calculated as 12 km^2 and the Extent of Occupancy (EOO) is 208 km^2 using GeoCAT (Bachman *et al.* 2011). Although the locations are situated within the protected area of Nam Sanam-Phou Pha Marn PPA and Nam Kading NPA, some disturbances are observed, which might bring a negative impact on its survival. Given this situation, the species is being assessed as Endangered (EN) according to the IUCN criteria B1a & b(ii, iii), B2a & b(ii, iii), and D (IUCN 2024).

Notes:—The genus *Trevesia* was described by Visiani in 1842. Due to its unique characteristics, such as palmately lobed leaves and pedicels lacking articulations, it was segregated from *Gastonia* Comm. ex Lam. in Lamarck *et al.* (1788: 610). The most recent revision by Jebb (1998) recognized seven distinct species. Since then, one more species, *T. vietnamensis* J. Wen & P.K. Lôc in Wen *et al.* (2007), was described. Our new species is the 9th species in the genus.

The genus *Trevesia* is closely related to *Brassaiopsis* (Li & Wen 2016), and the two genera are sister but distinct in phylogenetic analysis based on ITS (Fig. 1). The two genera are traditionally distinguished by leaf shape (simple, palmately lobed in *Trevesia* vs. simple (entire or palmately lobed) or palmately compound in *Brassaiopsis*), the merosity of floral parts (at least 7-merous in *Trevesia* vs. 5-merous in *Brassaiopsis*), and the locular number of the ovary (6–16-locular vs. 2–5-locular) (Jebb 1998, Shang & Lowry 2007). However, the description of *T. vietnamensis*, in 2007, blurred the generic boundaries. This species is positioned in the *Trevesia* clade and sister to *T. lateospina* in the phylogenetic analysis based on nuclear (ITS) and ribosomal (*trnL-F* and *ndhF*) datasets, but shows *Brassaiopsis*-like characters, including palmately compound leaves and 4–5-merous flowers with 4–5 locular ovaries (Wen *et al.* 2007). Our new species possesses 7-merous flowers with 7-locular ovaries that are consistent with the traditional characteristics of *Trevesia,* and is the second species having palmately compound leaves. As Wen *et al.* (2007) proposed, it might be appropriate to merge *Brassaiopsis* with *Trevesia*. Further comprehensive morphological and phylogenetic studies based on a large number of specimens are needed.

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Appendix

TABLE S1. Voucher information and GenBank accession numbers for Araliaceae in this study

Taxa	Voucher	Country (Locality)	ITS	Names used on Sequence
Aralia chinensis L.[2]	Wen 1136 (CS)	China (Hainan)	AF242256	
Aralia finlaysoniana (Wall. ex G. Don) Seem.[3]	Wen 10571 (US)	China (Yunnan, Hekou)	GU054665	
Aralia henryi Harms[4]	Wen 10640 (US)	China (Yunnan, Marlipo)	KC952338	
Aralia racemosa L.[3]	Wen 7291 (US)	USA (Wisconsin, Menominee)	GU054615	
Aralia stellata (King) J. Wen[3]	Maxwell 03-505 (US)	Thailand (Doichiang Dao, Doi Luang Valley)	GU054650	
Aralia vietnamensis Ha[3]	Shui 81844 (US)	China (Yunnan, Lvchun)	GU054666	
Brassaiopsis cf. *ficifolia* Dunn[2]	N.T. Vinh HAL 4581 (HN)	Vietnam (Thanh Hoa)	EF152169	
Brassaiopsis ficifolia Dunn	Wen 5933-14 (F)	Vietnam (Ha Giang)	AF551722	
Brassaiopsis glomerulata (Blume) Regel[2]	Wen 5064 (F)	China (Yunnan)	AY256901	
Brassaiopsis glomerulata (Blume) Regel[5]	Wen 5839 (US)	Vietnam (Lao Cai)	KF591483	
Brassaiopsis glomerulata (Blume) Regel[1]	Lowry 4839 (MO)	Vietnam	AY304789	
Brassaiopsis grushvitzkyi J. Wen, Lowry & H.T. Nguyen[2]	Wen 5864-2 (F)	Vietnam (Ha Giang)	AF551728	
Brassaiopsis hainla (Buch.-Ham. ex D. Don) Seem.[1]	Wen 4905 (F)	Nepal (Godawari)	AY389028	
Brassaiopsis hispida Seem[2]	Wen 5031(F)	China (Yunnan, Dulongjiang)	EF152170	
Cussonia gamtoosensis Strey[6]	Philipson 5623 (MO)	South Africa	MK978526	
Cussonia paniculata Eckl. & Zeyh.[6]	Philipson 5612 (MO)	South Africa	AY389032	
Dendropanax sessiliflorus (Standl. & A.C. Smith) A.C. Smith[2]	Wen 7002 (F)	Costa Rica (Puntarenas Prov.)	EF152174	
Dendropanax trifidus (Thunb.) Makino[2]	Wen 2461 (CS)	Japan (Tokyo)	AF242238	
Eleutherococcus sessiliflorus (Rupr. & Maxim.) S.Y. Hu[2]	Wen 3131 (CS)	China (Jilin)	AF242227	
Harmsiopanax ingens Philipson	Wen 10749 (US)	Indonesia (Papua, Jayawijaja)	JX106275	
Heptapleurum arboricola Hayata	Plunkett 1958 (NY)	USA	MK978569	
Heptapleurum arboricola Hayata	Wen 9448 (US)	China (Taiwan, Nantou)	KC952364	
Heptapleurum arboricola Hayata	Wen 6295 (US)	China (Yunnan, Baoshan)	GU054626	*Schefflera arboricola* (Hayata) Merr.[3]
Heptapleurum bengalense (Gamble) Esser	Wen 10531 (US)	China (Yunnan, Gejiu)	KC952345	*Schefflera bengalensis* Gamble[4]
Heptapleurum brevipedicellatum (Harms) Lowry & G. M. Plunkett	Lowry 4931 (MO)	Vietnam	MK978574	*Schefflera brevipedicellata* Harms[6]
Heptapleurum brevipedicellatum (Harms) Lowry & G. M. Plunkett	Lowry 6550 (MO)	China (Yunnan)	MK978575	*Schefflera brevipedicellata* Harms[6]

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TABLE S1. (Continued)

Taxa	Voucher	Country (Locality)	ITS	Names used on Sequence
Heptapleurum brevipedicellatum (Harms) Lowry & G. M. Plunkett	Plunkett 1998 (NY)	China (Yunnan)	MK978573	*Schefflera brevipedicellata* Harms[6]
Heptapleurum delavayi Franch.	Wen 5021 (F)	China (Sichuan)	EF152176	*Schefflera delavayi* (Franch.) Harms[2]
Heptapleurum heptaphyllum (L.) Y. F. Deng	Wen 6165 (US)	Vietnam (Ninh Binh, Bavi)	GU054641	*Schefflera heptaphylla* (L.) Frodin[3]
Heptapleurum heptaphyllum (L.) Y. F. Deng	Lowry 4941 (MO)	Vietnam	AY955459	*Schefflera heptaphylla* (L.) Frodin[6]
Heptapleurum heptaphyllum (L.) Y. F. Deng	Wen 8452 (F)	China (Yunnan)	MK978612	*Schefflera heptaphylla* (L.) Frodin[6]
Heptapleurum heptaphyllum (L.) Y. F. Deng	Plunkett 2050 (NY)	Vietnam	MK978611	*Schefflera heptaphylla* (L.) Frodin[6]
Heptapleurum karsticola* Kongx., Tak.Yamam. & Tagane, *sp. nov.	Tagane *et al.* Z1201 (FOF)	Laos (Khammouane, Khounkham)	PV821477	
Heptapleurum leucanthum (R.Vig.) Y.F.Deng	Wen 7369 (US)	Thailand (Chiang Mai, cult.)	KC952367	*Schefflera leucantha* R. Vig.[4]
Heptapleurum leucanthum (R.Vig.) Y.F.Deng	Wen 5028 (F)	China (Yunnan, Baoshan)	AY389060	*Schefflera yunnanensis* H. L. Li[1]
Heptapleurum oblongum (Craib) G. M. Plunkett & Lowry[6]	Plunkett 2036 (NY)	Vietnam	MK978632	
Heptapleurum pauciflorum (R. Vig.) Y. F.Deng	Wen 10594 (US)	China (Yunnan, Hekou)	KC952342	*Schefflera pauciflora* R. Vig.[4]
Heptapleurum petelotii (Merr.) G. M. Plunkett & Lowry	Wen 10918 (US)	Vietnam (Ninh Binh, Cuc Phuong)	KC952380	*Schefflera petelotii* Merr.[4]
Heptapleurum vidalianum (C. B. Shang) G. M. Plunkett & Lowry	Wen 10948 (US)	Vietnam (GuangNam, Ba Na)	KC952377	*Schefflera vidaliana* C. B. Shang
Schefflera candelabrum Baill.[1]	Lowry 4726 (MO)	New Caledonia	AF229728	
Heptapleurum wardii (C. Marquand & Airy Shaw) G. M. Plunkett & Lowry	Wen 9224 (US)	China (Xizang, Linzhi)	KC952332	*Schefflera wardii* Marquand & Airy Shaw[4]
Heptapleurum sp.	Shui 71007 (US)	China (Yunnan, Mile)	KC952370	*Schefflera* sp.[4]
Heteropanax fragrans (Roxb.) Seem.[2]	Wen 2213 (CS)	China (Guangdong)	AF242242	
Heteropanax fragrans (Roxb.) Seem.[4]	Pathak 4442 (US)	India (Arunachal Pradesh)	KC952400	
Oplopanax elatus (Nakai) Nakai[3]	Wen 5418-11 (US)	China (Jilin, Wusong)	GU054662	
Osmoxylon novoguineense (Scheff.) Becc[6]	Lorence 8157 (PTBG)	Hawaii (cultivated)	AF229726	
Osmoxylon orientale (Guillaumin) B.C.Stone[6]	Plunkett 1858 (NY)	Vanuatu	MK978543	
Panax bipinnatifidus Seem.	Li 714	China (Yunnan, Gongshan)	KU246152	
Panax trifolius L.[3]	Wen 10099 (US)	USA (Maryland, Baltimore)	GU054701	
Panax wangianus S. C. Sun	Wen 12167	China	KU246151	

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TABLE S1. (Continued)

Taxa	Voucher	Country (Locality)	ITS	Names used on Sequence
Raukaua anomalus (Hook.) A.D.Mitch.[6]	Mitchell CHR-527931 (CHR)	New Zealand	MK978544	
Raukaua edgerleyi (Kirk) Seem.[6]	Plunkett 2191 (NY)	New Zealand	MK978545	
Schefflera digitata J. R. Forst. & G. Forst.[1]	Mitchell s.n. (CHR 485642)	cultivated, Christchurch, New Zealand	U63188	
Schefflera pseudocandelabrum R. Vig.[1]	Lowry 4795 (MO)	New Caledonia	AY389054	
Schefflera vieillardii Baill.	Lowry 4747 (MO)	New Caledonia	AY389059	
Schefflera vitiensis (A.Gray) Seem.[3]	Lowry 5497 (MO)	Fiji	AY955489	
Schefflera vitiensis (A.Gray) Seem.[6]	Plunkett 2245 (NY)	Fiji	MK978682	
Seemannaralia gerrardii (Seem.) R.Vig.[6]	Philipson 5471 (MO)	South Africa	AY389062	
Sinopanax formosanus (Hayata) H. L. Li[3]	Wen 9390 (US)	China (Taiwan, Kaohsiung)	GU054628	
Tetrapanax papyrifer (Hook.) K. Koch[3]	Wen 10135 (US)	Indonesia (West Java)	GU054663	
Tetrapanax papyrifer (Hook.) K. Koch[4]	Wen 9431 (US)	China (Taiwan, Renai)	KC952336	
Trevesia lateospina Jebb[2]	Wen 7480 (F)	Thailand (Chiangmai)	EF152172	
Trevesia lateospina Jebb[3]	Wen 7480-1 (US)	Thailand (Lampang, Muang Bahn)	GU054664	
Trevesia laotica* Kongx., Soulad. & Tagane, *sp. nov.	Tagane *et al.* Z1168 (FOF)	Laos (Bolikhamxai, Nam Kading NPA)	PV821478	
Trevesia palmata (Roxb. Ex Lindl.) Vis.[4]	Wen 8460 (US)	China (Yunnan, Hekou)	KC952333	
Trevesia palmata (Roxb. exLindl.) Vis.[1]	Hao 901 (F)	China (Guangdong, Guangzhou)	AF242247	
Trevesia palmata (Roxb. Ex Lindl.) Vis.	Wen 5669 (US)	China (Yunnan)	KF591488	
Trevesia palmata (Roxb. Ex Lindl.) Vis.	Plunkett 1329 (WS)	cultivated, New York Botanical Garden	MK978685	
Trevesia sphaerocarpa Grushv. & Skvortsova[2]	N.T. Vinh HAL 4582 (HN)	Vietnam (Thanh Hoa)	EF152173	
Trevesia sundaica Miq[2]	Wen 6222 (F)	Indonesia	AF551732	
Trevesia vietnamensis J. Wen & P.K. Lôc[2]	N.T. Vinh HAL4579 (HN)	Vietnam (Thanh Hoa)	EF152171	
Outgroup				
Pittosporum illicioides Makino[4]	Wen 8486	China (Zhejiang, Anji)	JX106283	

Note: [1]Sequences of taxa from Plunkett *et al*. (2004); [2]Wen *et al*. (2007); [3]Li & Wen (2013); [4]Li & Wen (2014); [5]Valcarcel *et al*. (2014); [6]Plunkett *et al*. (2019); bold taxa are new sequences generated from the present study.