

## *Diospyros barteri* Hiern (Ebenaceae): new records for the vascular flora of Benin

Gbèwonmèdéa Hospice Dassou<sup>1,2</sup>, Aristide Cossi Adomou<sup>1</sup>, Chabi Ghyslain Kpétikou<sup>1</sup>, Peter Neuenschwander<sup>3</sup>

<sup>1</sup> Laboratoire de Botanique et Ecologie Végétale, Département de Biologie Végétale, Faculté des Sciences et Techniques, Université d'Abomey-Calavi, Benin

<sup>2</sup> Jardins Botanique et Zoologique Edouard Adjanohoun, Université d'Abomey-Calavi, Benin

<sup>3</sup> International Institute of Tropical Agriculture, 08 BP 0932, Cotonou, Bénin

Corresponding author: Gbèwonmèdéa Hospice Dassou ([daspice2@gmail.com](mailto:daspice2@gmail.com))

**Abstract.** *Diospyros barteri* was recorded for the first time from Dodja, a sacred forest in the Commune of Abomey-Calavi, Benin. We provide a detailed description, illustration, habitat, ecology, flowering period, and population size of this species. These occurrences fill a gap in the distribution of the species in the Dahomey-Gap territory. Our new records show the importance of botanical surveys in sacred forests which are hotspots of biodiversity in the country. However, sacred forests are unfortunately poorly maintained and managed and are difficult to access because they serve as central sites for ceremonies of local divinities in vodun celebrations.

**Key words.** Sacred forest, species monitoring, first record

**Dassou GH, Adomou AC, Kpétikou CG, Neuenschwander P** (2024) *Diospyros barteri* Hiern (Ebenaceae): new records for the vascular flora of Benin. *Check List* 20 (3): 636–640. <https://doi.org/10.15560/20.3.636>

### INTRODUCTION

In Benin, the flora of rainforests is confined to a few government-owned and community forests and to several hundred sacred areas in the south in the Guineo-Congolese zone. Together these forests cover less than 2% of the country but account for a fifth of all species and harbor two-thirds of all threatened plants in the country (Adomou et al. 2011). However, these hotspots of biodiversity are often poorly maintained and have difficult access because they serve as central sites for ceremonies and rituals for local divinities (e.g. vodun celebrations) (Henning and Oberländer 1995; Siebert 2004). During restoration of 14 ha of crop fields and young fallows to what has now become a species-rich secondary forest, the Sanctuaire des singes de Drabo Gbo (Neuenschwander and Adomou 2017), *Diospyros barteri* Hiern was discovered in the sacred forest of Dodja, only 0.8 ha in area and part of the “Sanctuaire”. Today, this forest is owned by the International Institute of Tropical Agriculture (IITA) and is easily accessible. However, it is used by the local zan-gbeto cult for its celebrations and is guarded by a local villager. Zan-gbeto (“guardian of the night”) is an initiatory secret society rooted in the vodun culture in southern Benin. It was created in the eighteenth century by King Tè-Agbanlin with the mission of watching over the king and his community and chasing away sorcerers and evil spirits during the night. Today, this fetish is still feared and invoked to settle conflicts between villagers, and it is also used in the management of forests for biodiversity conservation (Lokossou and Bossou 2012; Kokou and Sokpon 2006).

*Diospyros barteri* was initially known from secondary forests in West Africa south to Gabon (Hawthorne and Jongkind 2006) and listed as Vulnerable in a part of its native geographic range in Cameroon, Ghana, and Nigeria (Hawthorne 1998). This conservation status has remained the same until now (IUCN 2024). The species is among another seven species of Ebenaceae known to occur in Benin (Akoègninou et al. 2006). Two of them are pantropical or introduced species, and the remaining five—three of them of Guineo-Congolian origin—are all well represented in the Sanctuaire des singes de Drabo Gbo.

Here, we report new data on *D. barteri* in Benin, supported by samples collected the fields, taxonomic characters, a distribution map, and notes on habitat and phenological characters. An identification key to the species of *Diospyros* in Benin is included.



Academic editor: Robert P. Wagensommer

Received: 26 March 2024

Accepted: 13 May 2024

Published: 22 May 2024

Copyright © The authors. This is an open-access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International – CC BY 4.0)

## MATERIALS AND METHODS

The sacred forest of Dodja is only 0.8 ha in area and located at 06°31'07"N, 002°17'19"E. It was purchased by one of the co-authors (Peter Neuenschwander) in 2011, but it lost about 1,000 m<sup>2</sup> in 2016 by theft, as is common in the region, where traditional landownership is often not secured by title deeds. This loss has now been reversed and the stolen part is currently (2024) being reforested. In 2014, all title deeds and documents were given to International Institute of Tropical Agriculture, which integrated the sanctuary in its government-approved portfolio and research program which includes biological control and the protection of biodiversity.

Three expeditions (June 2022, January 2023, and February 2024) were made in the forest by us. Phenology was followed over one complete year (March 2023 to February 2024). Specimens were collected and identified at the National Herbarium of Benin (**BENIN**) with the help of the *Flora of West Tropical Africa* (Hutchinson et al. 1963) and an online specimen from Kew's Herbarium (Royal Botanical Garden, Kew, UK; K000190034). The description and illustration were based on our specimen and on the recent literature (Jongkind 2007). Eighteen voucher specimens were deposited in BENIN. The geographical coordinates were recorded using a GPS receiver using the WGS84 datum. The distribution map was prepared using ArcGIS v. 10.8 and includes both our data and occurrences from Jongkind (2007). We determined the population size by counting the total number of individual plants. The threat status of the species was determined by using IUCN Red List platform (IUCN 2024).

## RESULTS

*Diospyros barteri* Hiern in Trans. Cambridge Philos. Soc. 12: 187 (Hiern 1873)

Figure 1A–C

**New records.** BENIN – ABOMEY-CALAVI • Dodja; 06°51.887'N, 002°28.805'E; 34 m alt.; 18.VI.2022; AAC 193; 2 ♀; BENIN 1225 • same locality; 28.II.2024; AAC 194; 3 sex indet., BENIN 1265; DGH 98; 2 ♀, BENIN 1266.

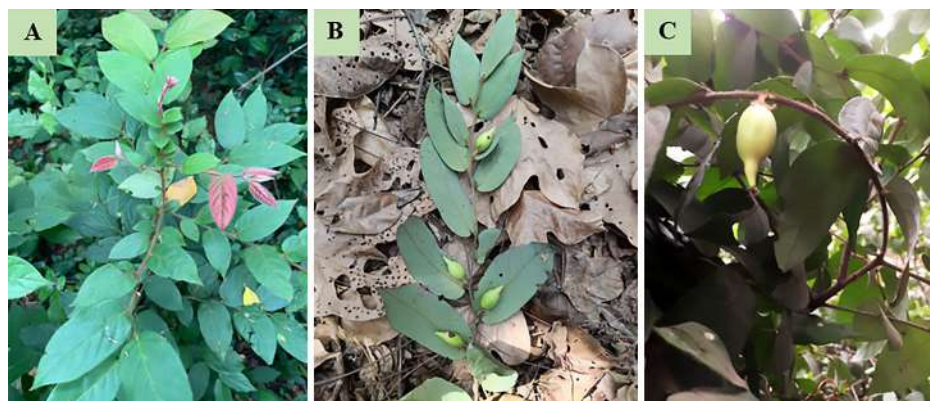
**Identification.** Forest shrub or small tree up to 7 m tall, sometimes scrambling. Young part covered with ferruginous hairs. Leaves simple and alternate, glaucous beneath, widely cordate and strongly reticulate; calyx lobes up to 2 mm wide; corolla completely covered with straight hairs; hairs on tube of open flower pointing upward; fruit pointed, glabrous, pale yellow.

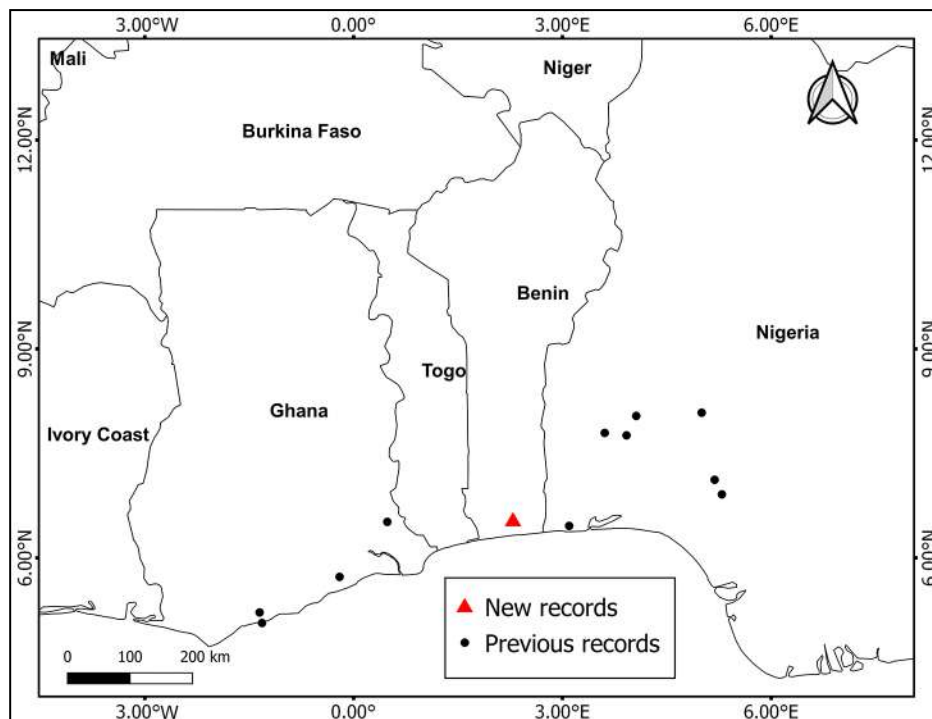
**Distribution.** *Diospyros barteri* is distributed across West Tropical Africa. Currently, it is known from Ghana and Nigeria (Jongkind 2007). Our new records are the first from Benin and expand the known distribution of *D. barteri* in tropical Africa (Figure 2).

**Phenology.** In Dodja, we found this species flowering started in January. Fruits were collected in late February.

**Habitats.** The specimens were collected from the undergrowth of the moist semi-deciduous forest island at Dodja (Figure 3) where the dominant species are *Cola gigantea* A. Chev. (Malvaceae) and *Celtis* L. spp. (Cannabaceae). This forest also has some of the biggest *Antiaris toxicaria* (J.F.Gmel.) Lesch. (Moraceae) and *Blighia* spp. (Sapindaceae) trees of the area, and there is an rare bush, *Oxyanthus tenuis* Stapf. (Rubiaceae). During the last few years, clearings of the canopy have been filled with fast-growing *Rhodognaphalon brevicuspe* (Sprague) Roberty (Malvaceae), *Ceiba pentandra* (L.) Gaertn. (Malvaceae), and *C. gigantea*, but also *Chrysophyllum albidum* G. Don (Sapotaceae). Despite this effort, the sacred forest, when viewed from outside, still has many clearings.

**Figure 1.** *Diospyros barteri* Hiern in Dodja forest (Benin). **A.** Habit. **B.** Leafy stem with young fruits. **C.** Fruit at ripe stage of development. Photographs: G.H. Dassou (UAC), A.C. Adomou and P. Neuenschwander (IITA), respectively.





**Figure 2.** Global distribution of *D. barteri*: previous records (black dots) from Jongkind 2007, GBIF.org), new records (red dot).

**Figure 3.** Sacred Forest of Dodja, a tiny biodiverse island in an agricultural landscape.



**Conservation status.** *Diospyros barteri* was given a preliminary global Red List status of Vulnerable (IUCN 2024). In Benin, the extent of occurrence (EOO) is 0.002 km<sup>2</sup>, based on current data. This tiny EOO is well below the threshold for Critically Endangered under criterion B1 (IUCN 2012), as for other species with a single occurrence in a country (Wagensommer et al. 2014; Perrino et al. 2023). The population is small, with an estimated 94 individuals. Further surveys and other research are needed to confirm this species’ distribution, origin, and population size, apart from the Dodja population, to better assess its conservation status in Benin.

**Key to distinguish Beninese *Diospyros* species**

- 1 Leaves glabrous or almost glabrous ..... 2
- Leaves pubescent or golden and silky underneath ..... 4
- 2 Calyx pubescent, orange; cupola star-shaped, with 4 or 5 lobes; lobes oval to triangular, with undulating margin, 1.2 cm high; fruit subglobose, pointed, 2.5–3.0 cm in diameter, 4–6 seeds, almost glabrous ..... *D. mespiliformis*
- Calyx glabrous except some marginal hairs, star-shaped, with 3 lobes ..... 3

- 3 Female inflorescence in groups of 3–5 flowers, fruit ellipsoid-conical with at its base a barely visible calyx; 1 or 2 seeds ..... ***D. abyssinica***
- Female inflorescence with solitary flowers, fruit ovoid, pointed with, at its base, 3 long lobes protruding from the calyx; several seeds ..... ***D. soubreana***
- 4 Calyx pubescent, star-shaped, divided into 4 or 5 lobes ..... 5
- Calyx hairy, in form of a cupola ..... 7
- 5 Calyx silky red, divided into 4 triangular teeth; fruit ovoid-conical, glabrous or, if pubescent, only at the apex, with 4 seeds; young branches in zigzag shape, with red hairs; leaves elliptical or oval ..... ***D. tricolor***
- Calyx with 4 or 5 lobes; fruit globular or cylindrical, with 2–6 seeds; leaves elliptical to oblong ..... 6
- 6 Big introduced tree; leaves oblong; calyx pubescent with 4 or 5 lobes; fruit globular, densely hairy, with 4–6 seeds ..... ***D. discolor***
- Climbing shrub, autochthonous; leaves smaller, elliptical, with cordate base; calyx pubescent, divided into 4 lobes; fruit cylindrical, glabrous, tip angled, with 4 seeds ..... ***D. barteri***
- 7 Calyx truncate, laterally split, 1.5 cm high, surrounding fruit up to its middle; fruit ovoid-subglobular, 2.5–4.0 cm long, glabrous, except at its base; style persistent, with 2–8 seeds ..... ***D. monbuttensis***
- Calyx with 3 triangular teeth, 5 mm high, fruit ellipsoid, pointed, 1.5 x 1 cm, glabrous except some hairs at the tip, 1–2 seeds ..... ***D. ferrea***

## DISCUSSION

The sacred forests of Benin, hotspots of biodiversity, are mostly outside established national nature reserves and often seriously degraded, which makes their protection of highest priority for nature conservation in Benin (Adomou et al. 2011; Neuenschwander and Sinsin 2011). Apart from a detailed study by Adomou (2005), the vegetation of these forests has not had long-term observations. This probably explains, why *D. barteri* has escaped detection. This species is well represented and protected in the sacred forest of Dodja, but it has not yet been found in any other forest in Benin. These forests, which are embedded in the mostly degraded Savannah forests of the Dahomey gap, sometimes consist of only a few trees, which makes a stochastic loss of species highly probable. Other species that are only known from a few stands, and sometimes only a few individuals, are *Distemonanthus benthamianus* Baill. (Fabaceae), *Coffea mannii* (Hook.f.) A.P.Davis (Rubiaceae), *Nesogordonia kabingaensis* (K.Schum.) Capuron ex R.Germ. (Malvaceae), *Entandrophragma angolense* C.DC. (Meliaceae), *Barteria nigritiana* Hook.f. (Passifloraceae), and *Pierrodendron kerstingii* (Engl.) Little (Simaroubaceae). They are all well represented in the Sanctuaire des singes de Drabo Gbo (Neuenschwander and Adomou 2017), but they and *D. barteri*, should be introduced to other sites as an assurance of their continued survival in Benin, as has recently been done for *Mansonia altissima* A. (Chev.) A. Chev. (Malvaceae) and *Maesopsis eminii* Engl. (Rhamnaceae). Additionally, *D. barteri*, because of its tiny EOO, should be declared Critically Endangered in the Benin IUCN Red List.

## ACKNOWLEDGEMENTS

We thank financial support of the Leventis Foundation during the last three years. GHD acknowledges the support of the Rufford Foundation through the 2nd Booster Grant (ID: 39633-D). We thank the editors and reviewers for their critical comments and suggestions that improved the manuscript.

## ADDITIONAL INFORMATION

### Conflict of interest

The authors declare that no competing interests exist.

### Ethical statement

No ethical statement is reported.

### Funding

This study was financially supported by the Leventis Foundation and the Rufford Foundation.

### Author contributions

Conceptualization: PN, ACA, GHD. Data curation: GHD, ACA. Formal analysis: GHD, CGK. Funding acquisition: PN; GHD. Investigation: PN, ACA, GHD, CGK. Methodology: GHD, CGK. Resources: PN; GHD. Supervision: PN, ACA. Visualization: GHD, CGK. Project administration: PN, ACA, GHD. Software: CGK. Validation: PN, ACA, GHD, CGK. Writing – original draft: PN, GHD. Writing – review and editing: PN, ACA, GHD, CGK.

**Author ORCID iDs**Gbèwonmèdéa Hospice Dassou  <https://orcid.org/0000-0003-4651-1802>Peter Neuenschwander  <https://orcid.org/0000-0003-0580-0376>**REFERENCES**

- Adomou AC** (2005) Vegetation patterns and environmental gradients in Benin: Implications for biogeography and conservation. PhD thesis, University of Wageningen, Wageningen, the Netherlands, 135 pp.
- Adomou AC, Agbani OP, Sinsin B** (2011) Plants. In: Neuenschwander P, Sinsin B, Goergen G (Eds.) Nature conservation in West Africa: Red List for Benin. IITA, Ibadan, Nigeria, 21–46.
- Akoègninou A, van der Burg WJ, van der Maesen LJG** (2006) Flore analytique du Bénin. Backhuys Publishers, Wageningen, the Netherlands, 1034 pp.
- Hawthorne W, Jongkind C** (2006) Woody plants of Western African forests: a guide to the forest trees, shrubs and lianes from Senegal to Ghana. Royal Botanical Garden, Kew, UK, 1023 pp.
- Hawthorne W** (1998) *Diospyros barteri*. The IUCN Red List of Threatened Species 1998: e.T33193A9759923. <https://doi.org/10.2305/iucn.uk.1998.rlts.t33193a9759923.en>. Accessed on: 2024-05-11.
- Henning C, Oberländer H** (1995) Voodoo. Taschen Verlag, Köln, 240 pp.
- Hiern WP** (1873) A monograph of Ebenaceae. Transactions of the Cambridge Philosophical Society 12: 27–300.
- Hutchinson J, Dalziel JM** (1963) Flora of west tropical Africa, 2nd edition. Revised by Keay RWJ, Hepper FN. Royal Botanical Garden, Kew, UK, 544 pp.
- IUCN** (International Union for Conservation of Nature and Natural Resources) (2012) IUCN Red List categories and criteria: version 3.1. Second edition. IUCN Species Survival Commission, Gland, Switzerland & Cambridge, UK.
- IUCN** (International Union for Conservation of Nature and Natural Resources) (2024) Guidelines for using the IUCN Red list categories and criteria. <https://www.iucnredlist.org>. Accessed on: 2024-03-20.
- Jonkind CH** (2007) The resurrection of *Diospyros rubicunda* (Ebenaceae), a former synonym of *Diospyros barteri*. Kew Bulletin 62: 637–640.
- Kokou K and Sokpon N** (2006) Les forêts sacrées du couloir du Dahomey. Bois et forêts des tropiques 2: 15–23.
- Lokossou AO and Bossou B** (2012) Benin's experience in the management of sacred forests for biodiversity conservation. International Partnership for the Satoyama Initiative. The United Nations University, <https://satoyama-initiative.org/>. Accessed on: 2024-05-11.
- Neuenschwander P, Adomou A** (2017) Reconstituting a rainforest patch in southern Benin for the protection of threatened plants. Nature Conservation 21: 57–82. <https://doi.org/10.3897/natureconservation.21.13906>.
- Neuenschwander P, Sinsin B** (2011) Sustainable nature protection for Benin: Conclusions. In: Neuenschwander P, Sinsin B, Goergen G (Eds.) Nature conservation in West Africa: Red List for Benin. International Institute of Tropical Agriculture, Ibadan, Nigeria, 331–347.
- Perrino EV, Mahmoud ZNA, Valerio F, Tomaselli V, Wagensommer RP, Trani A** (2023) Synecology of *Lagoecia cum-inoides* L. in Italy and evaluation of functional compounds presence in its water or hydroalcoholic extracts. Scientific Reports 13: 20906. <https://doi.org/10.1038/s41598-023-48065-w>
- Siebert U** (2004) Heilige Wälder und Naturschutz. Empirische Fallbeispiele aus der Region Bassilla, Nordbénin. Spektrum 88. LIT Verlag, Münster, Germany, 363 pp.
- Wagensommer RP, Fröhlich T, Fröhlich M** (2014) First record of the southeast European species *Cerintho retorta* Sibth. & Sm. (Boraginaceae) in Italy and considerations on its distribution and conservation status. Acta Botanica Gallica: Botany Letters 161: 111–115. <https://doi.org/10.1080/12538078.2014.892438>