Nordic Journal of Botany 000: 001–006, 2013
doi: 10.1111/j.1756-1051.2013.00304.x,

Subject Editor: John Parnell. Accepted 8 September 2013

Trachycarpus ravenii sp. nov. (Arecaceae, Corypheae) from central Laos

Leonid V. Averyanov, Khang Sinh Nguyen, Tien Hiep Nguyen, The Van Pham and Shengvilai Lorphengsy

L. V. Averyanov (av_leonid@mail.ru), Komarov Botanical Inst., Russian Acad. of Science, Prof. Papov Srt. 2, RU-197376 St Petersburg, Russia. – K. S. Nguyen, Inst. of Ecology and Biological Resources, 18 Hoang Quoc Viet, Cau Giay, Ha Noi, Vietnam. – H. T. Nguyen, Center for Plant Conservation, no. 25/32, Lane 191, Lạc Long Quân Rd, Nghia Dô, Cau Giay District, Ha Noi, Vietnam. – T. V. Pham, Inst. of Ecology and Biological Resources, 18 Hoang Quoc Viet, Cau Giay, Ha Noi, Vietnam. – S. Lorphengsy, National Science Council Dept, National Herbarium of Laos.

A new species *Trachycarpus ravenii* discovered in Kasi district, Vientiane province of central Laos is described and illustrated. Morphologically, it is closest to *T. oreophilus* and *T. princeps*, but differs by having a shorter stem of mature plants; glabrous, dull green petiole; almost circular leaf blade, waxy bluish–white abaxially; narrow leaf segments with narrow free lobes densely adpressed to each other, as well as in oblique-round apices of median leaf segments.

Trachycarpus H. Wendl. is a small genus of Asian fan palms (Arecaceae tribe Corypheae) occurring from the Himalayas to eastern China and Indochina (Gibbons and Spanner 1998, Govaerts and Dransfield 2005, Henderson 2009, World Checklist of Monocotyledons). Some of nine previously known species of the genus are cultivated as ornamental plants all over the world. Meanwhile, the distribution and habitat conditions of some of the species remains unclear (Gibbons and Spanner 1998, Henderson 2009). The most common species in cultivation, *T. fortunei* (Hook.) H. Wendl., reported tentatively from Himalayas, China and Japan, has never been observed in natural habitats. Other species of *Trachycarpus* were discovered as local endemics with very limited distributions often comprising few or even single known localities. The highest concentration of such endemics is observed in the eastern Himalayas where four species are recorded: *T. latisectus* Spanner, Noltie & Gibbons, *T. martianus* (Mart.) H. Wendl., *T. takil* Becc., *T. ukhrulensis* M. Lorek & K. C. Pradhan. Two species extend to the east and are known as strict endemics of southwestern China: *T. nanus* Becc. and *T. princeps* Gibbons, Spanner & S. Y. Chen (Gibbons et al. 1995, Shengji et al. 2010). One local endemic species is found in northwestern Thailand: *T. oreophilus* Gibbons & Spanner (Gibbons and Spanner 1997) and another in northern Vietnam: *T. geminisectus* Spanner, Gibbons, V. D. Nguyen & T. P. Anh (Gibbons et al. 2003). The distribution of the newly discovered species, *T. ravenii*, expands the area occupied by the genus in the south and southeastern directions. This species was observed in a very restricted limestone area in central Laos (Vientiane province) representing an isolated and extreme southern extension of the area occupied by the genus *Trachycarpus*. The new species differs from known *Trachycarpus* species and is described below as a new species for science.

Trachycarpus H. Wendl.

Type: *T. fortunei* (Hook.) H. Wendl. (*Chamaerops fortunei* Hook.).

10 species. Nepal, Bhutan, northern India, southwestern China, Myanmar, northwestern Thailand, central Laos, northern Vietnam.

Trachycarpus ravenii Aver. & K. S. Nguyen sp. nov. (Fig. 1–2)

Type: Vientiane Prov., Kasi Distr., Thong Mout village, around point 19°25′00.9″N, 102°08′38.0″E. Cliffy outcrops of rocky limestone on forestless mountain tops among secondary grasslands at elevation 1700 m a.s.l., male specimen, 22 Mar 2013, L. Averyanov, N. S. Khang, S. Lorphengsy, LA-VN 725 (holotype: LE, isotypes: NUOL, NHOL, Herbarium of the Center for Plant Conservation, Hanoi).

Etymology

This superb, kinglike tree is named after Prof. Peter H. Raven in recognition of the truly outstanding and essential role that

Figure 1. *Trachycarpus ravenii* sp. nov. Male specimen, d-exsiccates of Vietnamese flora 200/LA-VN 725. All photos and design by L. Averyanov.

Figure 2. *Trachycarpus ravenii* sp. nov. Female specimen, d-exsiccates of Vietnamese flora 201/LA-VN 726. All photos and design by L. Averyanov.

this noble person has played in the organization and support of field botanical explorations and new species discoveries within unexplored areas of Indochina.

Description

Erect unbranched dioecious fan palm. Stem solitary, straight or slightly ascending, to 6 m tall and 15 cm in diameter, with few insignificant remnants of leaf sheaths near apex or entirely naked, ringed. Leaves (15)18–25(30), palmate, forming a compact, dense hemispherical to almost spherical crown; old, dry, marcescent leaves hang downward, form a dense, broad skirt embracing an almost naked trunk. Leaf petiole slender, (40)45–55(60) cm long, triangular in cross section, 3.0–1.5 cm in diameter, glabrous, dull green, straight to slightly curved, at base strongly recurved, with few stiff, rigid, almost straight bristles; leaf sheaths rather short, fibrous; old sheaths forming a mass of interwoven fibers, fibers at apex of sheath on younger leaves forming a short ocrea; petiole margins with very small blunt teeth to almost unarmed. Leaf blade semicircular to almost circular in outline, 0.7–1.0 m long and wide, dark green adaxially, waxy bluish–white abaxially, divided to about half of their length into 50–60 stiff segments; hastula triangular-ovate, obtuse, 2.2–3.0 cm long and wide, with entire, light yellowish–brown, coriaceous margin. Leaf segments arranged in one plane, producing a nearly flat leaf profile, conduplicate, 1.5–2.0 cm wide, their lobes densely adpressed to each other toward the apex; apex of lobes bi-lobulate, lobules acute to strongly oblique roundish, often with small reflexed seta placed between lobules; secondary veinlets parallel, transverse veinlets almost invisible. Inflorescences (1)2–5(6), interfoliar. Male inflorescences with short peduncle, erect, 0.3–0.5 m long, oval in cross section, 8–12 cm wide, enveloped at base by 3–4(5) bracts, branched to 3–4 orders; rachillae 1–3 cm; inflorescence bracts base tubular, ovate, leathery, coriaceous, yellowish to chestnut-brown (when old), shortly hairy, concave, 20–30 cm long, (6)8–12 cm wide; flowers densely arranged, subsessile, white, not widely opening, globose, 2–3 mm in diameter, sepals ovate-triangular, 1.5–2.0 mm long, shortly connate at base; petals oblong-orbicular, twice as long as sepals; stamens 6, exceeding the petals; anthers bean-shaped, 1.2–1.4 mm long; pistillodes insignificant, less than half the length of stamens. Female inflorescences erect or spreading, robust, 0.8–1.2 m long, 15–20 cm wide, branched to 3 orders; rachillae 1–8 cm long; inflorescence rachis oval in section, with (4)6–8 broad sterile bracts; inflorescence bracts chestnut-brown, concave, coriaceous, 10–20(25) cm long, 5–8(10) cm wide; flowers solitary, subtended by minute triangular bracteoles. Old fruits brown to dull black, grooved, 1-seeded, almost globular, 7–8(10) mm in diameter.

Ecology

Primary and secondary forests, secondary scrub and grasslands on rocky highly eroded solid, crystalline limestone at elevations 1600–1800 m a.s.l., commonly on very steep cliffy rocky north-faced outcrops near mountain tops. Flowering in March to June and fruiting in September to October?

Table 1. Morphological discriminative features of *Trachycarpus* species native in Indochinese area.

Species feature	*T. ravenii* sp. nov.	*T. oreophilus*	*T. princeps*	*T. geminisectus*
Native country	central Laos	northwest Thailand	China, southwest Yunnan	north Vietnam
Native habitat elevation (m)	1700	1700–2150	1500–1900	1100–1600
Stem height (m)	± 6	± 12	7–10	1–2(3)
Character of trunk surface below apex	naked to slightly furry	naked	naked to slightly furry	densely furry
Number of leaves in canopy	(15)18–25(30)	± 20	18–26	10–12
Petiole length (cm)	(40)45–55(60)	50–60	60–90	± 85
Petiole margin	finely toothed to almost unarmed, glabrous	finely toothed, finely tomentose	finely toothed, finely tomentose	finely toothed, glabrous
Leaf sheath length	short	short	moderate	long
Ocrea length	very short	very short	moderate	large
Hastula length (cm)	2.2–3.0	± 2.5	?	± 1.5
Leaf blade form	almost circular, flat	circular or broader than long, flat	almost half-circular, slightly cup-shaped	circular or broader than long, flat
Leaf diameter (m)	0.7–1.0	0.7–1.0	0.60–0.75	0.85–1.30
Abaxial leaf surface character	waxy bluish–white	green to slightly glaucous	waxy white	glaucous-green to whitish waxy below
Number of leaf segments	50–60	60	45–48	± 40
Leaf segment junction	regularly split and separate	regularly split and separate	regularly split and separate	joined by 2–3 stuck together
Leaf lobe width (cm)	1.5–2.0	4–6	2–4	± 4
Character of free part of leaf lobes	densely adpressed to each other	diverging	diverging	diverging to almost flat
Apex of leaf segments lobules	acute to oblique-round	acute	acute to obtuse	acute
Hairiness of young inflorescence bracts	finely tomentose	finely tomentose to subglabrous	finely tomentose to subglabrous	finely tomentose

Distribution
Central Laos, Vientiane province, Kasi district, Thong Mout and Namken villages. Local endemic.

Similar species
Discovered plant clearly differs from all previously known *Trachycarpus* species. Morphologically, it is more or less close to three species occurring in Indochina: *T. geminisectus*, *T. oreophilus* and *T. princeps. Trachycarpus ravenii* distinctly differs from *T. geminisectus* in having tall, naked (not densely furry) stems, a large number of leaves with a small insignificant leaf sheath and ocrea, large hastula and narrow leaf segments. The new species differs from *T. oreophilus* and *T. princeps* in having a much shorter stem on mature plants; a glabrous, dull green petiole; an almost circular leaf blade with waxy bluish–white abaxially; narrow leaf lobes with narrow free lobules densely adpressed to each other, as well as oblique-round apices of median leaf segments. A comparison of selected morphological and taxonomic features of *Trachycarpus* species native to Indochina is shown in Table 1.

Conservation status
A number of earlier studies confirmed that all *Trachycarpus* species apart from *T. fortunei* are more or less seriously threatened and very close to full extinction in the wild (Gibbons and Spanner 1998, Kholia 2009, Kholia and Rajbhawan 2010). All of these species were recorded as local endemics whose limited distribution may be caused by the widespread and nearly complete destruction of primary plant communities in their native ranges. Degradation of primary native habitats continues across the distribution of the genus and is the main factor of *Trachycarpus* species threathened status and extinction. This is true for the survival status of *T. ravenii* as well. The estimated total known area of its distribution is less than 100 km^2 with no more than 100 observed mature individuals tentatively qualifying this palm as 'Critically Endangered' (CR) according IUCN criteria B1, C2 ai, aii and D (IUCN 2012). Conservation of all populations of this relictual species represents the highest priority of nature protection activity in central Indochina. As a first step, *T. ravenii* may be effectively protected in-situ in suitable habitats within the highest limestone formations in Indochina–Phachao Mountain. Establishing a protected area at Phachao Mountain will also protect large stands of intact, upper elevation limestone forests containing a rich diversity of native endemic species. *Trachycarpus ravenii* is an attractive tree providing a unique characteristic to the upland limestone landscape of central Laos.

Discussion

Trachycarpus ravenii is an integral native element of the outstandingly rich and very specific limestone flora found on the rocky tops of highly eroded ancient table-like

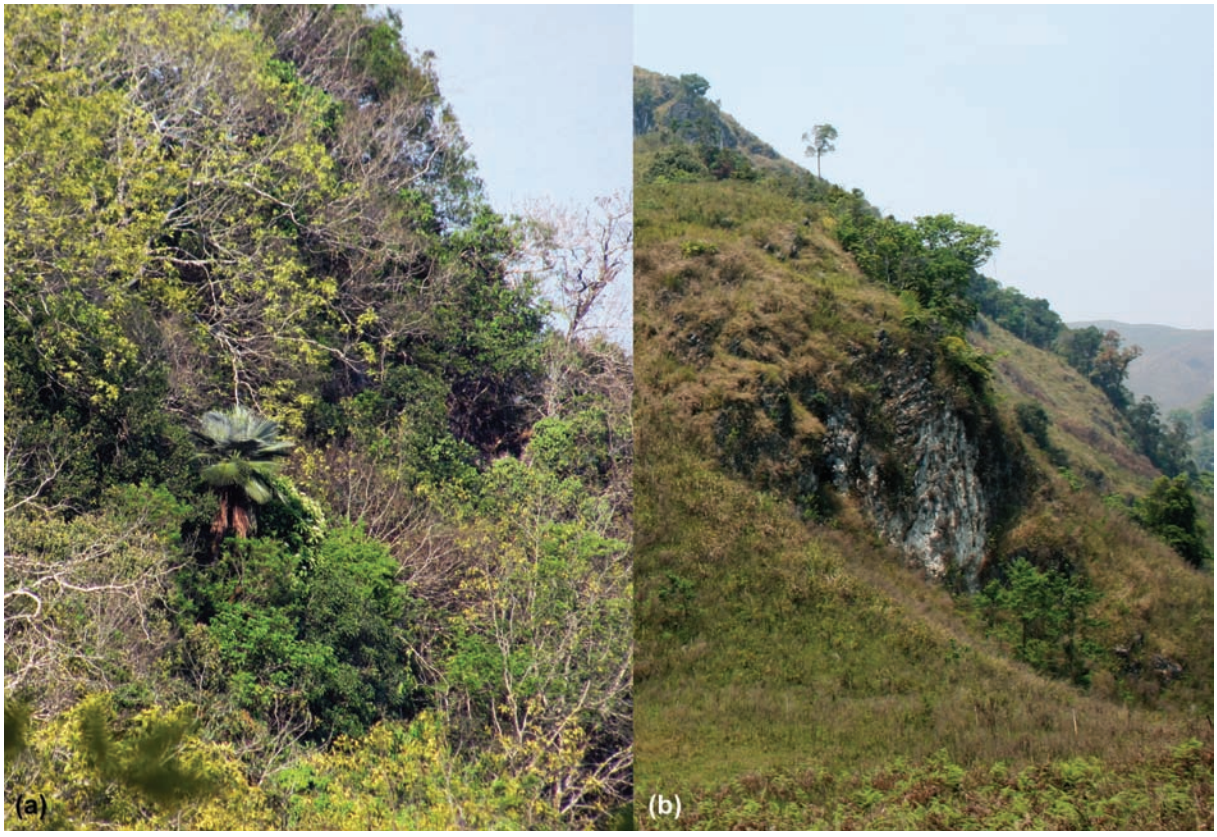

Figure 3. Natural habitats of *Trachycarpus ravenii* sp. nov. in central Laos (Vientiane province, Kasi district). (a) primary intact semideciduous forest on steep slopes of Phachao Mountain at elevation 1650–1700 m a.s.l. (Namken village area), (b) forestless mountain slopes with rocky limestone outcrops among secondary grasslands and open secondary scrub at elevation about 1700 m a.s.l. (Thong Mout village area). All photos by N. S. Khang.

formations with very steep, cliffy slopes found at elevations of 1600–1800 m a.s.l. and, probably, higher. In this habitat, the plant grows as a scattered tree within primary evergreen and semi-deciduous, rather short, gnarled forest appearing as an emergent above more or less closed forest canopy tier (Fig. 3a). In all studied localities the plant was observed as a petrophilous tree on very steep rocky slopes and on sub-vertical cliffs near the tops of mountains or ridges. *Trachycarpus ravenii* is also found surviving in secondary plant communities after primary forest degradation like many of its congeners (Gibbons and Spanner 1998, Kholia 2009, Kholia and Rajbhawan 2010). In a number of localities plants were observed as lone remnant trees or in small groups of a few trees in wide, often, completely deforested highland landscapes among secondary grasslands and short scrub (Fig. 3b). In such conditions trees survive only on rocky cliffy outcrops of northern exposure providing the habitat additional shade and humidity.

Trachycarpus ravenii is undoubtedly one of the most beautiful and majestic representatives of the genus. It's large, noble bluish–white leaves makes this plant highly desirable for cultivation as ornamental palm. It is expected to grow well in tropical and subtropical countries with a dry 'mediterranean' climate. The natural dry, rainless winter season in its native habitats lasts from October–November to May. Temperatures during this time fluctuate between 12–18°C, and during the coldest nights of January temperatures may fall to 5° or even 0°C. Summer in June–September is hot (25–35°C) with torrential rains. Soils are developed from solid crystalline limestone gravel and rocks and newer remains wet due to karstic erosion of mother rocks. Understanding how to successfully cultivate this beautiful species in- and ex-situ represents a very important initial step to successful protection.

Additional specimens examined (paratypes)

Vientiane Prov., Kasi Distr., Thong Mout village, around point 19°25′00.9″N, 102°08′38.0″E. Cliffy outcrops of rocky limestone on forestless mountain tops among secondary grasslands at elevation 1700 m a.s.l., female specimen, 22 Mar 2013, Averyanov L., N. S. Khang, S. Lorphengsy, LA-VN 726 (LE, NUOL, NHOL, Herbarium of the Center for Plant Conservation, Hanoi). Vientiane Prov., Kasi Distr., Namken village, Phachao Mt, around point 19°18′45.5″N, 102°22′31.4″E. Primary broad-leaved evergreen forest on very steep rocky slopes of remnant mountain composed of highly eroded solid crystalline limestone at elevations between 1500–1750 m a.s.l. 24 Mar 2013, Averyanov L., N. S. Khang, S. Lorphengsy LA-VN 793a (photos: LE, NUOL, Herbarium of the Center for Plant Conservation, Hanoi).

Acknowledgements – The authors would like to thank the organizers of the field work, authorities and staff members of the Faculty of Science, National University of Laos: Dr S. Bounphanmy, Dr V. Lamxay, Mr K. Inkhavilay, Mr S. Lanorsavanh and Mrs K. Chantthavongsa. The field work was financially supported from the USA National Geographic Society research program Flora of relict karstic formation of central Laos (Vientiane province, Vang Vieng and Kasi districts) 2012–2013 (grant no. 9141-12) and Mohamed bin Zayed Species Conservation Fund Investigation of the rare gymnosperm species of Laos. We are also grateful to Dr Daniel Harder for his review and improvement of the text language.

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