New records for the flora of Angola: observations from Uíge and Cuanza Norte

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**Background and aims** – Located in the transition zone of Guineo-Congolian and Zambezian phytochoria, the Angolan provinces of Uíge and Cuanza Norte are of particular interest for floristic studies and high biodiversity is expected. Nevertheless, explorations of the vegetation are relatively rare. Our study aims to supplement a recent checklist of vascular plants of Angola.

**Methods** – Data were collected during 17 field trips between 2013 and 2018, during which herbarium specimens were prepared for later identification of plant species. The results were compared with the current checklist as well as with other floristic works, herbarium collections and online databases relevant for the region.

**Key results** – We document 20 new records of indigenous vascular plant species for the flora of Angola (19 species and one subspecies), including four new generic records. Furthermore, nine alien species are added to the checklist of the flora of Angola.

**Conclusion** – Our results confirm that the flora of northern Angola is composed by elements of various adjacent areas. However, not all species present are known yet. Further botanical investigation is needed to complete our floristic knowledge of the region.

**Keywords** – Northern Angola; checklist; distribution; native flora; alien species; new records.

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Plant Ecology and Evolution is published by Meise Botanic Garden and Royal Botanical Society of Belgium
ISSN: 2032-3913 (print) – 2032-3921 (online)
the north and east, the Angolan provinces of Malanje, Cuanza Norte and Bengo in the south, and the Zaire province in the west. While most of the country is characterized by different savannah types, Uíge as well as parts of Cuanza Norte belong to the ecoregion called Western Congolian Forest-Savannah Mosaic (Olson et al. 2001). White (1983) concretised that elements of both the Guineo-Congolian and the Zambezian Regions are forming a Regional Transition Zone of high complexity. Even some pure Congolian forest patches exist along the big rivers such as the Cuango (Goyder & Gonçalves 2019). However, White (1983) depicted this area as grassland and wooded grassland secondarily formed following the destruction of the original vegetation.

Recent studies provide a more detailed picture of the area. During field trips in Uíge and Cuanza Norte we collected and identified 820 species of mosses (Müller 2015; Müller et al. 2019), ferns, gymnosperms and angiosperms being stored now in the Herbarium Dresdense (DR). In the mountain chain of Serra Pingano, an unknown Impatiens species was found and described as Impatiens pinganoensis Abrah. et al. (Abrahamczyk et al. 2016). Furthermore, ethnobotanical surveys from the region were published during the last years (Göhre et al. 2016; Heinze et al. 2017; Lautenschläger et al. 2018).

The checklist of vascular plants of Angola (Figueiredo & Smith 2008) comprises 6735 native and 226 non-native species (Figueiredo et al. 2009; Smith & Figueiredo 2017). Here, we present new records of another 19 species and one subspecies as well as of nine alien species.

**MATERIALS AND METHODS**

The data were collected during 17 field trips from 2013 to 2018. Data sampling was carried out between 5°58′59.2″S and 9°40′60.5″S and between 14°10′37.0″E and 16°17′04.5″E (fig. 1). All the surveys were permitted and accompanied by the local authorities. The Ministry of the Environment, Republic of Angola, and the Province Government of Uíge issued the required collection and export permits. For documentation, plant voucher specimens, complemented by photographs, were collected, dried and stored at the Herbarium Dresdense (DR), Technische Universität Dresden, Germany. Voucher specimen numbers are given in the checklist below. All sample data are available at Virtual Herbaria JACQ (https://herbarium.univie.ac.at/database/). Due to CITES trade regulations one orchid species is documented by photo voucher only. In a Memorandum of Understanding signed in 2014, the Instituto Nacional da Biodiversidade e Áreas de Conservação (INBAC), Angola, and the Technische Universität Dresden, Germany, agreed upon that duplicates of herbarium vouchers will be returned to Angola as soon as appropriate conditions to store them are established. Identification of collected plant specimens and data analysis were completed in Dresden. For identification, relevant floristic works were used and listed in the particular species description.

Furthermore, for some plant groups, specialists were consulted. Plant families are treated alphabetically.

**RESULTS**

Based on the checklist of the vascular plants of Angola (Figueiredo & Smith 2008), we present records of 20 native species new to the flora of Angola including three new genera (Epithema, Mendonia, Newbouldia), and 9 neophytes (three new genera: Eleutherine, Eryngium, Leptaspis).

![Figure 1 – Study area. A. Location of Angola in Africa. B. Location of the provinces Cuanza Norte (south) and Uíge (north) in Angola. C. Vegetation zones in the study area according to Barbosa (2009), collection sites marked by a black dot.](image-url)
Native species

Acanthaceae

*Asystasia vogeliana* Benth.


**Habitat** – Rain forest.

**Notes** – The light mauve flowers are comparatively large with a corolla up to 5 cm. It keys out next to *Asystasia scandens* (Lindl.) Hook. from which it differs by its inflorescence being longer and less dense. Additionally, its corolla tube is much longer and not suddenly widened to become bell-shaped in the upper two thirds, like in *A. scandens*.

**Specimens examined** – Angola: Uige: [Serra Pingano] 7°40′56.6″S, 15°24′49.1″E, 803 m alt., 25 Feb. 2017, T. Lautenschläger 2017_143 (DR, barcode 049160).


Balsaminaceae

*Impatiens burtonii* Hook.f. var. *burtonii*

**Distribution** – West Central Tropical Africa, East Tropical Africa.

**Habitat** – Understory of cloud forest.

**Notes** – A number of African *Impatiens* species is characterized by spirally arranged leaves with petioles at least 1 cm long and up to 10 lateral veins, a much-reduced peduncle and a navicular lower sepal being abruptly constricted into a short filiform spur. Within this group, *I. burtonii* keys out by usually pubescent, 3–4 mm long lateral sepals without glandular teeth, petioles which are not fimbriate-glandular, lateral united petals without a filiform appendage extending into the spur and a relatively large flower size (fig. 2D). Three varieties can be distinguished on spur length (being 16–23 mm long in var. *angusticalcarata* (De Wild.) R. Wilczek & G.M. Schulze while only 5–9 mm long in *I. burtonii* var. *wittei* (G.M. Schulze) Grey-Wilson and var. *burtonii*) combined with leaf lamina size (shorter than 20 mm with 3–6 pairs of lateral veins in var. *wittei* while 25–160 mm long with 6 to 11 pairs of lateral veins in var. *burtonii*).

**Specimen examined** – Angola: Uige: [Pambu] 7°25′56.0″S, 15°10′28.0″E, 1252 m alt., 17 Feb. 2015, B. Ditsch BD 742 (DR, barcode 050799).


Annonaceae

*Monanthotaxis gilletii* (De Wild.) Verdc.

**Distribution** – West Tropical Africa, East Tropical Africa.

**Habitat** – Rain forest.

**Notes** – This species is easily recognized by the large leafy bract on the peduncle in combination with large erect hairs on the branches. Other species with large leafy bracts have appressed hairs.


**References** – Boutique (1951): under the synonym *Popowia gilletii* De Wild.; Verdcourt (1971).

Araceae

*Anubias gilletii* De Wild. & T.Durand

**Distribution** – West Tropical Africa, West Central Tropical Africa.

**Habitat** – Submersed and emersed in river.

**Notes** – The species was identified from a living specimen collected at the locality given below and flowering later as a cultivated plant in the Botanical Garden of Dresden. It differs from the narrowly allied *Anubias hastifolia* Engl. by the position of the thecae (at the edge instead of partly or completely on top of the synandria), the form and size of the spathe and by the spathe in anthesis being reflexed (fig. 2A).

**Specimen examined** – Angola: Uige: [Kivelu] 6°01′00.0″S, 15°24′49.1″E, 803 m alt., 25 Feb. 2017, T. Lautenschläger 2017_143 (DR, barcode 049160).


Begoniaceae

*Begonia johnstonii* Oliv. ex Hook.f.

**Distribution** – East Tropical Africa.

**Habitat** – On rocks.

**Notes** – Determination of *Begonia johnstonii* was carried out by a specialist (M. Hughes, Royal Botanic Gardens, Kew, UK, pers. comm. 2018). Up to now, this species was only known from Kenya and Tanzania. Taking into account the dust-like seeds freely floating in the air, some anemochorous long distance dispersal may have spread the seeds from eastern Africa to Angola, where again suitable habitats on rocks...
within the forest may have facilitated successful establishment. According to Plana et al. (2004) the present distribution of Begonia johnstonii, B. engleri Gilg and B. annobonensis A.DC. could be the result of a climate change during the early Pliocene leading to rainforest expansion and isolating the populations of the three Begonia species which they described as functionally annual and well adapted to more seasonal conditions. In this case, the Angolan Begonia johnstonii might as well represent another relict population (fig. 2B).


References – de Wilde (2002); Hughes et al. (2015).

Bignoniaceae

Newbouldia laevis (P.Beauv.) Seem. ex Bureau

Distribution – West Tropical Africa, West Central Tropical Africa.

Habitat – In village.

Notes – This species is frequently grown as boundary in the north of the province Uíge, but also found roadside. The same was recorded in the neighbouring province Kongo Central of the D.R. Congo (Latham & Konda ku Mbuta 2014). This is the first record of the monotypic genus Newbouldia in Angola (fig. 2G).

Specimen examined – Angola: Uíge: [Kivala] 5°58′59.2″S, 15°11′5.4″E, 977 m alt., 25 Nov. 2015, A. Kempe TL 80 (DR, barcode 043913).

Reference – Heine (1963b).

Commelinaceae

Polyspatha hirsuta Mildbr.


Habitat – Rain forest.

Notes – While the inflorescence-axis bearing spathes is comparatively longer in the related P. paniculata Benth., here it does not exceed 4 cm.

Specimen examined – Angola: Uíge: [Serra Pingano] 7°40′22.1″S, 14°56′17.2″E, 615 m alt., 16 Feb. 2015, T. Ditsch BD 735 (DR, barcode 050939); [Bombo] 7°31′09.5″S, 14°33′53.7″E, 446 m alt., 12 Oct. 2016, A. Kempe 2016-40 (DR, barcode 044456); [Quijoao] 7°43′08.0″S, 14°44′45.0″E, 600 m alt., 19 Feb. 2017, T. Lautenschläger 2017-95 (DR, barcode 050787).


Marattiaceae

Ptisana salicifolia (Schrad.) Senterre & Rouhan


Habitat – Rain forest.

Notes – According to M. Lehnert (Martin-Luther-Universität Halle-Wittenberg, Germany, pers. comm. 28 Aug. 2019), two herbarium specimens of P. salicifolia from Angola were filed as Ptisana fraxinea (Sm.) Murdoch: US Catalog No.: 3001336 (barcode 01403971) and US Catalog No.: 3001339 (barcode 01403957). However, the locations indicated are certainly located in D.R. Congo. The French labelling also supports this assumption.

Specimens examined – Angola: Uíge: [Serra Pingano] 7°40′22.7″S, 14°56′17.7″E, 615 m alt., 18 Jul. 2015, T. Lautenschläger 21 (DR, barcode 052154); [Serra Uíge] 7°37′03.0″S, 14°57′11.0″E, 872 m alt., 28 Oct. 2013, B. Ditsch BD 505 (DR, barcode 050952).


Melastomataceae

Calvoa orientalis Taub.

Distribution – West Central Tropical Africa.

Habitat – Forest edge.

Notes – Glabrous herb, leaf lamina with the base rounded and more than 1.5 cm wide. The capsules of the specimen exhibit a 5-lobed crown that is exserted for 3 mm and winged with bright lobes.

Specimen examined – Angola: Uíge: [Murro] 6°36′55.2″S, 16°12′12.6″E, 861 m alt., 18 Feb. 2015, B. Ditsch BD 762 (DR, barcode 046846).

References – Soladoye (1985); Goncharov et al. (2011).

Gesneriaceae

Epithema tenue C.B.Clarke


Habitat – Secondary forest, on wet rocks (fig. 2C).

Notes – This is the first record of the genus Epithema in Angola.

Specimens examined – Angola: Uíge: [Serra Pingano] 7°40′22.1″S, 14°56′17.2″E, 615 m alt., 16 Feb. 2015, T. Ditsch BD 735 (DR, barcode 050939); [Bombo] 7°31′09.5″S, 14°33′53.7″E, 446 m alt., 12 Oct. 2016, A. Kempe 2016-40 (DR, barcode 044456); [Quijoao] 7°43′08.0″S, 14°44′45.0″E, 600 m alt., 19 Feb. 2017, T. Lautenschläger 2017-95 (DR, barcode 050787).


Calvoa seretii De Wild. subsp. seretii

Distribution – West Central Tropical Africa.

Habitat – Swampy forest.

Notes – Glabrous herb, leaf lamina longer than 3 cm, attenuate at base, apex acute. The capsules of the specimen exhibit a 5-lobed crown, exserted for only 1.5 mm. The petal lobes are reddish.

Specimens examined – Angola: Uíge: [Kikuambalembua] 7°53′59.1″S, 15°04′25.0″E, 984 m alt., 24 Feb. 2015, B. Ditsch BD 832 (DR, barcode 043267); [Kungu Quiximba] 7°36′17.8″S, 14°57′34.5″E, 880 m, 15 Mar. 2013, B. Ditsch BD 274 (DR, barcode 057588).


Uapaca vanhouttei De Wild.

Distribution – West Tropical Africa, West Central Tropical Africa.

Habitat – Swampy forest.

Notes – In contrast to other species from Guineo-Congolian forests the stipules of this species are linear, up to 10 mm long, and lack a distinct midrib. Several specimens were found in proximity to known populations from D.R. Congo.

Specimen examined – Angola: Uíge: [Kibulamakatenda] 6°38′0.0″S, 16°16′56.8″E, 801 m alt., 19 Feb. 2015, B. Ditsch BD 889 (DR, barcode 044171).


Phyllanthaceae

Antidesma laciniatum Müll.Arg. subsp. membranaceum (Müll.Arg.) J.Léonard


Habitat – Rain forest.

Notes – The species differs from other Western and Central African members of the genus by laciniate stipules. The subspecies is characterized by a persistent ferrugineous indumentum including long candelabra-like trichomes on the nerves of the lower leaf surface. The stipules of our samples are deeply lobed, with lobes sometimes branched. The branchlets, petioles, midribs and stipules are covered with long spreading hairs up to 1 mm long.

Specimens examined – Angola: Uíge: [Kikuambalembua] 6°53′59.1″S, 15°04′25.0″E, 984 m alt., 24 Feb. 2015, B. Ditsch BD 832 (DR, barcode 043267); [Kungu Quiximba] 7°36′17.8″S, 14°57′34.5″E, 880 m, 15 Mar. 2013, B. Ditsch BD 274 (DR, barcode 057588).


Poaceae

Leptaspis zeylanica Nees


Habitat – Understory of rain forest.

Notes – The achenes of this forest grass are enclosed in inflated conchiform lemmas densely covered by minute hooked hairs which favour epizoochory. Leptaspis zeylanica is a widespread species that also occurs in Madagascar and further east across to the Solomon Islands (Soderstrom et al. 1987). Nevertheless, this is the first record of the genus Leptaspis in Angola.

Specimen examined – Angola: Uíge: [Kungu Quiximba] 7°36′38.4″S, 14°57′49.2″E, 875 m alt., 13 Mar. 2013, B. Ditsch BD 254 (DR, barcode 041877).

Reference – Clayton (1972): under the synonym Leptaspis cochleata Thwaites.
Rubiaceae

**Atractogyne gabonii** Pierre

**Distribution** – West Central Tropical Africa.

**Habitat** – Rain forest.

**Notes** – This liana bears fusiform fruits that reach a length of 10 cm. The only previous known species from Angola, *Atractogyne bracteata* (Wernham) Hutch. & Dalziel, is a shrub with fruits up to 3 cm long.

**Specimen examined – Angola: Uige:** [Cassecchi] 7°34′36.6″S, 14°57′44.3″E, 880 m alt., 12 Mar. 2013, B. Ditsch BD 242 (DR, barcode 041882).

**Reference** – Cannon (1958).

Alien species

**Apiaceae**

**Eryngium foetidum** L.

**Distribution** – Central America, South America.

**Habitat** – Roadside.

**Notes** – Leaves of this short-lived species are characterized by a strong smell similar to that of *Coriandrum sativum* L. Like *Coriandrum* they are used as flavouring in many tropical and subtropical regions of the world (Menhglan & Watson 2005), including parts of Africa (Cannon 1958). We found plants of different ages indicating that the species is self-reproducing at the locality where it was found. This is the first record of the genus *Eryngium* in Angola.

**Specimen examined – Angola: Uige:** [Cassecchi] 7°34′36.6″S, 14°57′44.3″E, 880 m alt., footpath bordering secondary forest; 12 Mar. 2013, B. Ditsch BD 242 (DR, barcode 041882).

**Reference** – Cannon (1958).

**Asteraceae**

**Acanthospermum australae** (Loefl.) Kuntze

**Distribution** – Central America, South America.

**Habitat** – In a village, likely escaped.

**Notes** – In contrast to *Acanthospermum hispidum* DC. hitherto recorded from Angola (Figueiredo & Smith 2008) the achenes of this species lack two large erect apical spines. The website Invasive Species Compendium (CABI 2019) documented unintentional vector transmission by humans or animals for this species and identified it as potentially invasive.

**Specimens examined – Angola:** [Mabaya Mafixa] 6°51′06.8″S, 14°55′05.8″E, 812 m alt., 15 Jul. 2015, T. Lautenschläger 201 (DR, barcode 04336); [Kamankoko] 7°26′56″S, 15°05′39″ E, 930m, 10 Nov. 2014, T. Lautenschläger 2014-11-53 (DR, barcode 042726); [Kivala] 05°58′59″S, 15°11′15″E, 977m, 25 Nov. 2015, T. Lautenschläger 2015-11-74 (DR, barcode 050836).

**References** – Blake (1921); Adams (1963): under the synonym *Acanthospermum brasiliense* Schrank; Wild (1967); Lisowski (1991).

**Galinsoga quadriradiata** Ruiz & Pav.

**Distribution** – Central America, South America.

**Habitat** – In a village, likely escaped.

**Notes** – So far, only *Galinsoga parviflora* Cav. is recorded for Angola (Bossard 1996). Compared to this species the stems of *G. quadriradiata* are hispid with long spreading hairs and long-stalked glands (not glabrous or nearly so), the receptacle scales are simple to shortly laciniate (not trifid), and the pappus scales are shorter than the corolla of the disc florets (not longer). Schulz (1981) remarked that plants without any pappus scales are documented in the species as well. *G. quadriradiata* is known to occur in Cameroon and Northern Africa (e.g. Cheek M.R. 9027 (WAG), Cheek M.R. 8315 (KUPE)). CABI (2019) identified this species as potentially invasive.

**Specimen examined – Angola:** [Dimuca] 7°53′18.5″S, 15°30′27.2″E, 1291 m alt., 2 May 2014, A. Göhre 384 (DR, barcode 043142).

**Reference** – Adams (1963): under the synonym *Galinsoga ciliata* (Raf.) Blake.

**Convolvulaceae**

**Ipomoea hederifolia** L.

**Distribution** – Central America, South America.

**Habitat** – Secondary rain forest.

**Notes** – The salver-shaped, brightly scarlet flowers with distinctly awned sepals differ clearly from all the 48 *Ipomoea* species Figueiredo & Smith (2008a) compiled for Angola. *I. hederifolia* is an annual plant long known to occur as an ornamental weed in many tropical countries including parts of Africa (see references). In contrast to *I. purpurea* (L.) Roth and *I. tricolor* Cav. Gossweiler (1950) did not mention it as a subspontaneous ornamental from garden cultivation in Angola. Lejoly & Lisowski (1992) listed herbarium specimens of *I. hederifolia* from various regions of the D.R. Congo. They include Angola into the area of distribution, but no proof is given for the occurrence of the species there. CABI (2019) identified this species as potentially invasive.
Specimen examined – Angola: Uíge: [Kenga Quiximba] 7°36′51.0″S, 14°58′59.3″E, 810 m alt., 19 Nov. 2014, A. Göhre 124 (DR, barcode 042779); Cuanza Norte: [N’Dalantando] 9°20′04.5″S, 14°46′27.1″E, 697 m alt., 17 Nov. 2015, C. Heinze 51 (DR, barcode 043996).

References – Keay (1958b); Breen & Brunnett (1970): under the synonym Mimosa invisa Mart. var. inermis Adelb.

Iridaceae

Eleutherine bulbosa (Mill.) Urb.

Distribution – Central America, South America.

Habitat – In a village, likely escaped.

Notes – The bulbous rootstock with a length around 5 cm and a width of 3 cm is characteristic for E. bulbosa. The bulb is fleshy and reddish. The white flowers are organized in compound inflorescences. The species has its origin in Central and South America, but is widely introduced and distributed in Asia, Indochina and Africa. CABl (2019) identified this species as potentially invasive. This is the first record of the genus Eleutherine in Angola.

Specimen examined – Angola: Cuanza Norte: [Zavula] 9°20′04.5″S, 14°46′27.1″E, 697 m alt., 17 Nov. 2015, C. Heinze 51 (DR, barcode 043996).


Lamiaceae

Hyptis suaveolens (L.) Poit.

Distribution – Central America, South America.

Habitat – In a village, likely escaped.

Notes – In contrast to other species, H. suaveolens is pubescent and the veins on the lower side of the leaf are white-tomentose. The flowers are organised in axillary cymes. According to Morton (1963), the species is native to tropical America and now widespread in tropical Africa. CABl (2019) identified this species as potentially invasive.

Specimen examined – Angola: Uíge: [Kenga Quiximba] 7°36′51.0″S, 14°58′59.3″E, 810 m alt., 19 Nov. 2014, A. Göhre 99 (DR, barcode 044449).


Discussion

The main objective of our investigations was to collect and document ethnobotanical knowledge, not to carry out comprehensive floristic field studies on biodiversity. However, the results presented indicate that new records are very likely to be documented with ongoing field work and botanical exploration in northern Angola. According to Olson et al. (2001) four ecoregions important for conservation of global biodiversity are less than 1000 km away from Uíge, the centre of our present study: Congolian Coastal Forests (300 km to the northwest), Western Congo Basin Moist Forests and Central Congo Basin Moist Forests (700 km to the north and northeast respectively), and the Central and Eastern Miombo Woodlands (800 km to the east and south). Being part of a transition zone, remnant forests, woodlands and savannahs in
the study area provide suitable habitats for isolated populations of plants from all these ecoregions. Our knowledge of the species richness and the composition of flora and fauna of northern Angola is still limited (Figueiredo & Smith 2008; Goyder & Gonçalves 2019). Further studies must prove whether the relevance of the area in the context of global biodiversity conservation may be higher than estimated so far, especially as Angola is one of the botanically least explored countries in Sub-Saharan Africa (Sosef et al. 2017).

All of the nine new records of alien species presented here originate from the Neotropics. The strong historical connection between the West coast of Africa and the New World might explain this fact. Slaves from Angola were shipped to Brazil, both Portuguese colonies; plants with an economic value were transferred to Africa. But even before the peak of slave trade was reached in the 18th century a botanical homogenization between the two continents had taken place. The environmental historian Crosby (2003) termed the early transatlantic trade of slaves, livestock and cultivated plants “Columbian Exchange”. A transculturation of plant use traditions in Africa as well as America was one of its manifold profound effects (Voeks 2013).

Eight of the nine newly recorded alien species can be classified as weeds that were introduced to the region unwillingly. However, the distribution paths are difficult to reconstruct. Nevertheless, as five of the here listed nine species are classified as potentially invasive (CABI 2019), strong efforts to avoid their further distribution need to be undertaken.

ACKNOWLEDGEMENTS

The University Kimpa Vita was an essential base for our field work and provided logistical support. The authors would like to thank Dorothea Bedigian, Iain Darbyshire, Friedrich Ditsch, Stefan Dressler, Mikhail Goncharov, Paul Hoekstra, Mark Hughes, Markus Lehnert, Christian Schulz, and Jan Wieringa for assistance in the identification of selected herbarium specimens. We are also grateful to the Herbarium LISC in Lisbon and the Herbarium COI in Coimbra, Portugal for the assistance as well as to the Botanical Garden of the TU Dresden for cultivating plants until essential characters for identification appeared. We thank the reviewers for their very valuable recommendations. The fieldwork in Angola was supported by a travel fund from the German Academic Exchange Service (DAAD) and the program ‘Strategic Partnerships’ of the TU Dresden. These published results were obtained in collaboration with the Instituto Nacional da Biodiversidade e Áreas de Conservação (INBAC) of the Ministério do Ambiente da República de Angola. Since 2012 the Universidade Kimpa Vita in Uige, Angola and the Technische Universität Dresden, Germany, have a multifaceted cooperation including the establishment of a Botanical Garden with the focus on the documentation of local medicinal plants as well as biodiversity assessments.

REFERENCES


Communicating Editor: Elmar Robbrecht.

Submission date: 9 Apr. 2019
Acceptance date 10 Dec. 2019
Publication date: 26 Mar. 2020