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First documented reports of the Australian *Atriplex suberecta* (Amaranthaceae *s.l.*, Chenopodioideae) from Tunisia, a well-established weed in North Africa

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Abstract: *Atriplex suberecta* I.Verd. (Amaranthaceae *s.l.*, Chenopodioideae) is native to southern Australia and is alien but naturalized in warm temperate and subtropical regions of the world. In North Africa, the plant has been long established in Morocco, with recent findings in Algeria. Here we report numerous documented findings of *A. suberecta* from the Mediterranean part of the country, with a detailed morphological description, ecological characteristics, and composition of the alien *Atriplex* in Tunisia.

Keywords: Alien *Atriplex*, Chorology, New records, Xenophytes

Introduction

The cosmopolitan genus *Atriplex* includes 250–260 species mainly found in arid and semi-arid regions (Sukhorukov, 2014). In North Africa, the genus is mostly represented by native species with C_4-anatomy and different evolutionary history (Žerdoner-Čalasan *et al.*, 2022). Several adventive species were also found in the region, such as *A. canescens* (Pursh) Nutt., *A. holocarpa* F.Muell., *A. hortensis* L., *A. inflata* F.Muell, *A. nummularia* Lindl., *A. semibaccata* R.Br., *A. semilunaris* Aellen, and *A. suberecta* I.Verd. (Dobignard & Chatelain, 2011; Verloove *et al.*, 2025). Originating from southern Australia (Wilson, 1984), *A. suberecta*, a short-lived perennial herb, is locally naturalized in some Mediterranean areas such as Spain (Castroviejo, 1990), Negev desert (Danin, 2004), the Canary Islands (Verloove & Reyes-Betancort, 2011), Jordan (Taifour & El-Oqlah, 2017), and Cyprus (Hand, 2020). In Morocco, *A. suberecta* is a common invasive plant in the sandy coastal areas between Agadir and Casablanca (pers. obs. A. Sukhorukov; see also comments in Chambouleyron & Benrahmoune, 2017; Gordo *et al.*, 2025). Recently, *A. suberecta* was also discovered in Algeria (Gordo *et al.*, 2025). Its presence in Egypt (Sinai) remains uncertain: Boulos (1999) has reported the species from Sinai but indicates a shrubby life form that is clearly erroneous and makes the identification uncertain.

In the present contribution, we report the first documented records of *A. suberecta* in Tunisia. The work is part of an ongoing study on updating the checklist of the non-native Tunisian chenopodiaceous flora (e.g. Sukhorukov *et al.*, 2018; El Mokni & Iamonico, 2019; Iamonico & El Mokni, 2019; El Mokni & Debruille, 2021; El Mokni, 2024; El Mokni *et al.*, 2024; Sukhorukov *et al.*, 2025), undertaken since almost two decades.

Material and Methods

Localities and area distribution data presented here result from numerous fieldwork sessions

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undertaken by the first author during the last decade. The first extended population was discovered rather occasionally in 2016 in the southern part of the country. In order to obtain a better understanding of the current status of naturalization and distribution of the species, more targeted field studies were conducted in different areas and habitats seemingly suitable for the species establishment (i.e. roadsides, other strongly anthropogenically influenced habitats, and stream banks). Voucher specimens are kept at R. El Mokni's personal Herbarium (not yet listed in Index Herbariorum) deposited at the Faculty of Pharmacy of Monastir (Monastir University, Tunisia); two duplicates were sent to MW (acronym according to Thiers (continuously updated[+]). Nomenclature follows POWO (2026). Habitat descriptions are based on the first author's personal observations (REM).

Taxonomic Treatment

Atriplex suberecta I.Verd., Bothalia 6: 418. 1954. *Obione suberecta* (I.Verd.) G.L.Chu, Gen. New Evol. System World Chenopod.: 167. 2017. *Type*: SOUTH AFRICA, **Orange Free State**, Fauresmith, 06.11.1944, *M. Henrici* 3854 (holo PRE [PRE0368098–0 *n.v.*]; iso K [K000243893 digital image!]). **Figs. 1 & 2**

Annual or short-living perennial herbs. Stems 30–80 cm, whitish, much branched. Leaves 20–70(–90) × 10–40 mm, with petioles 3–20 mm long; blades ovate or rhombic, irregularly sinuate-dentate or lobed, sometimes with two prominent lobes. Inflorescences leafy, with intermixed male and female flowers. Valves of bract-like cover in female flowers 2–5 mm, rhombic, acute and connate to their half, sessile or with a short stalk up to 3 mm, slightly thickened and irregularly acutely toothed in the upper part. Seeds 1.0–1.7 mm, yellow-brown and reddish.

Flowering & Fruiting: Flowering and fruiting from May to November (-December).

Ecology and habitat: *Atriplex suberecta* were firstly photographed in July 2016 in disturbed coastal places in central Tunisia (TC, Monastir city) and near human-made habitats within communities of drought-tolerant plants together with other invasive ruderal weeds, namely *Bassia indica* (Wight) A.J.Scott (Amaranthaceae), *Euphorbia maculata* L. (Euphorbiaceae), *Nicotiana glauca* Graham, *Solanum elaeagnifolium* Cav. (both Solanaceae), *Symphyotrichum squamatum* (Spreng.) G.L.Nesom, (Asteraceae) and some native halophytes and halo-tolerant species, *e.g. Crithmum maritimum* L. (Apiaceae), *Limbarda crithmoides* (L.) Dumort.(Asteraceae), and *Suaeda aegyptiaca* (Hasselq.) Zohary, *S. spicata* (Willd.) Moq. (Amaranthaceae). Later, in December 2016, it was found in a dry river bed in the governorate of Tataouine in southwestern Tunisia (TS), together with some halo-gypsophytes, e.g. *Herniaria fontanesii* J.Gay (Caryophyllaceae), *Lygeum spartum* L. (Poaceae), *Reaumuria vermiculata* L. (Tamaricaceae), *Zygophyllum album* L.f., *Z. glutinosum* (Delile) Christenh. & Byng (Zygophyllaceae).

Specimens examined: TUNISIA, **Gabès**, Kettana, 13.04.2026, *R. El Mokni s.n.* (Herb. R. El Mokni); **Kairouan**, Kairouan-city, Kiosque Agil, 24.08.2024, *R. El Mokni s.n.* (Herb. R. El Mokni); **Monastir**, Frina, 17.08.2018, *R. El Mokni s.n.* (Herb. R. El Mokni); Karraeyia, 21.07.2016, *R. El Mokni s.n.* (Herb. R. El Mokni); Khénis, 12.12.2017, *El Mokni s.n.* (Herb. R. El Mokni, MW!); *ibid.*, 03.09.2020, *R. El Mokni s.n.* (Herb. R. El Mokni); Ksibet Mediouni, 21.07.2022, *R. El Mokni s.n.* (Herb. R. El Mokni); *ibid.*, 28.09.2024, *R. El Mokni s.n.* (Herb. R. El Mokni); Essouani, 10.10.2023, *R. El Mokni s.n.* (Herb. R. El Mokni); Monastir-city (bus station), 13.09.2025, *R. El Mokni s.n.* (Herb. R. El Mokni); **Sousse**, Sidi Abdelhamid, 12.09.2024, *R. El Mokni s.n.* (Herb. R. El Mokni); **Tatouine**, Chenini, 18.12.2016, *R. El Mokni s.n.* (Herb. R. El Mokni); *ibid.*, 12.11.2017, *R. El Mokni s.n.* (Herb. R. El Mokni, MW!).

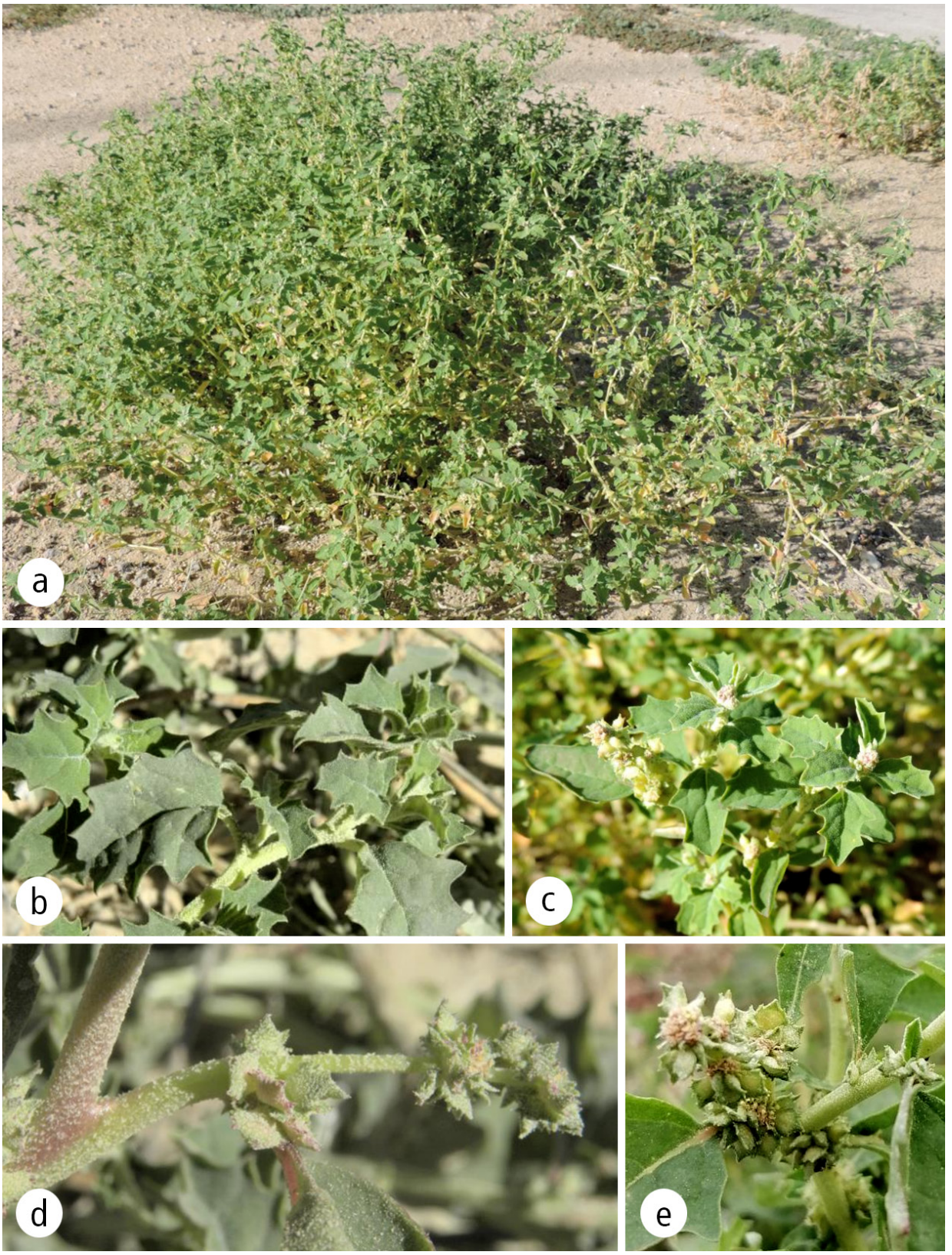

Fig. 1. *Atriplex suberecta* I.Verd. in Tunisia: **a**. Habit and habitat; **b**. Leaves; **c**. Flowering twig; **d-e**. Fruiting twigs with dentate bract-like cover (Photographed by R. El Mokni).

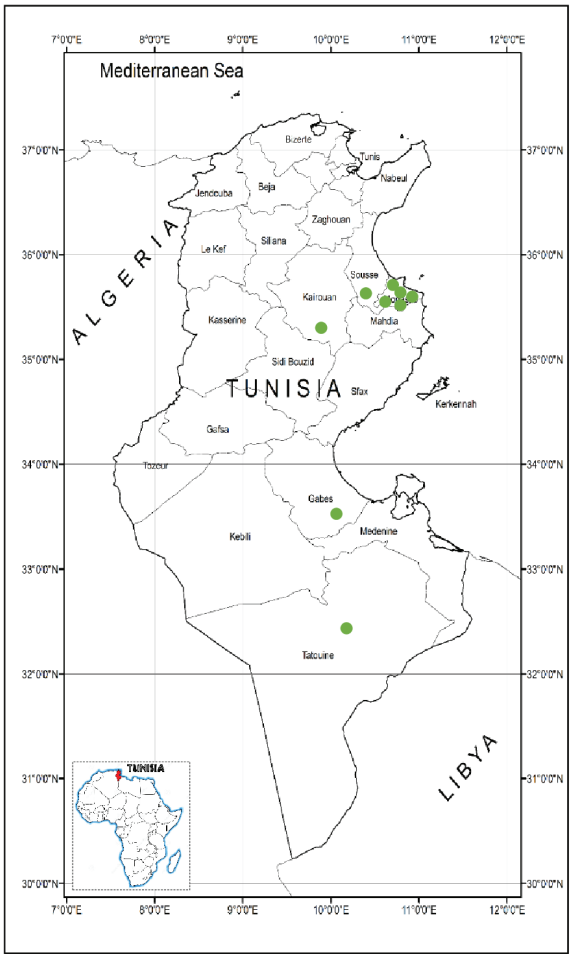

Fig. 2. Distribution of *Atriplex suberecta* I.Verd. in Tunisia based on our records

Distribution: Native to Australia (including New South Wales, South Australia, Tasmania, Victoria and Western Australia) (Wilson, 1984). *Atriplex suberecta* is reported as introduced species in the Americas (incl. Argentina, Bolivia, Canada, Mexico, USA: California and Hawaii), also found in Europe (Cyprus, France, Germany), Asia (locally in Negev Desert, Sinai, and in Saudi Arabia) and Africa (Namibia, South Africa, Zimbabwe) (POWO, 2026). In North Africa, *Atriplex suberecta* was first collected in early 1970s in Morocco (RAB!) and assigned three decades later as an invasive plant expanding its secondary adventive range (Molero & Montserrat, 2006). Algeria and Tunisia are other countries in North Africa where *A. suberecta* was documented with further rapid expansion within the central regions of the countries. Before 2016, the species was never observed in Tunisia, a floristically well-investigated region. No documented reports were published except one observation of Sebastián Lescano in 2022 on the online platform Global Biodiversity Information Facility (GBIF) (https://www.gbif.org/occurrence/3915446503) which matches well with the same locality discovered by the first author in 2016 within the southern part of the country. Based on the invasiveness in Morocco, we expect further spread of *A. suberecta* in Tunisia. Actually, its occurrence was extended within two main Tunisian regions, in Central Tunisia (TC) within three governorates (Monastir, Sousse and Kairouan) in seven distant localities and in Southern Tunisia (TS) only within Tataouine and Gabes governorates.

Alien *Atriplex* species in Tunisia

Until now, four alien *Atriplex* species were recorded in Tunisia. *Atriplex canescens* (Pursh) Nutt. (var. *gigantea* S.L.Welsh & Stutz) and *A. nummularia* Lindl. (subsp. *nummularia*), among other plants, were firstly introduced to North Africa due to their high fodder quality and palatability for livestock feeding in Tunisia in the late 19th century, roughly 1870–1900 (Franclet & Le Houérou, 1971), with further records in Morocco (Foury, 1954; Chriyaa, 1996), Algeria, Lybia, and Egypt (Le Houérou, 2000). While the occurrence of *A. canescens* remains sporadic and not very common (see Iamonico & El Mokni, 2019), *A. nummularia* has a wider distribution mainly in several coastal governorates of the TC and the TS. The first records of the Australian *A. semibaccata* in North Africa seem to originate from Egypt, made by N.D. Simpson who travelled there in the 1920s (K!). In the 1950s, it was cultivated in the National Institute for Agronomic Research (RAB!). Its invasion to Tunisia may appear either from the west or from the east.

The earliest record of *A. inflata* F.Muell. (≡ *A. lindleyi* Moq. subsp. *inflata* (F.Muell.) Paul G.Wilson) in

the entire North Africa was made in 1924 in Sfax city, Tunisia, when it was erroneously described as a new species *A. lampifer* Buxb. (Buxbaum, 1927). A mean of introduction to North Africa is not precisely known, but, in fact, it may have been unintentionally brought from Australia with some goods or with seeds of forage plants. Now it is a very common invasive plant in all governorates of the TC and coastal governorates of TS. *Atriplex suberecta* represents the fifth alien species of the genus found in Tunisia.

All these alien *Atriplex* are to be considered well naturalized, behave as 'natives', and are very common where they were firstly introduced mainly within central and southern Tunisia (Maire, 1962; Pottier-Alapétite, 1979 and pers. obs. R. El Mokni, made over the last two decades).

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Hyphaene dichotoma (Arecaceae): an addition to floristic diversity of eastern India

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Abstract: *Hyphaene dichotoma* (D.White bis ex Nimmo) Furtado (Arecaceae) is reported here as an addition to floristic diversity of eastern India, based on collections from forest of Bankura district, West Bengal. This species has previously been reported from Diu, Goa, Gujrat and Maharashtra. This study aims for a detailed description along with photographs and geographical latitudinal and longitudinal data that supports the addition to the flora of the Bankura district, West Bengal, India.

Keywords*:* Botanical exploration, Branching palm, Coastal ecology, Dichotomous, Palmyra palm

Introduction

Palms with dichotomous branching are classified under the genus *Hyphaene* Gaertn., which comprises approximately 8 species found across Africa, Madagascar, India, and Arabia (POWO, 2026). In India, only one species is found in the wild, *Hyphaene dichotoma* (D.White bis ex Nimmo) Furtado, commonly known as the "*Ravana Tal*". It is native to the west coast of India (Mahabale, 1982; Basu, 1985; Basu & Chakraverty, 1994; Renuka & Sreekumar, 2012; Garg & Sachan, 2016) mainly in Diu, Goa, Gujarat (Qureshimatva *et al.*, 2020; Hameed *et al.,* 2023) and Maharashtra (Hameed, 2024). The species is indigenous to India (Kulkarni & Mulani, 2004) and is morphologically similar to fossil specimens of *Palmoxylon arviensis* Ambwani reported from Nawargaon, Chandrapur district of, Maharashtra, Deccan Intertrappeans, Upper Cretaceous (Maastrichtian) (Bonde, 2008). The species was also listed as Near Threatened (Johnson, 1998).

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During field surveys in the Chotanagpur Plateau, particularly in the Lakshmi Sagar region of Bankura District, West Bengal, the authors observed multiple palm species and encountered a specimen of *Hyphaene*. The specimen is characterized by costapalmate leaves divided into numerous segments, open leaf sheaths split at the base forming a central wedge-shaped cleft, and long, spiny petioles. The stems exhibit dichotomous branching.

After thorough scrutiny of protologues and comparison with the type specimens, it is identified as *Hyphaene dichotoma* (D.White bis ex Nimmo) Furtado. Field observations indicate that individuals of *H. dichotoma* in the study area are over 100 years old, suggesting long-term establishment. Notably, organized silvicultural interventions in this region have been undertaken only within the past two decades, thereby ruling out recent plantation activities as the primary source of this population. The population also exhibits active natural regeneration, with the presence of both mature and juvenile individuals, indicating a self-sustaining demographic structure.

In addition, ethnobotanical surveys conducted among local communities revealed that the majority of respondents (n > 50) consistently reported the long-standing presence of these plants, with no evidence or recollection of deliberate planting. This traditional knowledge, coupled with field-based

ecological observations, supports the inference that the population is not of recent anthropogenic origin. Therefore, the species in this area can be considered either naturally occurring or well-naturalized. The present record represents a significant addition to the floristic diversity of eastern India and constitutes a noteworthy extension of the known distribution range of *H. dichotoma*.

Taxonomic Treatment

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Stems solitary, 14–23 m high, 21–28 cm across, ringed with prominent leaf scars, per crown, olive green; middle cleft present; sheath blades dichotomously branching to 2 or 3 times. Leaves costa-palmate, 19–29 number per crown, olive green; leaf sheaths 39–42 cm long, middle cleft present; sheath blades orbicular; petioles strongly armed and spiny at margins; hastula asymmetrical, *c.* 3.8 cm long; leaf segments *c.* 125 cm long, 51 per blade with bilobed apices. Inflorescence interfoliar, dioecious. Male inflorescence *c.* 38 cm long, peduncular bracts 1 or 2, leathery, 30–38 cm long, thick hairy outside; Rachillae 8–12, arranged spirally; rachis approximately 1.5 m long, entirely covered with rachillae bracts. Female inflorescence bearing at least two peduncular bracts, cartaceous, up to 32 cm long; rachis about 1.2 m long and approximately 1.1 cm in diameter. ending in a fertile rachillae (rachillae 5 in number), *c.* 37 cm long, *c.* 1.2 cm across; rachillae inserted in a spiral pattern. Fruits nearly oblong-globose, *c.* 4.8 × *c.* 3.9 cm, smooth or irregularly warted, brownish, fruit stalk covered with dense brown hairs, inner portion thick, fibrous; endosperm homogenous.

Habitat: Grows in dry deciduous forests of Bankura district, associated with *Azadirachta indica* A.Juss. (Meliaceae) and *Eucalyptus* sp. (Myrtaceae).

Flowering & Fruiting: Flowering occurs from January to March, followed by fruiting from April to October.

Distribution: India (Maharashtra, Goa, Gujarat, now in West Bengal).

Specimen examined: INDIA, **West Bengal**, Bankura district, Lakshmi Sagar, 18.01.2024, *R. Saha & R. D. Barman* BSI-CNH104099 (CAL).

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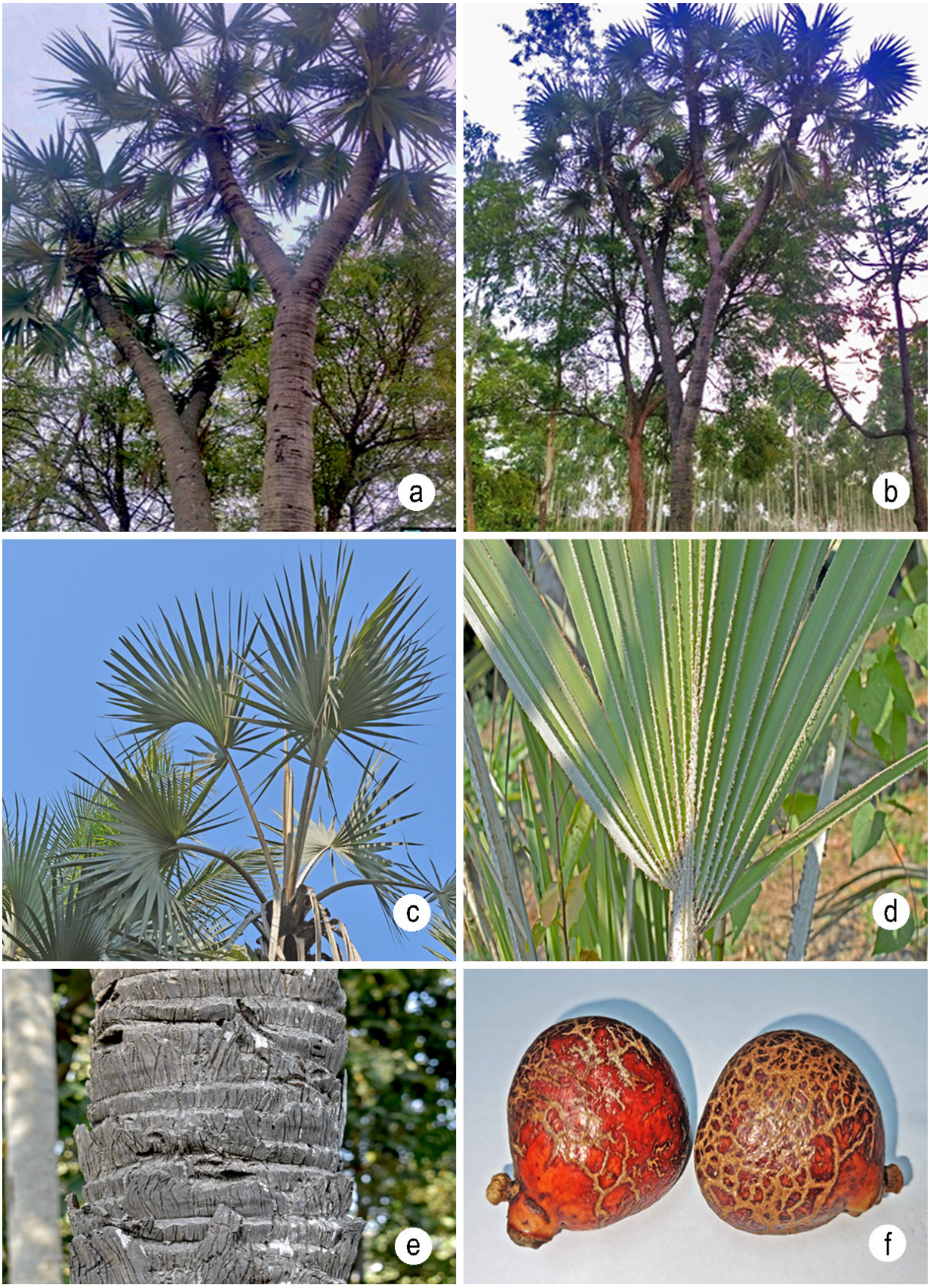

Fig. 1.*Hyphaene dichotoma* (D.White bis ex Nimmo) Furtado:**a** & **b**. Habit; **c** & **d**. Leaf arrangements; **e**. Stem; **f**. fruits (Photos S. Chowdhury & R.D. Barman).

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Notes on *Isachne veldkampii* (Poaceae) and reduction of *I. bhatii* as conspecific

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Abstract: The recently described species *Isachne bhatii* P.Biju, Josekutty & Augustine is treated as conspecific to *I. veldkampii* K.G.Bhat & Nagendran. A detailed description, notes on habitat, distribution, conservation status, and photographs are provided. Although the species was previously considered Critically Endangered, the present study reveals a broader distribution than was previously documented.

Keywords: Endemism, Grass, Micrairoideae, South India, Synonym, Variations

Introduction

Isachne R.Br. is the largest genus in the subfamily Micrairoideae (Poaceae), comprising approximately 105 species distributed worldwide (Soreng *et al.*, 2022). It is primarily distributed across tropical and subtropical regions of both hemispheres (Prakash & Jain, 1987). Recently, Kellogg *et al.* (2020) in their Checklist of Indian Grasses documented 37 species of the genus from India. Members of the genus are typically annual or perennial hygrophilous grasses. The inflorescence is usually an open panicle, occasionally racemose; spikelets sub-globose to obovoid, two-flowered, awnless, and borne on a short rachilla. The glumes are equal or subequal in length, and they disarticulate above the glumes (Prakash & Jain, 1984).

During the revisionary studies on the subfamily Micrairoideae in India, extensive field explorations were conducted between 2022 and 2025, resulting in the collection of many *Isachne* specimens from low-altitude lateritic plateaus of northern Kerala, South India. After carefully examining the collected materials and also herbarium specimens available in Indian herbaria (CAL, CALI, MH) in comparison with type materials and protologues of all the *Isachne* species present in India, it was understood that these specimens exhibited significant morphological variations, leading to ambiguity in species identification. Detailed examination revealed that *Isachne bhatii* P.Biju, Josekutty & Augustine does not stand out from *Isachne veldkampii* K.G.Bhat & Nagendran, hence, treated as conspecific.

Isachne veldkampii is a critically endangered species (Kumar, 2011) growing in marshy lands on the Manipal district, South Kanara, Karnataka (Bhat & Nagendran, 1983). Recently, the extended distribution of this species has been reported from the lateritic plateaus of Kannur district, Kerala (Pramod & Pradeep, 2012). Subsequently, *Isachne bhatii* was described by Biju *et al.* (2016) from the Kalliad lateritic plateau in the Kannur district of Kerala. Incidentally, the authors of the species have not compared the new taxon with *I. veldkampii,* instead with an Eastern Himalayan species, *I. clarkei* Hook.f., which is distantly related, and grows primarily in a seasonally dry tropical biome (POWO, 2025). The present study investigates the taxonomic identity of *I. bhatii* based on new collections and comparative analysis.

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Materials and Methods

This study is primarily based on live materials collected during botanical field expeditions from 2022 to 2025. Detailed morphological descriptions were prepared using both live specimens and herbarium specimens housed in CAL, CALI, and MH. Digital images of specimens from PND (Thiers, 2025) and Global Biodiversity Information Facility (GBIF, 2025) were also examined.

To assess morphological variations, multiple populations were studied using a M80 stereo microscope (Leica, Germany) equipped with a digital imaging system. Field photographs were captured with a D750 camera (Nikon, Japan). Updated descriptions were compared with the diagnostic characters and original illustrations provided in the protologues of *I. bhatii* and *I. veldkampii*. A distribution map was generated using QGIS software version 3.38.3 (QGIS, 2022).

An assessment of the conservation status of the species was carried out using the IUCN criteria and guidelines version 16 (IUCN, 2024). The conservation status of these species was assessed using the Extent of Occurrence (EOO) and Area of Occupancy (AOO), both of which were calculated in GeoCAT (Bachman *et al.*, 2011) using the required 2 × 2 km grid.

Taxonomic Treatment

Isachne veldkampii K.G.Bhat & Nagendran, Curr. Sci. 52: 258. 1983; V.Prakash & S.K.Jain, Fasc. Fl. Ind. 14: 36. 1984; K.G.Bhat, Fl. Uduppi 815. 2003; Pramod & Pradeep, J. Econ. Tax. Bot. 36(1): 59. 2012; Hillock Biodivers. Ecol. Fl. Madayippara 243. 2020. *Type*: INDIA, **Karnataka**, South Kanara district, Manipal, 150 m, 29.10.1977, *K.G.Bhat* 468A (CAL [CAL0000002118!]).

Isachne bhatii P.Biju, Josekutty & Augustine, Int. J. Pl. Anim. Environm. Sci. 6(3): 135. 2016, **syn. nov.** *Type*: INDIA, **Kerala**, Kannur district, Kalliad lateritic plateau, N 12°16'28.5", E 075°14'05.6" 82 m, 23.08.2014, *P. Biju & Augustine* 2491 (CAL, *n.v.*). **Figs. 1–4**

Glabrous annual hygrophilous herbs, tufted or non-tufted, erect or creeping with ascending branches, 3–32 cm long; rooting from the basal nodes, 4–12 cm long. Culms canaliculate; nodes and internodes ribbed, glabrous; nodes 0.5–5 cm long, not fully covered by leaf sheaths; leaf blades ovate or elliptical or lanceolate, 0.8–7 × 0.3–1.5 cm, 10–20-nerved, mid-nerve obscure, base obtuse, margins serrulate, apex acuminate, thick, glabrous on both surfaces, marginal hairs longer towards the base; sheath 0.5–1.5 cm long, canaliculate, margins hyaline, glabrous; ligule absent in normal leaves, present in flag leaves represented by fringes of hairs. Flag leaves ovate-lanceolate, 0.2–4 × 0.1–0.25 cm, glabrous on both surfaces, base obtuse, margins serrulate, marginal hairs longer towards the base; sheath 1–2.5 cm long, loose, margins hyaline, glabrous. Panicle 3–16 cm long, peduncle slightly canaliculate, glabrous, 4–16 branches arising from the peduncle; each branch with 1–7 spikelets, base bulbous; 1–4 glandular bands on the branches, 0.1–0.2 × *c.* 0.14 mm; pedicles 0.3–0.5 mm long, glabrous, eglandular; spikelet ovoid-elliptical, 1–1.5 × 1–1.3 mm, pale green to purplish. Glumes 2, shorter than lemmas, disarticulated above the glumes, minute hairs on the upper side; lower glumes elliptical, 0.8–1.2 × 0.6–1 mm, glabrous, faintly 3-nerved, margins hyaline, pale green or purple; upper glumes ovate, 1.2–1.5 × *c.* 1 mm, sparingly hairy, faintly 5-nerved, margins hyaline, folded, pale green or purple. Florets 2 per spikelet, similar, bisexual, ovate to

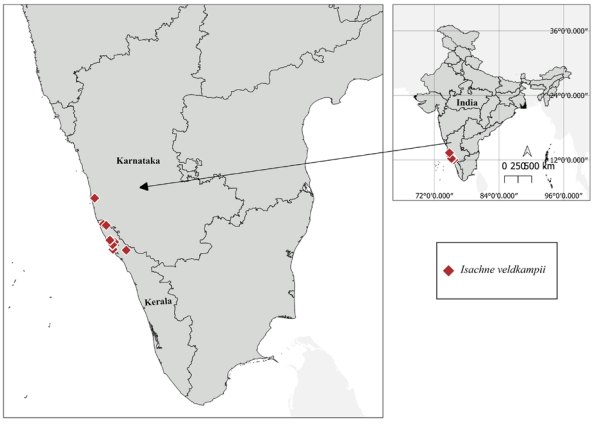

Fig. 1.Distribution of *Isachne veldkampii* K.G.Bhat & Nagendran in the Western Ghats (prepared using QGIS software version 3.38.3).

Fig. 2. *Isachne veldkampii* K.G.Bhat & Nagendran: **a**. Habitat; **b**. Microhabitat (Photos Haritha P. Bharathan).

obovate, 1.3–1.5 × 0.8–1 mm, pale green to slightly purple; lemma similar, elliptic, 1–1.5 × 0.7–1 mm, sub-equal, margins folded, indistinctly nerved, coriaceous, outer surface puberulous, with woolly hairs at the base; paleas similar, elliptical, 0.8–1.2 × 0.5–0.8 mm, flat, with involuted margins, tuft of woolly hairs at the base, scabrous hairs on the upper side. Lodicules 2, cuneate. Stamens 3, anthers oblong, 0.6–1 × 0.3 mm, opening through longitudinal slit, pale yellow or purplish; filaments *c.* 0.5 mm long; pistils *c.* 0.8 mm long; ovary ovoid *c.* 0.3 × *c.* 0.3 mm; style 2, 0.2–0.4 mm long; stigma plumose, *c.* 0.5 mm long, purple or purplish red. Grains ovoid, 0.8–1 × *c.* 0.7 mm, brownish.

Flowering & fruiting: Flowering from August to October and fruiting from mid-August to October.

Habitat: *Isachne veldkampii* is usually found growing along low-altitude marshy lands and near temporary pools of lateritic plateaus, associated with species such as *Coelachne madayensis* Pramod & Pradeep (Poaceae), *Drosera indica* L. (Droseraceae), *Eriocaulon cuspidatum* Dalzell, *E. eurypeplon* Körn. (Eriocaulaceae), *Geissaspis cristata* Wight & Arn. (Fabaceae), *Murdannia semiteres* (Dalzell) Santapau (Commelinaceae), *Rhamphicarpa longiflora* (Arn.) Benth. (Orobanchaceae), *Rotala malabarica* Pradeep, K.T.Joseph & Sivar., *R. malampuzhensis* R.V.Nair ex C.D.K.Cook (Lythraceae), and several species of *Fimbristylis* Vahl (Cyperaceae) and *Utricularia* L. (Lentibulariaceae).

Distribution: Endemic to South India.

Conservation status: Isachne veldkampii exhibits a narrow distribution, based on the values Extent of Occurrence (EOO) of 218.059 sq. km and an Area of Occupancy (AOO) of *c.* 44 sq. km. According to the IUCN Red List Categories and Criteria (IUCN, 2024), these metrics place the species under the Endangered (EN) category. Although it was previously assessed as Critically Endangered, recent field data indicate a marginally broader

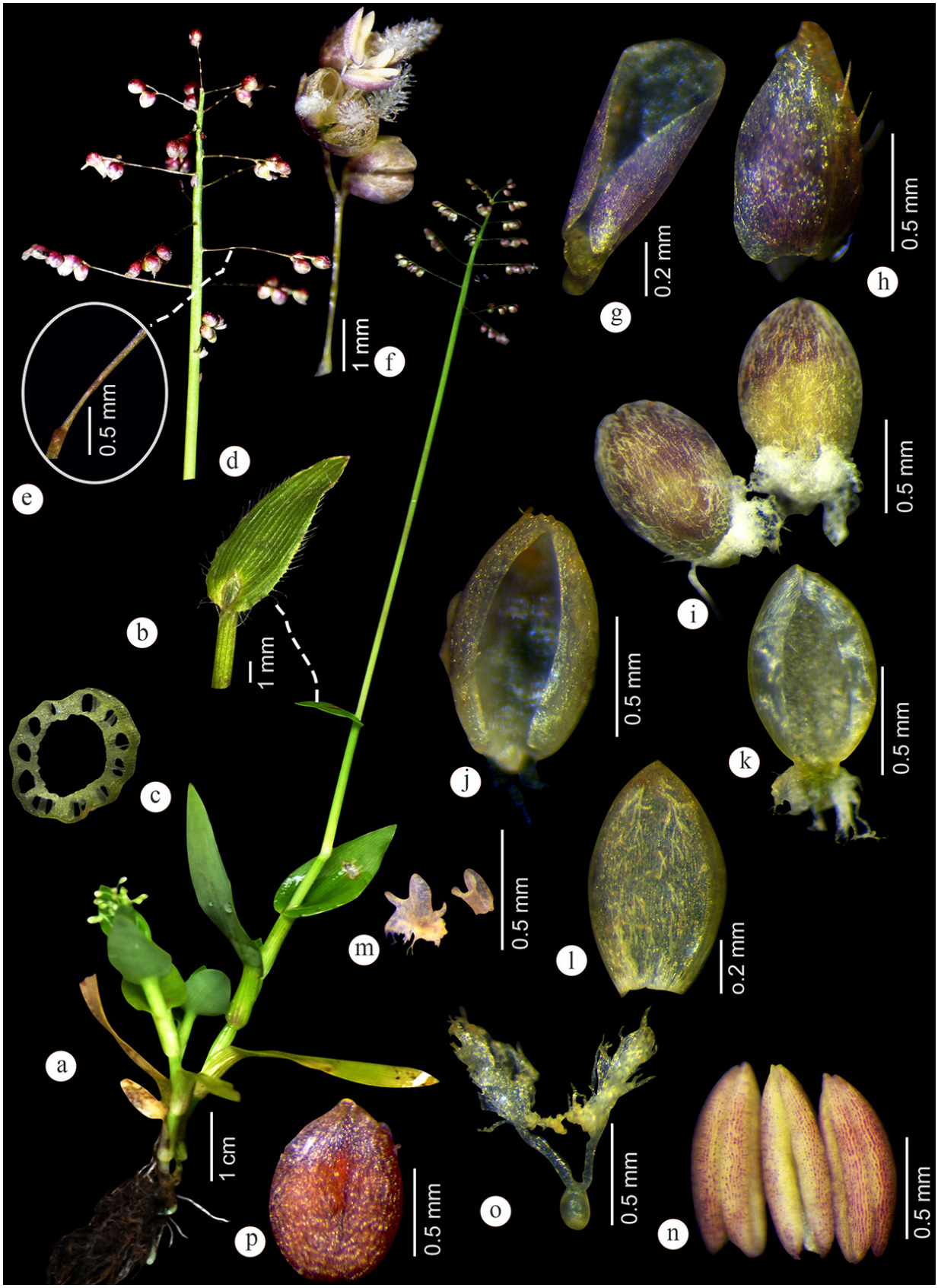

Fig. 3. *Isachne veldkampii* K.G.Bhat & Nagendran: **a**. Habit; **b**. Flag leaf; **c**. Cross-section of culm; **d**. Panicle; **e**. Enlarged view of glandular band; **f**. Panicle branch; **g**. Lower glume; **h**. Upper glume; **i**. Lower and upper florets; **j**. Lemma; **k**. Palea-abaxial view; **l**. Palea-adaxial view; **m**. Lodicules; **n**. Anthers; **o**. Pistil; **p**. Caryopsis (Photos Haritha P. Bharathan).

Fig. 4. Variations in the growth form of *Isachne veldkampii* K.G.Bhat & Nagendran (Photos Haritha P. Bharathan).

range than earlier records. However, the species continues to face serious threats, primarily due to unregulated laterite brick mining, which is widespread in its habitat.

Specimens examined: INDIA, **Kerala,** Kannur, district, Blathur, 26.08.2023, *Haritha P. Bharathan* 199974 (CALI; Kalliad, 16.07.2024, *Haritha P. Bharathan* 197267 (CALI); Korom, near Alakkad, N 12°40'01.7", E 75°00'51.4", 80 m, 19.08.2024, *Haritha P. Bharathan* 197276 (CALI); Madayippara, 46 m, 06.08.2023, *Haritha P. Bharathan* 199935, 199936, 199937; *Ibid.,* 15.07.2024, *Haritha P. Bharathan* 197266 (CALI); Madayippara near Vadukunda Shiva Temple, 20.08.2010, *C. Pramod* 126538 (CALI [CALI129093]); *Ibid.,* 25.07.2011, *C. Pramod* 126699 (CALI [CALI129092]); *Ibid.,* N 12°01'54.1", E 75°15'26.2", 09.08.2011, *C. Pramod* 126703 (CALI [CALI129090]); *Ibid.,* 11.09.2011, *C. Pramod* 126777 (CALI [CALI129088]); *Ibid.,* 24.09.2011, *C. Pramod* 133681 (CALI [CALI129096]); *Ibid.,* 28.07.20112, *C. Pramod* 133271 (CALI [CALI129095]); Kasargod district, Way to Bedrampalla, 12°38'20.6"N, 75°05'09.8"E, 170 m, 21.08.2024, *Haritha P. Bharathan* 197287 (CALI); Karindalam, 100 m, 15.08.2023, *Haritha P. Bharathan* 199953, 199954, 199955 (CALI); Periye, 102 m, 09.09.2011, *K.V.C. Gosavi* 753 (SUK); Near Permuda, N 12°40'01.7", E 75°00'51.4", 215 m, 21.08.2024, *Haritha P. Bharathan* 197286 (CALI).

Notes: While describing *Isachne bhatii*, the authors appear to have overlooked *I. veldkampii*, a morphologically diverse species that usually inhabits wet areas near seasonal pools of lateritic hillocks in southern India. The authors of *I. bhatii* compared their new taxon with *I. clarkei* Hook.f., which occurs in the northeastern states of India, China, Myanmar, Taiwan and New Guinea (Kellogg *et al.*, 2020; POWO, 2025). However, *I. veldkampii* exhibits considerable variation, particularly in foliar morphology and plant size (3–32 cm long), which encompasses the diagnostic features of *I. bhatii*. The type specimens of *I. bhatii* could not be traced from CAL and MH. The specimens provided by the first author of the species from his personal collection was also critically examined. The

studies, along with a thorough examination of the protologues, herbarium specimens, and field data, revealed the characters attributed to *I. bhatii* fall well within the variation range of *I. veldkampii*. Hence, *I. bhatii* P.Biju, Josekutty & Augustine is reduced into the synonymy of *I. veldkampii* K.G.Bhat & Nagendran.

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Obituary

Peter Hamilton Raven (1936–2026): A Global Architect of Biodiversity Conservation and a Friend to Indian Botany

The international botanical community mourns the passing of Dr Peter H. Raven, President Emeritus of the Missouri Botanical Garden, and one of the most influential biologists of the modern era. To many, he was a trusted and steadfast advocate for the study and conservation of tropical flora. He was equally revered in India as a mentor, collaborator, and visionary who connected tropical botany and biodiversity in general with global conservation policy.

Born in Shanghai in 1936, Raven's scientific journey began in California where his early fascination with plants led him to the California Academy of Sciences. He completed his undergraduate studies at the University of California, Berkeley (1957) and earned his Ph.D. in botany from the University of California, Los Angeles (1960). After a period on the faculty at Stanford University, in 1971, he began his leadership of the Missouri Botanical Garden as its Director and later President, and was also appointed as George Engelmann Professor of Botany at Washington University in St. Louis. Over nearly four decades, he transformed it from being a regional U.S. institution into an international leader in botanical research. Under his leadership, major international initiatives such as the Flora of China and Flora of North America projects were undertaken, while the Garden too became a vital resource for scientists across South Asia.

Raven's academic contributions were crucial in helping to reshape evolutionary biology. His landmark 1964 paper, "Butterflies and Plants: A Study in Coevolution," co-authored with Paul R. Ehrlich, introduced and formalized the concept of coevolution—demonstrating reciprocal evolutionary change between interacting species. This work remains one of the most cited in evolutionary biology.

He authored more than 700 scientific publications straddling systematics, biogeography, evolution, ethnobotany, and conservation biology, and he had a particular interest and expertise in the family Onagraceae. His widely used textbook, Biology of Plants, co-authored with Ray F. Evert and Susan E. Eichhorn, has educated generations of students globally and remains especially influential in India.

Raven maintained deep and enduring ties with India where he was a regular visitor. He frequently connected with institutions such as the Botanical Survey of India (BSI) and laboratories of the Council of Scientific & Industrial Research

(CSIR), advocating strongly for conservation of biodiversity hotspots such as the Western Ghats and the Himalayas. Through collaborations with the Missouri Botanical Garden, he helped train Indian botanists, particularly in modern plant taxonomy and herbarium management.

Raven was a leading advocate for the idea that human survival depends fundamentally on plant diversity. He warned early on about the accelerating biodiversity crisis and the "Sixth Extinction," yet remained dedicated to finding practical solutions, promoting many approaches to biodiversity conservation, including seed banks, in situ and ex situ conservation, ecological restoration and international cooperation.

His contributions earned global recognition and he received numerous national and international honors in recognition of his contributions, including the National Medal of Science in the U.S.A., a MacArthur Fellowship and numerous international awards. He was a member of the U.S. National Academy of Sciences and served on its Council from 1983 to 1986, and was Home Secretary of the Academy from 1987 to 1999. He was elected as a Fellow of multiple academies worldwide, including the Pontifical Academy of Science. He was widely honored by Indian scientific bodies, such as the Indian National Science Academy (INSA) and the Indian Academy of Sciences (IAS) reflecting his enduring influence on Indian botanical research.

When Raven assumed leadership of the Missouri Botanical Garden at the age of 35, it was modest in scale. By his retirement in 2010, it had become a global hub for research, conservation biology, and education, with major international collaborative programmes in regions and countries including Africa, Madagascar and Latin America. He expanded its herbarium to become one of the world's largest, and established key centers for conservation science at the Garden, and expanded the institution's library (now named in his honour) to become one of the world's greatest repositories of botanical literature. Beyond his institutional leadership, he co-founded the Donald Danforth Plant Science Center in St. Louis and helped St. Louis to become a major center for plant science.

Following his retirement, he remained a busy, effective and energetic advocate for plants, sustainability and for the protection of the ecosystems on which humanity depends. He lectured widely throughout the world as a great ambassador for biodiversity, sustainability and for the Missouri Botanical Garden.

For me personally he was a formidable supporter and advocate for the efforts that I and many others made in plant conservation, and in the development of botanic gardens and their role in saving plant species. I will never forget the generous support that he gave me when I had the honour of following him as President of the Missouri Botanical Garden on his retirement in 2010.

Peter Raven's passing marks the end of an important and transformational era in botanical science. He combined intellectual rigor with a powerful ability to communicate—from detailed plant systematics to global environmental policy. For India and the world, his legacy lives on in the scientists he mentored, the institutions he shaped, and the conservation movement he helped to grow.

Peter Wyse Jackson
President Emeritus Missouri Botanical Garden
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Obituary

Dr. Amarjit Singh Soodan (1 September 1959–21 November 2025): A renowned Botanist, taxonomist and mentor

Amarjit Singh Soodan, one of the renowned botanists of India and a distinguished authority in plant taxonomy and phytolith research, passed away peacefully at his residence in Alpha International City, Daburji, Amritsar, on 21 November 2025. He was 66 years old and is survived by his wife and two children. His passing marks the end of a distinguished era in the botanical community of North India, where he inspired generations of students, researchers and colleagues through his scholarship, humility and unwavering commitment to the discipline of botany.

Dr. Soodan completed both his M.Sc. and Ph.D. in Botany at the University of Jammu, laying the foundation for a research career deeply rooted in plant systematics. His academic training shaped his lifelong dedication to understanding the taxonomy, diversity and evolutionary structures of grasses, one of the most ecologically significant groups of plants. During his doctoral years, he cultivated expertise in both classical taxonomy and microscopic analytical techniques, skills that would later define much of his scientific legacy.

Dr. Soodan served for decades at Guru Nanak Dev University (GNDU), Amritsar, where he held the position of Associate Professor in the Department of Botanical & Environmental Sciences. He started his career as Curator of the University Botanical Garden. In this role, he played a central part in the development, maintenance and academic utilization of the garden as a teaching and research facility. At Guru Nanak Dev University, he taught plant taxonomy, systematics and biodiversity studies, earning widespread reputation as an exceptionally dedicated teacher. His field excursions, herbarium training sessions and garden-based practical demonstrations were appreciated by students for their clarity, depth and hands-on rigor.

A well-known botanist across India, Dr. Soodan specialized in "Grass Systematics and Phytolith research", becoming one of the leading experts in these fields. His meticulous work on the taxonomy of Himalayan and Punjab grasses, combined with advanced phytolith (plant silica bodies) studies, contributed significantly to both modern systematics and paleoecological reconstruction.

Over the course of his career, he authored more than 80 research articles in reputed national and international journals. His widely cited and referenced publications include

taxonomic evaluations of Poaceae (grasses), micromorphological and Scanning Electron Microscopy (SEM) studies of plant silica bodies, investigations of diagnostic phytolith morphotypes in roots, culms, leaves and inflorescences, as well as floristic and ecological surveys across the North-Western Himalayas and Punjab. Through this extensive body of work, he significantly contributed to species delimitation, enriched herbarium collections, and developed valuable diagnostic tools for research in taxonomy, archaeobotany and environmental sciences.

Dr. Soodan was a mentor in the truest sense, supervising 10 M.Phil. and 10 Ph.D. scholars, many of whom now hold distinguished academic, administrative and research positions across India. His students fondly remember his patience in guiding them through complex identifications, his insistence on clear and rigorous research methodology, his passion for fieldwork and herbarium curation. Equally admired was his willingness to support students even beyond office hours. His enduring legacy is reflected not only in the scientific competence of the scholars but also in the professional ethics and dedication he instilled in them.

Beyond his role as a teacher and guide, Dr. Soodan was associated with several botanical societies, participated actively in national conferences and workshops, and contributed to collaborative research projects related to taxonomy, biodiversity assessment and environmental studies. His expertise in specialized plant groups made him a sought-after resource person for academic evaluations, thesis committees, and botanical surveys.

Beyond academics, Dr. Soodan will be remembered for his gentle nature, humility, and generosity of spirit. He had an uncommon ability to balance scientific precision with warmth and compassion. Colleagues often remarked on his calm demeanor, his willingness to share knowledge, and the dignity with which he conducted both his personal and professional life.

The botanical community of India has lost an extraordinary scholar — a man whose contribution to grass taxonomy, phytolith systematics and botanical education will endure in scientific literature, herbaria, and in the minds of those he mentored.

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