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# *Dioscorea sphaeroidea* (Dioscoreaceae), a threatened new species from the high-altitude grasslands of southeastern Brazil with wingless seeds

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## Abstract

*Dioscorea sphaeroidea* is endemic to the high-altitude grasslands of the Serra dos Órgãos National Park located in southeastern Brazil. Based on the spheroid shape of its fruit and seed, i.e., not flattened or winged, this new species is morphologically unusual in the *Dioscorea* genus. Moreover, its unique morphology leaves this new species with no clear position in the infrageneric taxonomy of *Dioscorea*. Herein we present the morphological description of this species, including a discussion of its ecology and habitat, distribution, and preliminary risk of extinction assessment.

**Key words:** Atlantic rainforest, critically endangered species, Dioscoreales, endemism, neotropics

## Introduction

Dioscoreaceae is comprised of four genera and about 650 species distributed worldwide, but particularly in tropical regions (Govaerts *et al.* 2007; WCSP 2014). With over 600 species, *Dioscorea* Linnaeus (1753: 1032) is the genus with largest number of species, and it is the most widely distributed genus in the family (Govaerts *et al.* 2007). The genus is richest in the neotropics, with over 50% of known species. The Brazilian flora has the largest number of species, with 131 *Dioscorea* species, 96 of which are endemic (Kirizawa *et al.* 2013).

The phylogenies for the family have shown that *Dioscorea* is a monophyletic genus (Caddick *et al.* 2002a, 2002b), but with a rather complex and paraphyletic infrageneric classification (Wilkin *et al.* 2005). The infrageneric classification of *Dioscorea* was initially based on the characteristics of the seed wing. Thus, the species of the subgenus *Dioscorea* (*Eudioscorea*) are circumscribed by a circular wing surrounding the seed, and the species of the subgenus *Helmia* (Kunth 1850: 414) R. Knuth (1924: 50) are characterized by an elongated wing toward the base of the seed (Knuth 1924). Each subgenus is also subdivided into sections, 17 for *Helmia* and 39 for *Dioscorea*, mostly based on characteristics of inflorescence morphology, but with poorly defined boundaries. This fact prevents most of the known species of *Dioscorea* from inclusion in any of the subgenera or sections, with the current morphological delimitations provided by Grisebach (1842), Uline (1897) and Knuth (1924). Moreover, Wilkin *et al.* (2005) renders the previous infrageneric classifications redundant.

Based on the spheroid shape of its fruit and seed, i.e., not flattened or winged, *Dioscorea sphaeroidea* is morphologically unusual in the *Dioscorea* genus. It was discovered during a field investigation in southeastern Brazil, more specifically in the high-altitude grasslands of Serra dos Órgãos National Park (Fig. 1).

## Material and Methods

*Dioscorea sphaeroidea* was described and illustrated by composite line-drawings from dried material. The new species was carefully compared with *Dioscorea* specimens from BR, C, CAY, CESJ, COAH, COL, CR,

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CUVC, CVRD, ESA, F, FCAB, FURB, GUA, HAL, HAS, HB, HCF, HRCB, HUCP, HUEFS, HUPG, HVASF, HXBH, IAC, ICN, INPA, IPA, IRBR, JE, JVR, K, L, LPS, M, MBM, MEXU, MG, MNHN, MO, MVFA, MVFQ, MVM, NY, P, PACA, PEL, PH, RB, RBR, RFA, RFFP, S, SMDB, SP, SSUC, U, UFP, ULS, UNR, UPCB, US, UV, WU, XAL, Z and ZT. The preliminary risk assessment was based on the IUCN Red List Categories and Criteria (IUCN 2001).

**FIGURE 1**: The habitat of *Dioscorea sphaeroidea* in high-altitude grasslands of Serra dos Órgãos National Park, southeastern Brazil. Photograph by R.S. Couto.

## Taxonomy

***Dioscorea sphaeroidea*** R. Couto & J.M.A. Braga, *sp. nov.* (Figs. 2–3).

The new species is characterized by the small discoid tuber and reduced size of the branches (dwarf plant), male flowers with three stamens and flattened pistillode, female flowers with columnar 3-part stylus and entire at the end of each branch, and three staminodes, capsules orbicular, with three wings inflated by two seeds in each locule, providing globular aspect and containing a spheroid seeds without wing, thus differing from the vast majority of *Dioscorea* species that have flat and winged seeds.

**Type:**—BRAZIL, Rio de Janeiro: Teresópolis, Parque Nacional da Serra dos Órgãos, Pedra do Sino, 2200 m, 22°27'44.3"S, 43°01'51.6"W, 31 March 2010, *R.S. Couto et al. 316* (Holotype: RB!; isotype: R!).

Twining vine, dioecious, right-twining, glabrous. Underground system consisting of a small discoid tuber 1,5–4 cm diameter, with only one meristematic point from which the single aerial stem grows, with fine roots emerging from the edge of the tuber, yellow to light brownish periderm and yellowish-white parenchyma, ca. 5 cm from the ground surface. Stems 15–50 cm long, initially erect, becoming twining, terete, unarmed, herbaceous, green, 1–2 mm in diameter, with cataphylls only in the first node. Leaves alternate, entire, monomorphous; petiole 1.5–3.5 cm long, twisted at the base, canaliculated; blade 2–4.5 × 1.2–4 cm, green above and bright green below, papyraceous, cordate to ovate, with extremely narrow sinus, base cordate, apex acute, the basal lobes rounded and often overlapping, veins 7, prominent below, the outermost pair bifid. Staminate inflorescence 1.5–3.5 cm long, patent, 1–3 per axil, heterothetic compound inflorescence with racemes in principal axis and drepanium in secondary axis,

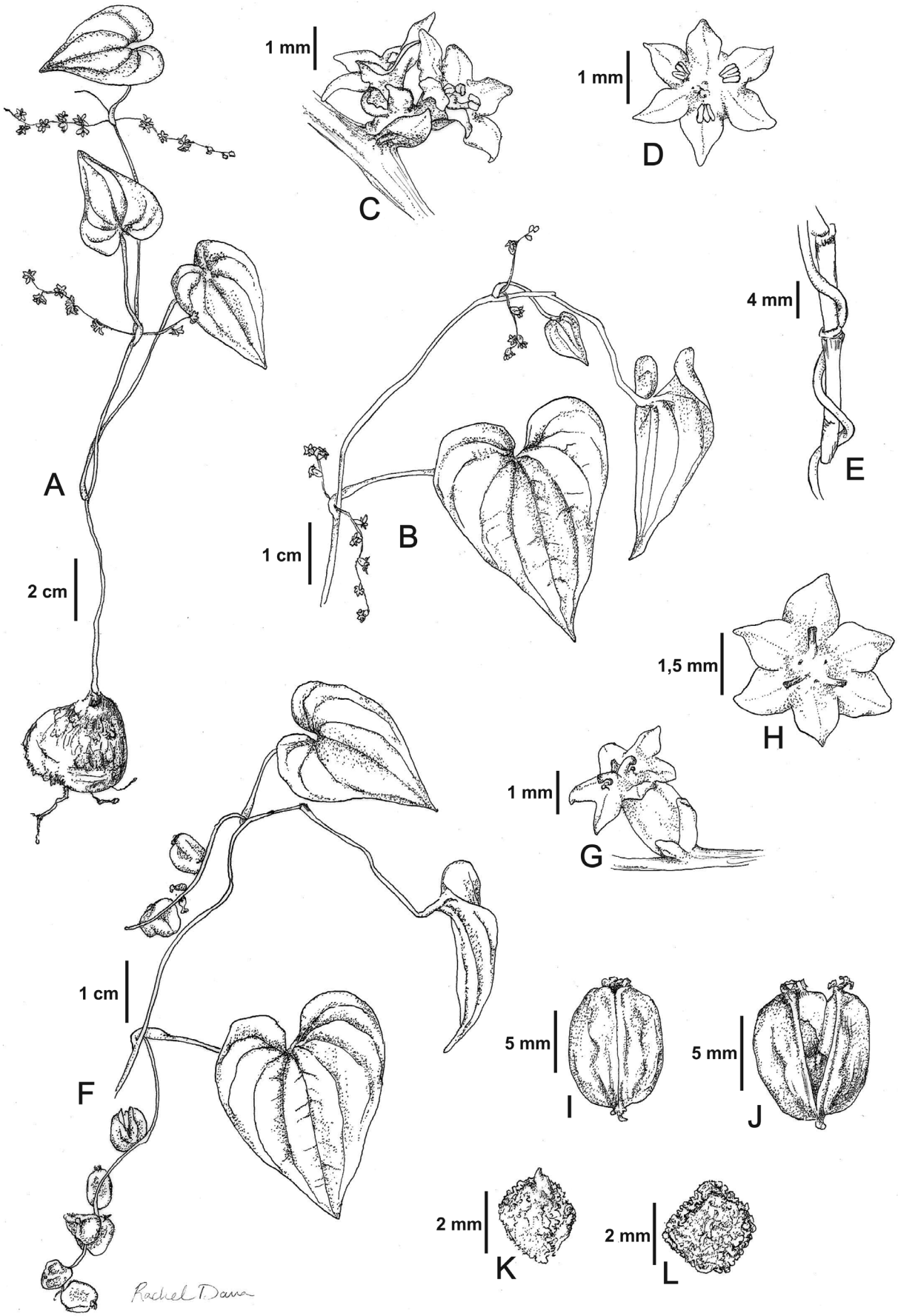


**FIGURE 2**: *Dioscorea sphaeroidea*. **A.** Habit. **B**. Staminate plant. **C**. Secondary axis of the staminate inflorescence. **D**. Staminate flower. **E**. Right-twining stem. **F**. Pistilate plant. **G-H**. Pistilate flower. **I-J**. Fruit. **K-L**. Seed. Drawn by R. Dana.

1–3 flowers per node of the rachis. Staminate flowers sessile, two bracteoles 0.5–1 mm long, ovate to deltoid, membranous, perianth light green, rotated, with a shallowly concave torus, inner and outer tepals 1–1.5 × 0.8–1.4 mm, ovate to ovate-acuminate, with a fine midrib; stamens 3, filaments free, inserted at the center of the torus, included, filaments ca. 0.5 mm long, anthers ca. 0.3 mm long, pistillodes present and flattened in the center of the flower. Pistillate inflorescence 1.5–4 cm long, simple, spicate, initially erect, later pendent, one per axil, pistillate flowers sessile, one per node of the rachis, two bracteoles 0.5–1 mm long, oblong to ovate-acuminate, perianth yellowish to light green, rotate, with an slightly convex torus, inner and outer tepals 1–1.7 × 1–1.6 mm, ovate, with a fine midrib; gynoecium tricarpellary, style ca. 0.5 mm long, thick, columnar, trifid at the apex, entire and rounded at the end of each stigmatic branch, staminodes 3, ca. 0.2 mm long, antheriform; ovary dark green. Capsules 0.6–1 × 0.5–0.8 cm, light green to yellow when immature and light brown to black when mature, orbicular, with three wings inflated by two seeds in each locule, providing globular aspect to the capsule, fleshy valves when immature and chartaceous valves when mature, dehiscence opening up to about ¾ of its size, perianth traces at the apex; seeds 2–3 mm long, spheroid, wing less, testa dark brown or black, and rugose.

**Distribution and habitat**:—This species is endemic to Brazil and limited to the Rio de Janeiro State, more specifically Teresópolis municipality, inside the Serra dos Órgãos National Park, where it has thus far been found only in the high-altitude grasslands near the summit of Pedra do Sino, always exceeding an altitude of 2000 meters (Fig. 1). *Dioscorea sphaeroidea* is found in locations sheltered from the strong winds that occur in the high-altitude grasslands, usually protected under small bushes or rocks that also allow some light.

**Phenology**:—Flowering and fruiting only observed in March.

**Conservation status**:—This species is apparently rare, with only small populations grouped in restricted areas approximately 1.5 m in diameter, occurring selectively in high-altitude grasslands limited to the Serra dos Órgão National Park. Even though this species occurs in a protected area, its conservation is still at risk from fire, unsupervised tourism, unregulated land use and hunting. This species has a very small population (known population with no more than 100 mature individuals) with an Extent of Occurrence (EOO) of ca. 2 km ² and Area of Occupancy (AOO) of ca. 8 km ². Therefore, this new species was evaluated on the basis of the IUCN Red List Categories and Criteria (IUCN 2001), as Critically Endangered (CR B2ab[iv] + C2a[ii]).

**Etymology**:—The new species is named for its spheroid seed, an unusual shape among species of the genus, which, as a rule, are characterized by flat and winged seeds.

**Additional specimens examined (paratypes):—**BRAZIL. Rio de Janeiro: Teresópolis, Parque Nacional da Serra dos Órgãos, Pedra do Sino, próximo ao cume, 2200 m, 22°27'44,3"S, 43°01'51,6"W, 31 March 2010, *R.S. Couto et al. 317* (RB!); Teresópolis, Parque Nacional da Serra dos Órgãos, Pedra do Sino, 2216 m, 22°27'44,3"S, 43°01'51,6"W, 22 March 2007, *M. Nadruz et al. 1782* (RB!).

**Affinities and notes on critical characters**:—*Dioscorea sphaeroidea* has creeping branches and habit similar to other *Dioscorea* species, which are primarily dwarf plants that occur in the high-altitude grasslands of Brazil. However, this species can be easily distinguished from others in the same habitat, especially by the shape of the capsule and the seeds (Figs. 2I–L, 3E–F). The new species is also characterized by the small discoid tuber, male flowers with three stamens and flattened pistillode, female flowers with style ca. 0.5 mm long, thick, columnar, trifid at the apex, entire and rounded at the end of each stigmatic branch, and three staminodes (Figs. 2–3). The immature capsule is tender and almost spherical, with the locules inflated by the round seeds (Fig 3E). Even when the seeds are fully developed and viable, their shape does not change, nor do any winged projections develop, thus remaining spheroid.

The existing classification for the subgenera is based on seed wing morphology. Moreover, Wilkin *et al*. (2005) suggests many changes in fruit and seed morphology across the phylogeny. Consequently, the infrageneric position of *D. sphaeroidea* is uncertain by the absence of elongated wing or any distinguishable projection, and no subgenus or section can be designated for it.

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We are grateful to Marcus Alberto Naduz Coelho from the Rio de Janeiro Botanical Garden who has shown us the first collection of the species and accompanied us in the field. Without his support, this new species would not have been discovered. The authors also acknowledge Rachel Dana for her illustration of *D. sphaeroeides* for this article and the financial support of CAPES.

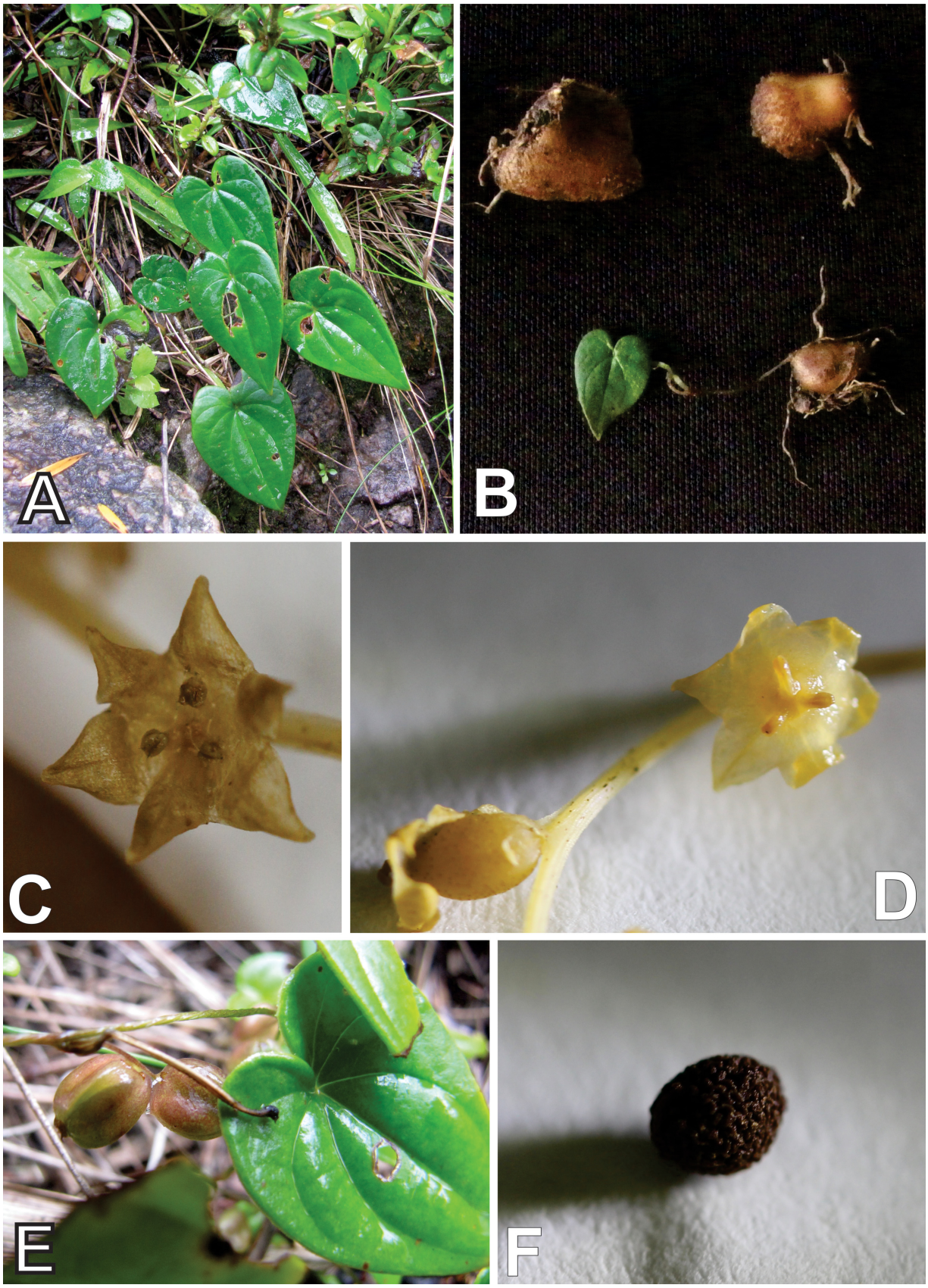


**FIGURE 3**: *Dioscorea sphaeroidea*. **A**. Habit. **B**. Tubers. **C**. Staminate flower. **D**. Pistilate flower. **E**. Immature fruits. **F**. Seed. Photographs by R.S. Couto.

## References


Caddick, L.R., Rudall, P.J., Wilkin, P., Hedderson, T.A.J. & Chase, M.W. (2002a) Phylogenetics of Dioscoreales based on combined analyses of morphological and molecular data. *Botanical Journal of the Linnean Society* 138: 123–144. http://dx.doi.org/10.1046/j.1095-8339.2002.138002123.x

Caddick, L.R., Rudall, P.J., Wilkin, P., Hedderson, T.A.J. & Chase, M.W. (2002b) Yams reclassified: a recircumscription of Dioscoreaceae and Dioscoreales. *Taxon* 51: 103–114. http://dx.doi.org/10.2307/1554967

Govaerts R., Wilkin P. & Saunders R.M.K. (2007) *World Checklist of the Dioscoreales: yams and their allies*. Royal Botanic Gardens Kew, Kew, 65 pp.

Grisebach, A.H.R. (1842) Dioscoreae. *In*: Martius, C.F.P., Eichler A.G & Urban, I. (eds.) *Flora Brasiliensis* v. 3(1). Fried, Fleischer, Leipzig, pp. 25–48.

IUCN (2001) *IUCN Red List Categories and Criteria* v. 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge. Available from: http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria (accessed 14 February 2014).

Kirizawa, M., Xifreda, C.C., Couto, R. & Araújo, D. (2013) Dioscoreaceae. *In*: *Lista de Espécies da Flora do Brasil*. Jardim Botânico do Rio de Janeiro, Rio de Janeiro. Available from: http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB104 (accessed: 26 December 2013).

Knuth, R. (1924) Dioscoreaceae. *In*: Engler H.G.A. (ed.) *Das Pflanzenreich* 4, 43(87), Verlag von Wilhelm Engelmann, Leipzig, pp. 1–387.

Kunth, C.S. (1850) Dioscorineae. *In: Enumeratio Plantarum*. v. 5. Sumtibus J.G. Cottae, Stutgardiae et Tubingae, pp. 323–456.

Linnaeus, C. (1753) *Dioscorea*. *In*: *Species Plantarum*. v. 2. Impensis Laurentii Salvii, Holmiae, pp. 1032–1034.

Uline, E.H. (1897) Dioscoreaceae. *In:* Engler, A. & Prantl, K. (eds.) *Die Natürlichen Pflanzenfamilien* v. 2(5). W. Engelmann, Leipzig, pp. 80–87.

Wilkin, P., Schols, P., Chase, M.W., Chayamarit, K., Furness, C.A., Huysmans, S., Rakotonasolo, F., Smets, E., & Thapyai, C. (2005) A plastid gene phylogeny of the yam genus, *Dioscorea*: roots, fruits and Madagascar. *Systematic Botany* 30: 736 – 749. http://dx.doi.org/10.1600/036364405775097879

WCSP (2014) *World Checklist of Selected Plant Families*. Facilitated by the Royal Botanic Gardens, Kew. Available from: http://apps.kew.org/wcsp/ (accessed: 14 February 2014).