

**Occurrence of *Clerodendrum japonicum* (Lamiaceae) and *Phoenix loureiroi* (Arecaceae) in Bhutan**

Phub Gyeltshen<sup>1,2,\*</sup>, Dhan Bdr. Gurung<sup>1</sup>, Rinchen Dorji<sup>2</sup>, Sangay Tshewang<sup>1,2</sup>, Phuentsho<sup>1,3</sup>,  
Krishna P. Dhimal<sup>1,2</sup>, Dechen Yangdon<sup>1</sup>, Sangay Choden<sup>1</sup>, and Ngawang Dorji<sup>1</sup>

**Abstract**

Occurrence of two species, *Clerodendrum japonicum* var. *japonicum* and *Phoenix loureiroi* var. *pedunculata*, which are poorly known in Bhutan are discussed. Their occurrence in Bhutan is not published in journals except for few incidental sightings noted in social media. These species were collected from Athang Gewog in Wandgüe Phodrang District and Sergithang Gewog in Tsirang District. *Clerodendrum japonicum* var. *japonicum* is similar to variety *C. japonicum* var. *bethuneanum*, but can be distinguished from it by the uniformly red corolla. *Phoenix loureiroi* var. *pedunculata* differs from *P. loureiroi* var. *loureiroi* by the absence of a continuous strip of sclerotic, tannin-filled cells along the leaflet margins, and by its unique geographical distribution. Detailed morphological description, distribution, and ecology along with photographs of the species are provided.

**Keywords:** Arecaceae, *Clerodendrum japonicum* var. *japonicum*, Lamiaceae, *Phoenix loureiroi* var. *pedunculata*, taxonomy

**Introduction**

Bhutan has a very rich and diverse flora, comprising numerous economically important plants such as timber trees and medicinal herbs, and especially many attractive and desirable horticultural groups particularly Orchidaceae

and Ericaceae (Grierson and Long, 1983). More specifically, on account of the multiple biogeographic origins, diverse topography, ecological complexity, and a wide range of climatic and soil conditions support a diverse range of floristic complexes. Yet, substantial portion of Bhutanese flora remains under-collected, and many more taxa are yet to be discovered; numerous species of plants found in Sikkim and Darjeeling are still unknown in Bhutan (Grierson and Long, 1983) today. This presents a gap in our knowledge of the diverse flora of the country, and the lack of recent checklists or revisions of flora of Bhutan prompted this study.

In the Flora of Bhutan, Grierson and Long (1999) described 11 species of *Clerodendrum*

<sup>1</sup> College of Natural Resources, Royal University of Bhutan, Punakha, Bhutan

<sup>2</sup> Department of Forest and Park Services, Ministry of Energy and Natural Resources, Bhutan

<sup>3</sup> National Biodiversity Centre, Serbithang, Ministry of Agriculture and Livestock, Bhutan

\* Corresponding author: [gyeltshenforest@gmail.com](mailto:gyeltshenforest@gmail.com)

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that are known to occur in Bhutan: *Clerodendrum bracteatum* Wall., *Clerodendrum chinense* (Osbeck) Mabb., *Clerodendrum colebrookeanum* Walp., *Clerodendrum indicum* (L.) Kuntze, *Clerodendrum hastatum* Lindl., *C. japonicum*, *Clerodendrum splendens* G.Don, *Clerodendrum thomsoniae* Balf., *Clerodendrum viscosum* Vent. (synonym of *Clerodendrum infortunatum* L.), *Clerodendrum wallichii* Merr. (synonym to *Clerodendrum laevifolium* Blume), and *Clerodendrum serratum* Moon (synonym of *Rotheca serrata* [L.] Steane & Mabb.). Of these, eight species are known to occur in Bhutan, and are distributed in the subtropical and warm broadleaved forest at elevations ranging from 270–2100 m above mean sea level. Two of these species, *C. splendens* and *C. thomsoniae*, are non-native species and are domesticated and cultivated in gardens. *Clerodendrum japonicum* is now separated into two varieties: *Clerodendrum japonicum* var. *japonicum* and *Clerodendrum japonicum* var. *bethuneanum* (H. Low) Wearn & Mabb. (Wearn and Mabblerley, 2011). Both the species are morphologically similar, but the former variety can be distinguished from the latter by its corolla being uniformly red. The variety that is found in Bhutan is identified as *C. japonicum* var. *japonicum*.

Likewise, Noltie (1994) described four species of *Phoenix* species in the flora of Bhutan: *Phoenix loureiroi* Kunth, *Phoenix acaulis* Roxb., *Phoenix rupicola* T.Anderson (Figure 1) and *Phoenix sylvestris* (L.) Roxb. Of these, only *P. rupicola* is known to occur in Bhutan, growing in the ravines, shaded cliffs in subtropical forests, and steep rocky hillsides at elevations between 360–1220 m above mean sea level. It flowers in May–June. However, *P. loureiroi* is found in dry Sal forest and grasslands on lower hills between 300–760 m above mean sea level, and it flowers in November (Noltie, 1994). *Phoenix loureiroi* has now two accepted varieties: *Phoenix loureiroi* var. *loureiroi* and *Phoenix loureiroi* var. *pedunculata* (Griff.) Govaerts (World Checklist of Vascular Plants (WCVP, 2023)). The former variety is distinguished from

the latter variety by the presence of a continuous strip of sclerotic, tannin-filled cells along leaflet margins, discontinuous patches of such cells abaxially in the midrib region (Barrow, 1998), and by its unique geographical distribution. The variety that occurs in Bhutan is identified as *P. loureiroi* var. *pedunculata*. In this report, detailed morphological description, distribution, phenology, and ecology along with colour photographs of the species are provided.

## Materials and Methods

During a recent field survey and data collection for an undergraduate dissertation and botanical exploration in Athang and Sergithang Gewogs in Wangdue and Tsiring Districts from July 2022 to January 2023, two previously scarcely known plant species were found near a stream and in a Chirpine forest. Using the Flora of Bhutan (Noltie, 1994; Grierson and Long, 1999), the species were tentatively identified as *Clerodendrum japonicum* (Thunb.) Sweet and *Phoenix loureiri* Kunth. Noltie (1994), and Grierson and Long (1999) incorporated a brief description of these species in the Flora of Bhutan based on its distribution in Darjeeling and Sikkim states of India, but the occurrence of *C. japonicum* and *P. loureiroi* from Bhutan then was unknown. The present collection of the species from Wangdue district confirms the distribution of species in Bhutan.

Measurements and morphological character assessments of the species were examined, based on fresh materials and dried specimens. They were compared with morphologically similar species by affinities inferred using descriptions (Noltie, 1994; Barrow, 1998; Grierson and Long, 1999; Wearn and Mabblerley, 2011; Deori et al., 2013; WCVP, 2023), online specimens available at Global Biodiversity Information Facility [GBIF] (<https://www.gbif.org/>), digital images in the Bhutan Biodiversity Portal [BBP] (<https://biodiversity.bt/>) and herbarium THIM. Proto-



**Figure 1.** *Phoenix rupicola*. A. Habit; B. Portion of inflorescence with fruits.

logues and images of type specimens were gathered from JSTOR Global Plants (<http://plants.jstor.org>).

The habit and macromorphological characters were photographed with a Nikon D3400 camera, and morphological measurements were taken with a measuring tape and a 15 cm ruler scale. Description was based on specimens collected from the field. A microscope was used to observe the minute morphological parts. The voucher specimens were deposited to the National Herbarium (THIM).

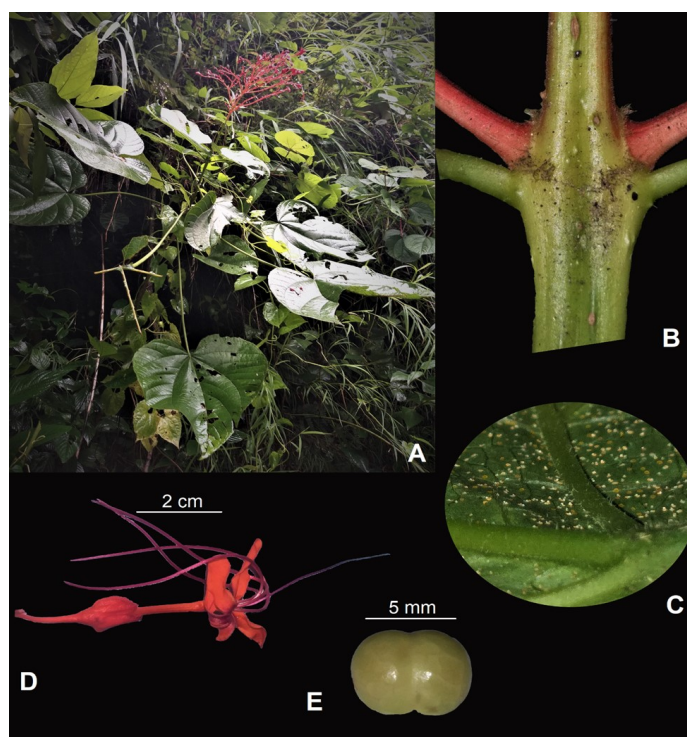
## Results and Discussion

*Clerodendrum japonicum* var. *japonicum*

Synonyms: *Clerodendrum coccineum* H.J.Lam in Verben. Malay. Archip.: 296 (1919). *Clerodendrum occcineum* (Loisel.) D.Dietr. in Syn. Plant. 3: 616 (1842). *Clerodendrum darrisii* H.Lév. in Report. Spec. Nov. Regni Veg. 11: 301 (1912). *Clerodendrum dentatum* (Roxb.) Steud. in Nomencl. Bot., ed. 2, 1: 382 (1840). *Clerodendrum esquirolii* H.Lév. in Repert. Spec. Nov. Regni Veg. 11: 302 (1912). *Clerodendrum imperialis* Carrière in Rev. Hort. (Paris) 46: 110 (1874). *Clerodendrum japonicum* f. *album* (C.Pei) Moldenke

in Phytologia 61: 332 (1986). *Clerodendrum japonicum* var. *album* C.Pei in Mem. Sci. Soc. China 1(3): 144 (1932). *Clerodendrum kaempferi* (Jacq.) Siebold in Verh. Batav. Genootsch. Kunsten 12: 31 (1830). *Clerodendrum kaempferi* f. *album* (C.Pei) Moldenke in Phytologia 61: 398 (1986). *Clerodendrum kaempferi* var. *album* (C.Pei) Moldenke in Phytologia 1: 167 (1935). *Clerodendrum kaempferi* f. *salmonium* Moldenke

in Phytologia 34: 18 (1976). *Clerodendrum leveillei* Fedde ex H.Lév. in Fl. Kouy-Tchéou: 442 (1915). *Clerodendrum scopiferum* Miq. in Fl. Ned. Ind. 2: 881 (1858). *Clerodendrum singalense* Miq. in Fl. Ned. Ind., Eerste Bijv.: 568 (1861). *Clerodendrum squamatum* Vahl in Symb. Bot. 2: 74 (1791).



**Figure 2.** *Clerodendrum japonicum* var. *japonicum*: A. Habit; B. Portion of stem; C. Section of abaxial surface of leaf showing hairs; D. Flower; E. Top view of a fruit.



*Volkameria coccinea* Loisel. in Herb. Amat. Fl. 8: t. 519 (1827). *Volkameria dentate* Roxb. in Fl. Ind. Ed. 3: 61 (1832). *Volkameria kaempferi* Jacq. in Icon. Pl. Rar. 3. t. 500 (1794).

**Type:** *Volkameria japonica* Thunb., Nova Acta Reg. Soc. Sci. Upsal. 3: 203, 208. 1780. Type: Japan. 1691-1692, Kaempfer s. n. (holotype BM-Sloane!), Figure 2.

**Description:** Shrub, up to 4 m tall. Branchlets quadrangular, glabrous, nodes hairy. Leaves phyllotaxy decussate; petioles variable corresponding to leaf size, 2–45 cm long for basal ones, often minutely pubescent, green; blade broadly ovate, 15–30.2 x 18–29.2 cm, apex acute to shortly acuminate, base cordate, margin subentire to shallowly dentate, adaxial surface pubescent, abaxial surface glabrous, with numerous glandular scales, sparsely pubescent on veins, venation palmate, 6–7 pairs. Inflorescence panicle, up to 20–33 cm long, bracteolate, rachis sparsely hairy, red; pedicel 0.8–1.2 cm long. Calyx connate at base, lobes ovate, 9–12.5 x 4.5–8 mm, glabrous, enclosing half of the corolla tube during anthesis. Corolla tube, 2.4–3.0 cm long; lobes elliptic, 12–16 x 4–6 mm, glabrous, red. Stamens 4, exserted, 4–5 cm from the corolla tube. Style exserted, 3.5 cm from the corolla tube. Ovary ± cylindrical, shallowly 4-lobed, glabrous. Fruit drupe, pale green, shallowly to deeply 2-lobed.

**Specimens examined:** BHUTAN. Tsirang District, Sergithang Gewog, Gawathang, Gerichu, 900 m, 27 June 2022, *Phub Gyeltshen* 72 (THIM).

**Habitat:** Typically, this lowland plant grows along the stream and river banks, roadsides, and waste ground at elevations ranging from 70–450 masl, although it has been observed growing up to 900 m (Wearn and Mabberley, 2011), and even up to 1200 m (Grierson and Long, 1999).

**Phenology:** Flowering from May-June, and fruiting from July to September.

**Distribution in Bhutan:** The plant was observed at Gerichu streambank, en-route to Gawathang village under Sergithang Gewog in Tsirang District, and by Tandin Wangchuk from Bjachho Gewog in Chukha District in 2014. In 2020, Sangay Wangchuk observed the plant in Samtse District, while Kinlay Wangdi found it near Phakchu in Samdrup Jongkhar District in 2022. The first author also observed the plant in Nganglam in Pemagatshel District, on the way to Gongdue Gewog under Mongar Dzongkhag in June 2022.

**Global distribution:** It is native to Andaman Island, Bangladesh, Borneo, China, East Himalaya, India, Jawa, Laos, Nepal, Philippines, Sumatera, Taiwan, Thailand, Tibet, Vietnam, and introduced to Japan, Korea, Mexico Southeast, Mexico Southwest, Peninsular Malaysia, and Sri Lanka. Now, it is widely cultivated in gardens.

**Taxonomic notes:** Morphologically, *Clerodendrum japonicum* var. *japonicum* differs from *C. japonicum* var. *bethuneanum* by its uniform red corolla (vs. corolla lobes with purple and white basal markings), and from *Clerodendrum intermedium* Cham. in having larger calyx lobes, 9–12.5 x 4.5–8 mm (vs. 3–5 x 1.3–1.5 mm), and less delicate inflorescences (vs. delicate inflorescences). It is also similar to *Clerodendrum paniculatum* L., but differs from it by its entire to dentate leaf margins (vs. leaf margins distinctly lobed). Among the recorded *Clerodendrum* species in Bhutan, the variety is allied to *C. infortunatum* due to its paniculate inflorescence and five corolla lobes, but it differs by having deeply cordate leaf base (vs. leaf base truncate or shallowly lobed), entire to dentate leaf margins (vs. margin regularly serrate), corolla red (vs. white or pinkish).

*Phoenix loureiroi* var. *pedunculata* (Griff.) Govaerts, World Checkl. Palms 171: 170 (2005).

Synonyms: *Phoenix humilis* var. *pedunculata* (Griff.) Becc. in Malesia 3: 384 (1890). *Phoenix pedunculata* Griff. in Palms

Brit. E. Ind.: 139 (1850). *Phoenix humilis* var. *robusta* Bacc. in Malesia 3: 238 (1890). *Phoenix humilis* var. *typica* Becc. in Malesia 3: 380 (1890). *Phoenix loureiroi* var. *humilis* S.Barrow in Kew Bull. 53: 563 (1998). *Phoenix ouseleyana* Griff. in Calcutta J. Nat. Hist. 5: 347 (1845). *Phoenix robusta* (Becc.) Hook.f. in Fl. Brit. India 6: 427 (1892).

**Type:** Neilgherri Hill, June 1849, Wight 2767 (K!), Figure 3.

**Description:** Plant to 3.5 m tall, rough with persistent leaf bases. Leaves 1–2 m long, petiole 35–65 cm long, leaf sheath reddish-brown, fibrous; pinnae 40–130 per side of rachis, fascicled in irregularly distant groups of 2–3, spreading in more than one plane, pinnae 25–38 cm long, 0.6–1.5 cm wide, midrib distinct but not keeled on the lower surface, glabrous. Male inflorescences erect, to 65 cm, with 30 rachillae, ca. 10 cm long; female inflorescences erect, becoming arched, to 20 cm, with 40 rachillae, ca. 40 cm long. Fruits ovoid to obovoid,  $1.8 \times 0.9$  cm, blue

-black when ripe, Seed obovoid, 11–18 x 6–9 mm, with rounded ends, and raphe extending the full length of seed; endosperm homogeneous.

**Specimens examined:** BHUTAN. Wangdue Phodrang District, Athang Gewog, Ada, 1000 m, 20 December 2022, *Phub Gyeltshen* 73 (THIM).

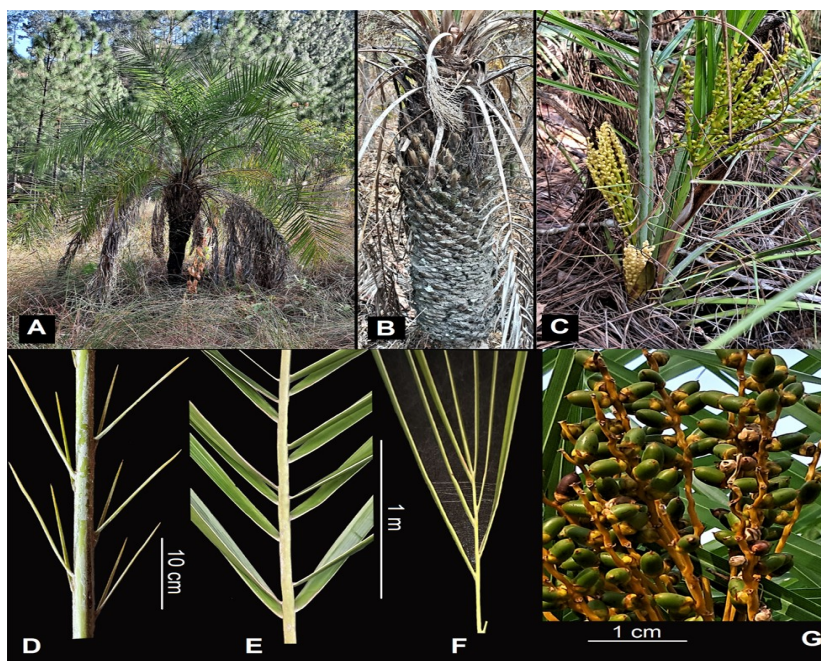
**Habitat:** It prefers open areas of subtropical and Chirpine forest, steep slopes, and disturbed areas at elevations ranging from 700–1800 masl in Bhutan.

**Phenology:** Flowering from September–November, and fruiting from December to May.

**Distribution in Bhutan:** It is distributed in Athang, Jarigang, Nangzhina, Rukha, and Zawa under Athang Gewog, Kamechu, Taksha, Pinsa, and Zawakha under Daga Gewog in Wangdue Phodrang District; Patale and Sergithang in Tsirang District, near about Tingtibi in Zhemgang District, and in Samtse District.

**Global distribution:** It is native to Bangladesh, the East and West Himalayas, India, Nepal, and Pakistan.

**Additional specimens examined:** BHUTAN. Wangdue Phodrang District, Basachu, 27.45°E, 89.9°N, 900–1500 m, 23 May 2000, *Y. Dorji* 9 (THIM12055) (THIM!), (3 specimens); Taksha, 27.15°E, 90.0667°N, 482 m, 12 September 2012, *S. Tshering* 224(THIM12061) (THIM!), (2 specimens).



**Figure 3.** *Phoenix loureiroi* var. *pedunculata*: **A.** Habit; **B.** Trunk; **C.** Habit with inflorescence and infructescence; **D.** Petiole with spines; **E.** Mid section of the leaf; **F.** Apical portion of the leaf; **G.** Portion of inflorescence with fruits.

**Taxonomic notes:** Beccari (1890) originally considered *Phoenix loureirii* (spelled as *P. loureiri* by Barrow (1998) to be a variety of *P. humilis*. It has been corrected to *P. loureiroi* as it honours Loureiro (Gros-Balthazard *et al.*, 2021). Upon the initial description of *Phoenix humilis* by Beccari (1890), five varieties were identified from India and Indo-China regions. The three Indian varieties, *Phoenix humilis* var. *typica* Becc., *Phoenix humilis* var. *pedunculata* Becc., and *Phoenix humilis* var. *robusta* Becc. were synonymized under *P. loureiri* var. *humilis* (Becc.) S. Barrow in 1998, but all these names are now synonyms of *P. loureiroi* var. *pedunculata*, which is accepted by the WCVF (2023). This variety differs from *P. rupicola* by its sub-whorled leaflets that spreads in more than one plane (vs. leaflets inserted singly and regularly, spreading in a single plane), and its leaflet width usually > 1.5 cm (vs. leaflet width < 1.5 cm). The species population appears to be stable and is common in the Chirpine forest of Wangdue Phodrang District in Bhutan. Forest fires have affected growth in some areas, but the species seems to thrive in disturbed areas and has been domesticated in gardens.

## Conclusion

*Clerodendrum japonicum* var. *japonicum* and *Phoenix loureiroi* var. *pedunculata* are discussed in this paper. The former species grows in low-land areas at elevations of up to 1200 m along stream and river banks, roadsides, and waste

ground. It is currently known from five locations in Bhutan. The latter species, on other hand, grows in open areas of subtropical and Chirpine forest, steep slopes, and disturbed areas in Bhutan at elevations ranging from 700 to 1800 m. It is known from four locations in Bhutan. Understanding species diversity and distribution records are crucial for biodiversity assessment, which is useful in prioritizing areas for conservation. The species is expected to be found in other areas with similar habitats, and more explorations and assessments are required to determine its population and conservation status in Bhutan.

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## References

- Beccari, O. (1890). Rivista monografica delle specie del genere *Phoenix*. Malesia 3:345–416
- Barrow, S.C. (1998). A Monograph of *Phoenix* L. (Palmae: Coryphoideae). *Kew Bulletin*, 53(3): 513–575. <http://www.jstor.org/stable/4110478>. Accessed 15 January 2023.
- Deori, C., Roy, D.K., Talukdar, S.R., Pagag, K. and Sarma, N. (2013). Diversity of the genus *Clerodendrum* Linnaeus (Lamiaceae) in Northeast India with special reference to Barnadi Wildlife Sanctuary, Assam. *Pleione*, 7(2): 473 - 488. 2013.
- Grierson, A.J.C. and Long, D.G. (1983). *Flora of Bhutan including a record of plants from Sikkim*. Volume 1 Part 1, Royal Botanic Garden, Edinburgh and Royal Government of Bhutan.
- Grierson, A.J.C. and Long, D.G. (1999). *Flora of Bhutan including a record of plants from Sikkim and Darjeeling*. Volume 2 Part 2, Royal Botanic Garden, Edinburgh and Royal Government of Bhutan.
- Gros-Balthazard, M., Baker, W.J., Leitch, I.J., Pellicer, J., Powell, R.F. and Bellot, S. (2021). Systematics and

- Evolution of the Genus Phoenix: Towards Understanding Date Palm Origins. In *The Date Palm Genome, Vol. 1. Phylogeny, Biodiversity and Mapping*, eds. J.M. Al-Khayri, S.M. Jain and D.V. Johnson, pp. 29–54. DOI: [https://doi.org/10.1007/978-3-030-73746-7\\_2](https://doi.org/10.1007/978-3-030-73746-7_2)
- Noltie, H.J. (1994). *Flora of Bhutan including a record of plants from Sikkim and Darjeeling*. Volume 3 Part 1, Royal Botanic Garden, Edinburgh and Royal Government of Bhutan.
- WCVP. (2020). World checklist of vascular plants, version 2.0. Facilitated by the Royal Botanic Gardens, Kew. <http://wcvp.science.kew.org/>. Accessed 20 January 2023.
- Wearn, J.A. and Mabberley, D.J. (2011). *Clerodendrum* (Lamiaceae) in Borneo. *Systematic Botany*, 36 (4):1050-1061. DOI: <https://doi.org/10.1600/036364411X605056>