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Diospyros phengklaii (Ebenaceae), a new species from south-western Thailand

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ABSTRACT

Diospyros phengklaii Duangjai, Sinbumroong & Suddee is described and illustrated. It is a species of tree only known from Bang Saphan District, Prachuap Khiri Khan Province, upper Peninsular Thailand. Phylogenetic evidence from multiple plastid DNA sequences supports *D. phengklaii* as a distinct taxon and as a member of *Diospyros* clade XI *sensu* Duangjai *et al.* (2009).

KEYWORDS: *Diospyros*, morphology, new species, phylogenetics, Prachuap Khiri Khan, taxonomy.

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INTRODUCTION

The genus *Diospyros* is the largest genus in the Ebenaceae and contains over 600 species distributed in the tropics and subtropics (Wallnoefer, 2001; Duangjai *et al.*, 2006; 2009). Approximately 300 species occur in the Asia-Pacific region (Bakhuizen, 1936–1955; Singh, 2005). In Thailand, more than 60 species have been recorded, of which over half occur in south-western and peninsular Thailand (Phengklai, 1981; 2005).

During floristic exploration in the tropical evergreen forests of Prachuap Khiri Khan, the second author collected specimens of an unfamiliar species of *Diospyros*. It has narrowly cylindrical fruits resembling the fruit of *Carica papaya* 'Khaekdam'. After careful consultation of the literature and herbarium specimens, supported by phylogenetic analyses using multiple plastid DNA sequences, we concluded that these specimens are morphologically distinct from any known species. Therefore, a new species is described below.

MATERIALS AND METHODS

The herbarium specimens of *Diospyros* (including type specimens, or digital images) conserved at BK, BKF, K, L, and P were studied. The material of the new species was compared with the relevant literature (Hiern, 1873; Bakhuizen, 1936–1955; Ng, 1978; 2001; Phengklai, 1981; 2005; Lee *et al.*, 1996; Huang *et al.*, 2015; Udayan *et al.*, 2015). The morphological description of the new species is based on the type specimens, *Sinbumroong 56-2* and on field surveys during 10 October 2012 and December 2013 which the second author visited the type locality 6 times. The conservation status of the new species was evaluated following the IUCN Red List Categories and Criteria (IUCN, 2012).

To clarify the taxonomic status and phylogenetic placement of the new species, we conducted phylogenetic analyses based on eight plastid regions (*rbcL*, *atpB*, *matK*, *ndhF*, *trnK* intron, *trnL* intron, *trnL-trnF* spacer, and *trnS-trnG* spacer). The sampling consists of 150 accessions representing 120 species of *Diospyros*, most of them except the new species we obtained DNA sequences from previous study of the first author (Duangjai *et al.*, 2009). Outgroup sampling included members of the other genera of Ebenaceae, i.e. *Euclea*, *Lissocarpa* and *Royena*. DNA extraction, PCR amplification, and sequencing of the new species using procedures outlined in Duangjai *et al.* (2009). Phylogenetic analyses were performed using both maximum parsimony (MP) and Bayesian inference (BI). DNA sequences of

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eight plastid regions of the new species (voucher *Sinbumroong 56-2*) were submitted to the Genbank (Genbank accession numbers MG924493 for atpB, MG924494 for ndhF, MG924495 for *rbcL*, MG924496 for *trnK* and *matK*, MG924497 for *trnL* intron and *trnLF* spacer, MG924498 for *trnSG* spacer).

TAXONOMY

Diospyros phengklaii Duangjai, Sinbumroong & Suddee, **sp. nov.**

Diospyros phengklaii resembles *D. filipendula* in the leaves with dense brown hairs, 4–5-merous flower with a salver-shaped corolla tube, and with long pedicel. It differs from that species by the bigger fruit, fruit narrowly cylindrical instead of ellipsoid, ovary (8–)10-locular rather than 4-locular. Type: Thailand, Prachuap Khiri Khan, Bang Saphan, Thong Mongkhon, E543764.58 N12317473.46, 25 Mar. 2013, *Sinbumroong 56-2* (holotype **BKF** [213821], isotypes **BK**, **BKF** [213822, 213823, 213824], **K**). Figs. 1 & 2.

Small tree, 10–18 m high, up to 65 cm girth at breast height; trunk crooked; outer bark blackish-brown, smooth or scaly and sparsely lenticelled; inner bark thick, yellow and becoming yellowish-brown; sapwood white; branches horizontal, arranged in pseudowhorls; young branchlets green with densely appressed brown hairs; older branchlets blackish-brown, glabrescent, smooth to fissured; canopy dense and round; buds densely covered with appressed brown hairs. *Leaves* alternate; petiole 0.3–0.5 cm long, with dense brown hairs; lamina lanceolate, ovate-lanceolate to elliptic-oblong, 2.3–5.2 × 6.5–15 cm, base rounded or obtuse (rarely cuneate), apex acuminate (rarely acute), margin ciliate then entire, green on both sides, the lower side slightly paler, when very young entirely covered with brown indumentum, soon glabrescent, in the adult stage glabrous except for the shortly hairy midrib on the lower surface; midrib impressed above, raised below, covered with dense brown hairs, secondary veins (7–)8–10(–11) pairs, slightly impressed above, raised below, faintly ascending towards apex, anastomosing, tertiary veins inconspicuous, occasionally minutely translucent dotted. *Male flowers* unknown. *Female flowers* only known in bud, solitary, (4–)5-merous, pedicels 0.8–1.8 cm, with appressed brown hairs. *Calyx* entirely covered with dense appressed hairs, lobes triangular, 2–3 mm long. *Corolla* salver-shaped, 12–15 mm long, divided to middle. *Ovary* velutinous, (8–)10-locular; style single, short; stigma shortly bifid. Staminodes absent. *Fruits* green (yellow when mature), narrowly cylindrical (resembling the fruit of *Carica papaya* 'Khaekdam'), 4.4 –7.5 × 9.5–15 cm, pendulous, apex acute, nearly circular in cross section, smooth, sparsely pubescent, (8–)10-locular; seeds (8–)10, endosperm smooth, calyx persistent at the base of the fruit, lobes triangular, not reflexed, not undulate or plicate, 3–4 × 3–3.5 mm, fruit stalk 8–18 mm long.

Thailand.— SOUTH-WESTERN Prachuap Khiri Khan [Bang Saphan, Thong Mongkhon, *Sinbumroong 56-2* (**BK**, **BKF** (4 specimens), **K**)].

Vernacular.— Maphlap phengklai (มะพลับเพ็งคล้าย).

Distribution.— Endemic to south-western Thailand, only known from Bang Saphan District, Prachuap Khiri Khan Province; may also be found in Myanmar.

Ecology.— Tropical evergreen forest along stream; ca 200 m alt.

Conservation status.— Endangered ENB1ab(iii) (IUCN, 2012). This species is currently known only from one locality with only 13 individuals found. The locality found is close to a village which is subject to human disturbance.

Phenology.— Flowering and fruiting all year round.

Etymology.— Named in honour of Dr Chamlong Phengklai, a senior botanist at the Forest Herbarium (BKF).

Phylogenetic placement.— Aligned length of the combined dataset (*rbcL*, *atpB*, *matK*, *ndhF*, *trnK* intron, *trnL* intron, *trnL-trnF* spacer, and *trnS-trnG* spacer) was 8237 bp, of which 1875 sites were variable and 1012 were maximum parsimony informative. Both maximum parsimony and Bayesian inference analyses were generally congruent so only the Bayesian analysisis presented here (Fig. 3). Overall phylogenetic relationships and the clades recovered within genus *Diospyros* in this study are congruent to those previously published (Duangjai *et al.*, 2009). The Asian species of *Diospyros* are found in eight different major clades (i.e. I, III, V, VI, VII, IX, X, and XI) and most of them and the new species, *D. phengklaii*, belong to *Diospyos* clade XI (Fig. 3).



Figure 1. *Diospyros phengklaii* Duangjai, Sinbumroong & Suddee. A. fruiting branchlet; B. female flower; C. young fruit (A from *Sinbumroong 56-2* (BKF), B–C from photographs taken on 10 October 2012). Scale bars: A–C = 2cm. Drawn by Wanwisa Bhuchaisri.

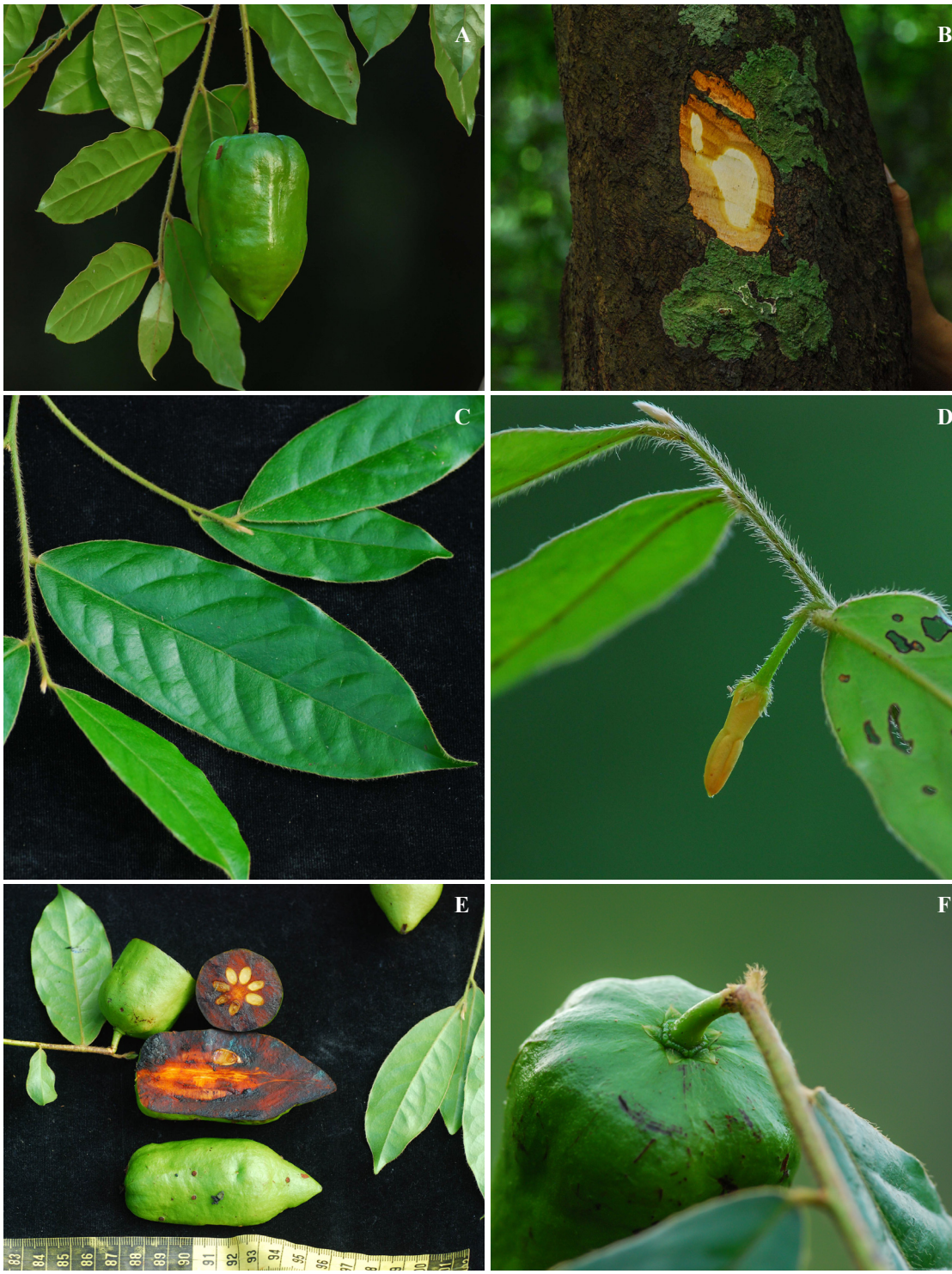


Figure 2. *Diospyros phengklaii* Duangjai, Sinbumroong & Suddee. A. fruiting branchlet; B. stem & bark; C. leaves; D. flower bud of female flower; E–F. fruits. Photographs were taken by the second author on 10 October 2012 (B–F) and 25 March 2013 (A).

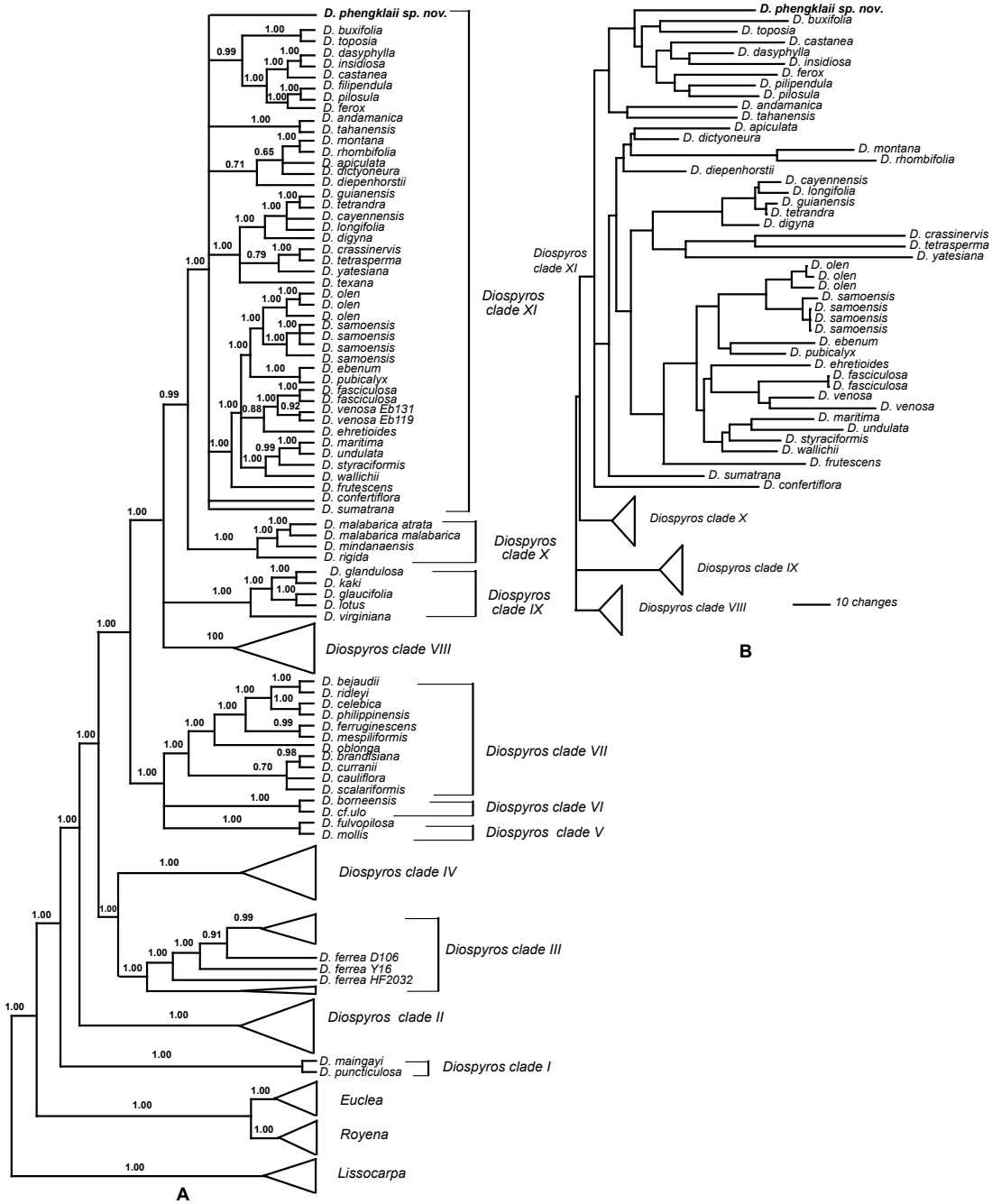


Figure 3. Phylogenetic position of *Diospyros phengklaii* Duangjai, Sinbumroong & Suddee (in bold font) inferred from Bayesian analysis of the combined data matrix. A. 50 % majority-rule tree. Posterior probability values (PP) higher than 0.50 are given above branches. B. Bayesian phylogram of *Diospyros* clade XI.

Moreover, DNA sequences of the new species show substantial differences from *D. filipendula* and other 24 Asian *Diospyros* in clade XI, ascertaining its recognition as distinct taxa (Fig. 3B).

Notes.— *Diospyos phengklaii* is similar in morphology to *D. filipendula* however results from phylogenetic analyses revealed that these two species are not closely related.

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