

Paving the way to the systematic understanding of a challenging clade of lepidote African *Croton* (Euphorbiaceae)

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Abstract. *Croton* is a predominantly woody pantropical genus that exhibits the so-called ‘Odd Man Out’ pattern, with Africa having the lowest species diversity across the tropics. Previous phylogenetic analyses have shown that all the Old World species of *Croton* sampled so far form a single clade nested within a New World backbone. Here we focus on a taxonomically challenging group of African *Croton* characterized by the presence of lepidote indument. Species delimitation within this group has proven difficult due to the lack of strong morphological differentiation and the incompleteness of numerous herbarium specimens from tropical Africa. We sequenced two universal genetic regions (ITS, *trnL-F*) using multiple accessions per species/morphospecies based on herbarium material to provide a preliminary phylogenetic framework to guide the lineage sampling for a broader phylogenomic study targeting this group and the rest of all African *Croton*. We also used these molecular data, along with information on geographic occurrences, to aid in the identification of poor, immature or infertile specimens and to detect possible instances of taxonomic misidentification in herbarium collections. Our results show that African lepidote species belong to several separate clades, one of them containing the majority of the lepidote species. Phylogenetic resolution within this largest lepidote clade is low, but several highly supported subclades were recovered. The sampling of these subclades should be considered in any future study aimed at reconstructing a phylogenetic tree of African *Croton* using phylogenomics.

Keywords. Africa, lepidote indument, Odd Man Out pattern, phylogenetics, taxonomy, tropics.

Resumen. *Croton* es un género pantropical predominantemente leñoso que exhibe el llamado patrón “Odd Man Out”, con África presentando la diversidad de especies más baja de todas las regiones tropicales. Análisis filogenéticos previos han demostrado que todas las especies de *Croton* del Viejo Mundo muestreadas hasta ahora forman un solo clado anidado dentro de clados neotropicales. Aquí nos centramos en un grupo taxonómicamente desafiante de *Croton* africanos caracterizado por la presencia de indumento lepidoto. La delimitación de especies dentro de este grupo ha resultado difícil debido a la baja diferenciación morfológica aunada a la existencia de numerosos especímenes de herbario pobres o incompletos. Secuenciamos dos regiones genéticas universales (ITS, *trnL-F*) utilizando múltiples accesiones por especie/morfoespecie basadas en material de herbario para proporcionar un marco filogenético preliminar y guiar así el muestreo para un estudio filogenómico más amplio de *Croton* africanos. También utilizamos estos datos, junto con información sobre los registros geográficos, para facilitar la identificación de especímenes inmaduros o estériles, y detectar posibles errores de identificación en colecciones de herbario. Nuestros

resultados muestran que las especies africanas con indumento lepidoto pertenecen a varios clados separados, de entre los cuales uno contiene la mayoría de ellas. La resolución filogenética dentro de este clado es baja, pero se recuperan varios subclados con fuerte apoyo estadístico. El muestreo de representantes de estos subclados debería considerarse en cualquier estudio futuro destinado a reconstruir un árbol filogenético de *Croton* africanos mediante filogenómicas.

Palabras clave. África, filogenética, indumento lepidoto, patrón “Odd Man Out”, taxonomía, trópicos.

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INTRODUCTION

Tropical regions host the highest levels of global biodiversity and endemism (Hawkins 2001; Kreft & Jetz 2007), and include the majority of the global biodiversity hotspots (Mittermeier & al. 2011). However, this biodiversity is unevenly distributed across the world's tropics. Numerous tropical plant genera and families have significantly lower plant species richness in Africa than other tropical areas such as Madagascar, the Neotropics or Southeast Asia (Richards 1973; Aldasoro & al. 2004; Couvreur, 2015). Species-rich groups such as *Acalypha* L., *Arecaceae* Bercht. & J. Presl, *Begonia* L., *Chrysobalanaceae* R. Br., *Dryopteris* Adans., *Sloanea* L., and *Solanum* L. show this biodiversity pattern (e.g., Neale & al. 2006; Bardon & al. 2013; Couvreur 2015; Sessa & al. 2017; Pennington & Wise 2017; Echeverría-Londoño & al. 2020; Levin & al. 2022), and for this reason, continental tropical Africa is known as the “Odd Man Out” of the tropics (Richards 1973; Couvreur 2015). Another giant plant genus with a pronounced Odd Man Out pattern is *Croton* L. (1223 spp.; Moonlight & al. 2024), with c. 56 species in tropical Africa (Barberá & al. in prep.), approximately 114 species in Madagascar (Berry & al. 2017), and more than 750 species in the Neotropics (van Ee & al. 2011).

Croton species are usually woody, including subshrubs, shrubs or trees, and only exceptionally herbs (van Ee & al. 2011; Arévalo & al. 2017). Leaves are simple, turning orangish before abscission; laticifers seem to be ubiquitous although latex is not always evident (Feio & al. 2016; Vitarelli & al. 2021); secretory structures, including colleters, nectaries, and idioblasts, are also present (Vitarelli & al. 2015); flowers are small, inconspicuous, unisexual, grouped in tir-soid inflorescences with female flowers appearing in proximal cymules and male flowers more distally (Riina & al. 2009; Thaowetsuwan & al. 2020, 2024; Fig. 1). Trichomes are also widespread in the genus (van Ee & al. 2011; Pinto-Silva & al. 2023) and their morphology, as well as their density and distribution patterns, are widely used as taxonomic characters (e.g. van Ee & al. 2011; Caruzo & al. 2016; Sodr  & al. 2019). *Croton* trichomes can be classified into several types, of which stellate and lepidote seem to be the most common throughout the genus (Pinto-Silva & al. 2023).

Understanding the causes of any biogeographic pattern requires good taxonomic knowledge of the group in question and a dated phylogenetic framework to be able to conduct historical biogeography analyses (Wen & al. 2019; Riina & al. 2021b). In the particular case of *Croton* from tropical Africa, both taxonomy and phylogenetic relationships are still highly problematic. The Old World *Croton* (*C.* subg. *Croton*) has not been formally divided into sections as the other three New World subgenera (van Ee & al. 2011) and phylogenetic structure and lineage relationships among them are still poorly understood due to the low taxonomic representation of African species in previous phylogenetic studies focused on Old World taxa (van Ee & al. 2015; Haber & al. 2017).

Unpublished preliminary phylogenetic data (P.E. Berry, pers. comm.) taken within the context of both morphology and previous phylogenies of Old World *Croton* (van Ee & al. 2015; Haber & al. 2017) suggest the existence of a clade of eight African species, which share a distinctive lepidote indument and the tree habit. Currently accepted species that would be part of this lepidote clade are *C. aubrevillei* J.L onard, *C. gratissimus* Burch., *C. haumanianus* J.L onard, *C. mayumbensis* J.L onard, *C. megalocarpoides* Friis & M.G.Gilbert, *C. megalocarpus* Hutch., *C. mubango* M ll.Arg. and *C. oligandrus* Pierre ex Hutch. Since their respective discoveries, these eight species have never been taxonomically revised together. There have been only partial, geographically limited revisions in the context of regional floras,



Fig. 1. Field images from two typical African lepidote species of *Croton*: **a-d**, *C. mayumbensis*; **a**, fruiting branch; **b**, abaxial side of a leaf showing dense lepidote indument; **c**, aspect of a fruit covered by lepidote trichomes; **d**, basilaminar nectary gland; **e**, *C. gratissimus*, fragment of inflorescence showing pistillate (left) and staminate (right) flowers, axis and flower buds covered by a dense indument of lepidote trichomes [photos: **a** and **c**, P. Barberá; **b** and **d**, P. Ruiz de Diego; **e**, R. Riina].

such as Flora of West Tropical Africa (Hutchinson & Dalziel 1958), Flora of Tropical East Africa (Radcliffe-Smith 1987) or Flora Zambesiaca (Radcliffe-Smith 1996). However, most morphological characters in these species are very similar, as can be seen by comparing both herbarium sheets (including types) and protologues. Identification keys included in these floras use different combinations of characters to distinguish them, but none of them treat all eight above-mentioned species nor their complete distributions. For this reason, all the characters used, present in more than one species, cannot be used reliably to identify them without ambiguity. Therefore, some herbarium specimens could have been misidentified based on a geographic bias (i.e., the area covered by a given floristic treatment). Nonetheless, some species seem to have a few easily discernible characters, although their observability on specimens is dependent on phenology (Fig. 2). For example, *C. megalocarpus* is clearly distinguished by the size of its fruit, bigger than those of any other *Croton* species in Africa, while *C. haumanianus* can be recognized by its unusual indehiscent fruits (most *Croton* species have dehiscent fruits).

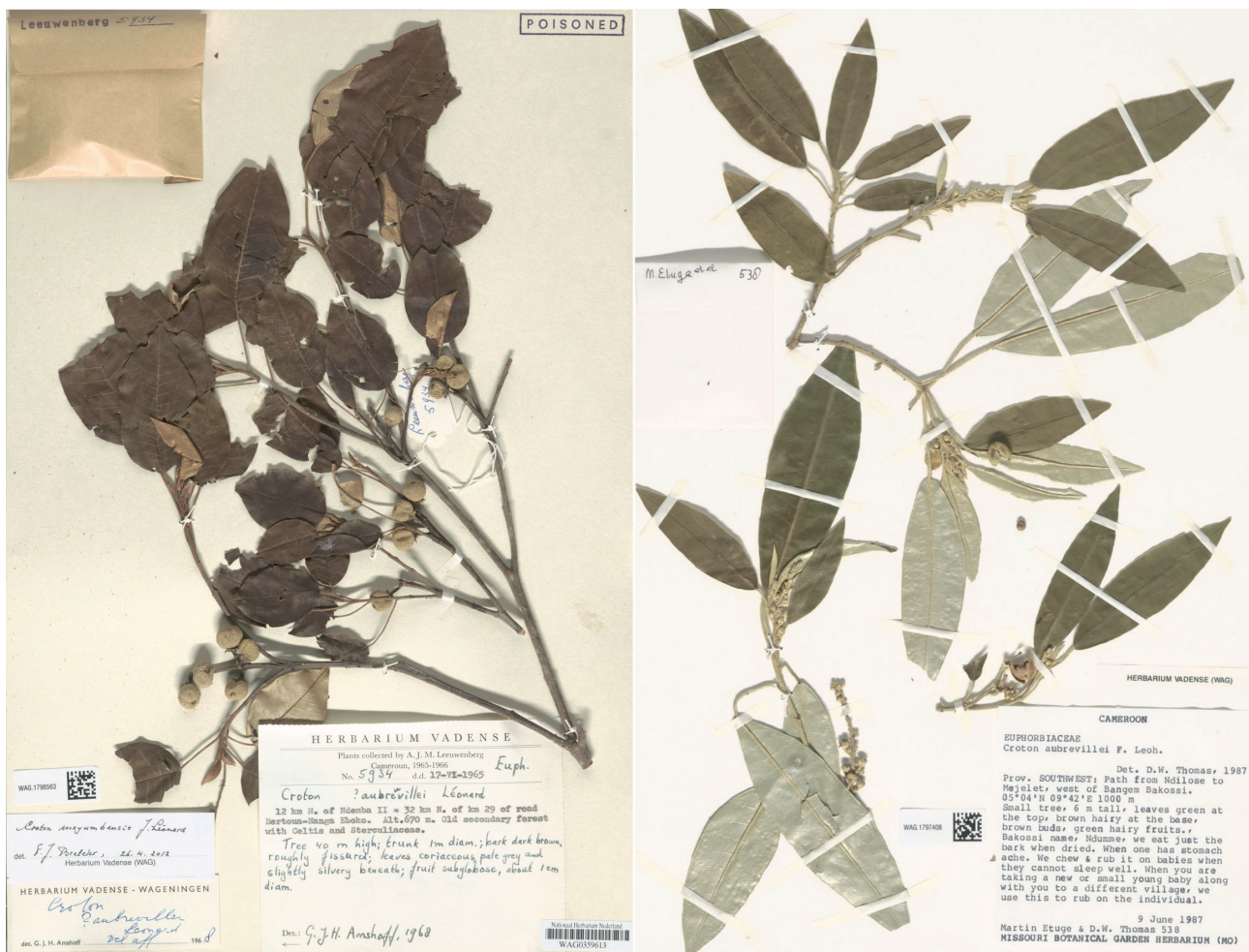


Fig. 2. Examples of herbarium specimens of two lepidote species of *Croton* from Africa: **a**, specimen Leeuwenberg 5934 (WAG) bearing fruits but no flowers, initially identified as *C. aubrevillei* and later as *C. mayumbensis*; **b**, specimen Etuge & Thomas 538 (WAG), with young fruits and flowers in bud, currently identified as *C. aubrevillei* but it is likely a misidentification as it was recovered in our phylogenetic analysis clustered with specimens of *C. gratissimus* (see Results).

There are several other species with lepidote trichomes in continental Africa (e.g., *C. macrostachyus* Hochst. ex Delile, *C. menyharthii* Pax, *C. pseudopulchellus* Pax), though those do not seem to be very closely related to the aforementioned clade (Haber & al. 2017), which is the focus of this study. The two Old World *Croton* phylogenies published to date have focused on geographic areas other than mainland Africa: the Western Indian Ocean Region (Haber & al. 2017), and Australia (van Ee & al. 2015). In fact, only 17 species of the about 56 species of African *Croton* have been represented in previous phylogenetic studies (Berry & al. 2005; van Ee & al. 2008; van Ee & al. 2015; Haber & al. 2017; Masa-Iranzo & al. 2021). A phylogenetic study, using high-throughput sequencing, is currently targeting the African *Croton*. However, specimen selection from the lepidote species has been challenging because of our insufficient taxonomic knowledge.

Molecular phylogenetics has proven to be very valuable in the delineation of evolutionary lineages and the establishment of taxonomic classifications (APG-IV 2016; Bouman & al. 2021; Kulkamp & al. 2023; Rossine & al. 2025). We here provide a first step toward resolving the taxonomy of a group of African lepidote *Croton* trees using evidence from molecular phylogenetics and species geographic occurrence information. In this context, we aim to: i) determine if all lepidote species from continental Africa form a monophyletic group and ii) shed light into species boundaries within the study group using molecular traditional markers previously used in the genus (nuclear ITS and plastid *trnL-F*). We expect our results to be useful to guide the taxon sampling of an ongoing phylogenomic study by providing a better phylogenetic and geographic representation of lepidote lineages across tropical Africa.

MATERIALS AND METHODS

Study material and sampling

Leaf tissue samples were obtained from a total of 105 herbarium specimens of *Croton* deposited in nine different herbaria (Appendices 1, 2). All sampled specimens were originally collected from different countries of sub-Saharan continental Africa (Table 1, Appendices 1, 2). The main criteria used for the selection of the specimens, in addition to their being accessible for sampling, was to obtain a representative sample of several morphologically similar *Croton* species with lepidote indument from continental Africa (Fig. 1), as well as a good representation of their geographic distribution within the continent. In the case of the specimens identified in herbaria as *C. gratissimus* or its synonym, *C. zambesicus* (Govaerts & al. 1999), we tried to represent, besides its distribution range, the taxonomically recognized phenotypic variation: *C. gratissimus* var. *gratissimus* and *C. gratissimus* var. *subgratissimus*. Additionally, samples from some indeterminate herbarium specimens with lepidote indument (as *Croton* sp.) were also included. *Croton megalocarpoides*, a lepidote tree from eastern Africa, could not be sampled during the lab-work stage of this study.

Table 1. Number of specimens sampled and newly sequenced per species and genetic region (ITS and *trnL-F*) in this study, excluding already published sequences obtained from GenBank.

Taxon	No. samples	No. successful samples	ITS	<i>trnL-F</i>
<i>Croton aubrevillei</i> J.Léonard	7	6	6	5
<i>Croton gratissimus</i> Burch.	39	19	16	6
<i>Croton haumanianus</i> J.Léonard	11	7	6	3
<i>Croton mayumbensis</i> J.Léonard	4	3	3	2
<i>Croton megalocarpus</i> Hutch.	15	8	7	5
<i>Croton mubango</i> Müll.Arg.	12	4	3	2
<i>Croton oligandrus</i> Pierre ex Hutch.	6	3	3	2
<i>Croton megalocarpoides</i> Friis & M.G.Gilbert	0	--	--	--
<i>Croton</i> sp.	9	8	7	3
<i>Croton menyharthii</i> Pax	1	1	1	0
<i>Croton somalensis</i> Vatke & Pax	1	1	1	0
Total	105	60	53	28

In order to increase the taxon sampling, DNA sequences from additional specimens were retrieved from GenBank (Appendix 1): 30 ITS and 18 *trnL-F* sequences. These included all the previously published sequences of *Croton* from mainland Africa, as well as some representatives from Madagascar (5 species) and other Old World areas (2 species from Southwest Asia, 1 species from Australia). Additionally, 4 taxa (New World *Croton* species) were selected to be part of the outgroup. Our sampling included representatives of all 4 *Croton* subgenera (van Ee & al. 2011). Sequences corresponding to the outgroup were also retrieved from GenBank (see Appendix S1).

DNA Extraction and sequencing of selected markers

DNA extraction was carried out following the CTAB protocol (Doyle 1991) from fragments of leaf tissue from herbarium specimens in all cases. In order to carry out the extraction, approximately 15 mg of tissue from each sample was used, which was pulverized in a TissueLyser prior to the chemical extraction procedure. The concentration of DNA obtained was evaluated using the QubitTM fluorometer (ThermoFisher). Once the DNA was extracted, dilutions

of each extraction were carried out in sterile water at a ratio of 1:20. These dilutions were used to amplify two markers (internal transcribed spacer, ITS; tRNA-Leu and tRNA-Phe intragenic spacer, *trnL-F*) commonly used in *Croton*, either alone (Berry & al. 2005; Riina & al. 2009), or together with other markers (van Ee & al. 2011; Masa-Iranzo & al. 2021). For the amplification of each of the markers, a pair of primers were initially used, although in the samples that failed to be amplified, an additional pair of internal primers was used for each of them, with the aim of amplifying them in two fragments per marker (Table 2). The reagents and concentrations used in the PCR reaction were the same for both markers: 12 µL of MyTaq RedMix (Bioline), 1 µL of each primer at a concentration of 10 µM, 1 µL of diluted DNA sample, and 10 µL of sterile water. The thermocycler program was optimized for each marker (Table 2). For those samples in which any of the markers could not be fully or partially amplified by using internal primers, PuReTaq-RTG PCR Beads (Illustra) were used, in which case 1 µL of each primer was added at a concentration of 10 µM, 1 µL of diluted DNA sample and 22 µL of sterile water to each “bead”, and the PCR reaction was otherwise carried out according to the same protocols. A total of 34 PCRs were performed, 18 for ITS and 16 for *trnL-F*, including up to four repetitions of the most problematic samples.

Table 2. Primers used in this study for the amplification of the 2 molecular markers (ITS, *trnL-F*) selected.

Primer	Sequence	PCR program	Reference
ITSw1	CCTTATCATTTAGAGGAAGGAG	5' 95°C + 36 x [1' 95°C + 90" 50°C+45" 75°C] + 10' 75°C	Silva & al. 2020
ITS2	CCRAGATATCCGTTGCCGAG		Cheng & al. 2016
ITS3	YGACTCTCGGCAACGGATA		Cheng & al. 2016
ITSw2	TATGCTTAAAYTCAGCGGGT		Silva & al. 2020
<i>trnL-Fc</i>	CGAAATCGGTAGACGCTACG	36 x [2' 94°C + 1' 95°C + 2' 53°C + 1' 72°C] + 10' 72°C	Taberlet & al. 1991
<i>trnL-Fd</i>	GGGGATAGAGGGACTTGAAC		Taberlet & al. 1991
<i>trnL-Fe</i>	GGTTCAAGTCCCTCTATCCC		Taberlet & al. 1991
<i>trnL-Ff</i>	ATTGAACTGGTGACACGAG		Taberlet & al. 1991

PCR products were evaluated by 1% agarose gel electrophoresis, using RedSafe™ (iNtron) as an intercalating agent. The result of the electrophoresis was revealed with ultraviolet light, and the samples for which it was observed that amplification of a DNA fragment of the size of the marker had occurred, were subjected to an enzymatic clean-up process by adding 6.5 µL of ExoSAP-IT™ (ThermoFisher), diluted 1:10 in sterile water, plus one thermocycler cycle, 15 minutes at 37°C, then 15 minutes at 80°C. Once purified, two 5 µL aliquots of each of the samples were mounted in 96-well plates together with their respective forward and reverse primers, and sent for sequencing in the MacroGen Inc. (Madrid, Spain) laboratories. The sequencing of the amplified DNA fragments was carried out by the Sanger method (Sanger & al. 1977).

Sequences editing and alignment

The chromatograms resulting from the sequencing of each sample in both directions, forward and reverse, were visualized and assembled in the Geneious Prime software (Geneious Prime 2022.0.2, <https://www.geneious.com>). We reviewed and edited by hand any possible inconsistencies or ambiguities, and generated consensus sequences. These sequences were aligned separately for ITS and for *trnL-F* using MAFFT v1.4.0 (Katoh & Standley 2013), default settings, implemented in Geneious Prime. In total, 34 sequences of ITS and 22 of *trnL-F* were combined to our newly generated sequences. The resulting alignments were visually inspected and doubtful regions were manually edited to achieve the most parsimonious alignment. Additionally, we removed all the sequences that lacked complete data per marker, and in the case of *trnL-F*, the repetitive and highly gappy central region (c. 100 base pairs, bp) was excluded for the analyses, because they introduced ambiguity in the alignment.

Phylogenetic analyses

Phylogenetic relationships were reconstructed using Bayesian inference in MrBayes v3.2.7a (Ronquist & al. 2012) hosted on the CIPRES Science Gateway portal (Miller & al. 2010). Each data matrix was analyzed separately. Molecular evolutionary models were obtained using Jmodeltest v2.10 (Darriba & al. 2012) based on the Akaike Information Criterion (AIC), as done in previous studies (Masa-Iranzo & al. 2012); in the case of ITS, it was a GTR+I+G model; for *trnL*-F we selected the GTR+G model. For each data matrix, 2 runs of 4 MCMC chains (3 heated, 1 cold) were run for 50 million generations, and a burn-in of 25%. The degree of convergence of the MCMC was assessed by monitoring the split sequences in MrBayes, accepting values of standard deviation of split frequencies below 0.01, and in Tracer v1.7.1 (Rambaut & al. 2014), accepting values for the different parameters of the effective sample size (ESS) > 200. After each analysis, a Maximum Clade Credibility tree (MCC) was built following the majority rule (> 50%) and visualized with FigTree v1.4.4 (Rambaut 2010). A combined analysis of the markers was discarded because significant topologic incongruences were detected between gene trees.

Geographic mapping of herbarium specimens

We used data from GBIF (Global Biodiversity Information Facility, www.gbif.es, <https://doi.org/10.15468/dl.zhb49r>, last accessed November 2022) and additional information from herbarium specimens not available via GBIF (see Appendix 3 for information about all specimens). Specimens of the eight focal species preserved in herbaria was the only filter used to obtain the dataset for mapping species occurrences. We used the most recent taxonomic determination of each herbarium specimen (we had either images or physical herbarium sheet on loan from the majority of the specimens) as indicated on the herbarium sheet. The records were subject to a thorough review as many of the GBIF records had partial or erroneous information. We completed and corrected the locality data by checking the actual specimens (from images or herbarium loans). In cases where the coordinates were not included in the herbarium label, we inferred them from the locality information provided and georeferenced using the online platform GeoNames (www.geonames.org/). In some species (seven records) only the country was mentioned; we used the country centroid provided by GBIF (marked in the Appendix 3 as 'Country Centroid'). Coordinates in sexagesimal format were converted to decimal format using Google Maps. When the altitude was missing in the herbarium label, we used Google Earth to obtain an approximate value. Lastly, we completed the occurrence dataset with the records of the specimens that were sequenced for the phylogenetic analyses and were not present in the GBIF dataset. The ESRI Satellite Layer and our occurrence dataset were overlapped to visualize the distribution of all the specimens using QGIS 3.20.3 (2020, www.qgis.org).

RESULTS

Sequencing and alignment of molecular data

In this study, 122 new sequences were generated: 67 corresponded to the nuclear region ITS and 55 to the plastid marker *trnL*-F (Table 1). Of all the ITS sequences, 43 came from the amplification of both intergenic spacers ITS1-ITS2 in a single PCR; 13 came from sequencing separately in two fragments (two PCRs) and 11 corresponded to partial sequences, i.e. coming from samples in which only one fragment (ITS1 or ITS2) of the ITS region was amplified successfully. Regarding the *trnL*-F sequences, amplification of the complete marker was not achieved in a single PCR: 36 sequences came from the amplification of two separate fragments (two PCRs), and 19 corresponded to partial sequences. For 39 of the initially selected samples it was not possible to amplify ITS (neither partial or total), while 51 samples could not be amplified for *trnL*-F (neither partial or total). The length of the final alignments used in the phylogenetic analyses was 521 bp for ITS and 581 bp for *trnL*-F. These alignments consisted of 87 ITS sequences and 54 *trnL*-F sequences, including all sequences downloaded from Genbank, and after excluding all the partial sequences because they generated artifactual phylogenetic clusters. Voucher information and Genbank accession numbers for all the published and newly generated sequences used in the phylogenetic analyses are available in Appendix 1. Similarly, specimens (36) that we tried and failed to amplify are included in Appendix 2.

Phylogenetic structure of the African lepidote group

The phylogenetic trees generated from the ITS and *trnL*-F matrices showed a mostly consistent topology, albeit with some relevant incongruences (Figs. 3, 4). In general, both trees were characterized by low phylogenetic resolution. Though ITS was only slightly more informative than *trnL*-F (182 and 173 informative sites respectively), the resulting tree was significantly more resolved for ITS than for *trnL*-F. Deeper nodes in the ITS tree showed moderate to low support compared with shallower nodes which were better supported (Fig. 3), while in the *trnL*-F tree most basal nodes collapsed into a large polytomy comprising the entire Old World clade along with specimens from the New World (Fig. 4).

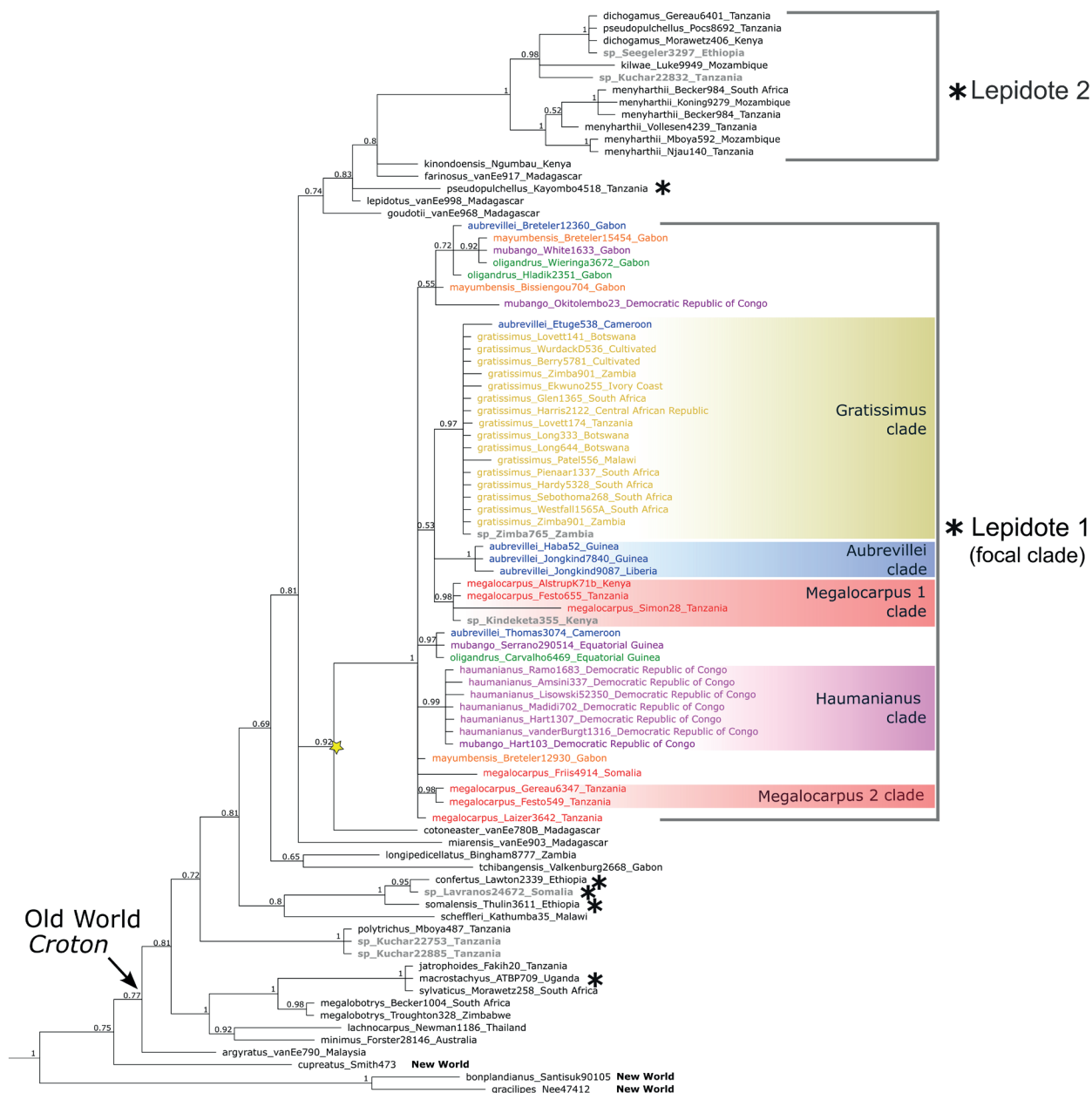


Fig. 3. Bayesian Maximum Clade Credibility (MCC) tree of the African *Croton* and relatives from other regions, based on ITS data. Asterisks indicate the presence of lepidote indument (*) and yellow stars on clade nodes mark well-supported incongruences (PP > 0.85) with respect to the *trnL*-F phylogeny. Specimens that were identified as part of the focal clade of this study (Lepidote1) are represented by different colors: *Croton aubrevillei* (blue), *C. gratissimus* (dark yellow), *C. haumanianus* (pink), *C. mayumbensis* (orange), *C. megalocarpus* (red), *C. mubango* (purple), *C. oligandrus* (green) and *Croton* sp. (grey). The most external outgroup (rooting taxon, *C. sampatiki* from the New World) was excluded from the figure for convenience.

Regarding the focal group of lepidote species, the ITS analysis recovered a clade (Lepidote1-clade; PP = 1) formed exclusively by specimens of *C. aubrevillei*, *C. haumanianus*, *C. gratissimus*, *C. mayumbensis*, *C. megalocarpus*, *C. mubango*, *C. oligandrus*, and two undetermined specimens labeled as “sp.” (Fig. 3). Inside this clade, a broad polytomy was recovered from which several well-supported subclades emerged, albeit none of them showed a resolved internal structure. The focal lepidote clade recovered in the ITS analysis appeared as two different well-supported clades in the *trnL*-F tree: one made of several specimens identified as *C. aubrevillei* (PP = 0.98, Fig. 4) and another with all other specimens included in the corresponding ITS focal lepidote clade. These two clades formed a clade together with *C. confertus* (PP = 1; Fig. 4), while in the ITS tree, the Lepidote1-clade was found as a sister group of the Malagasy *C. cotoneaster* (PP = 0.92, Fig. 3)

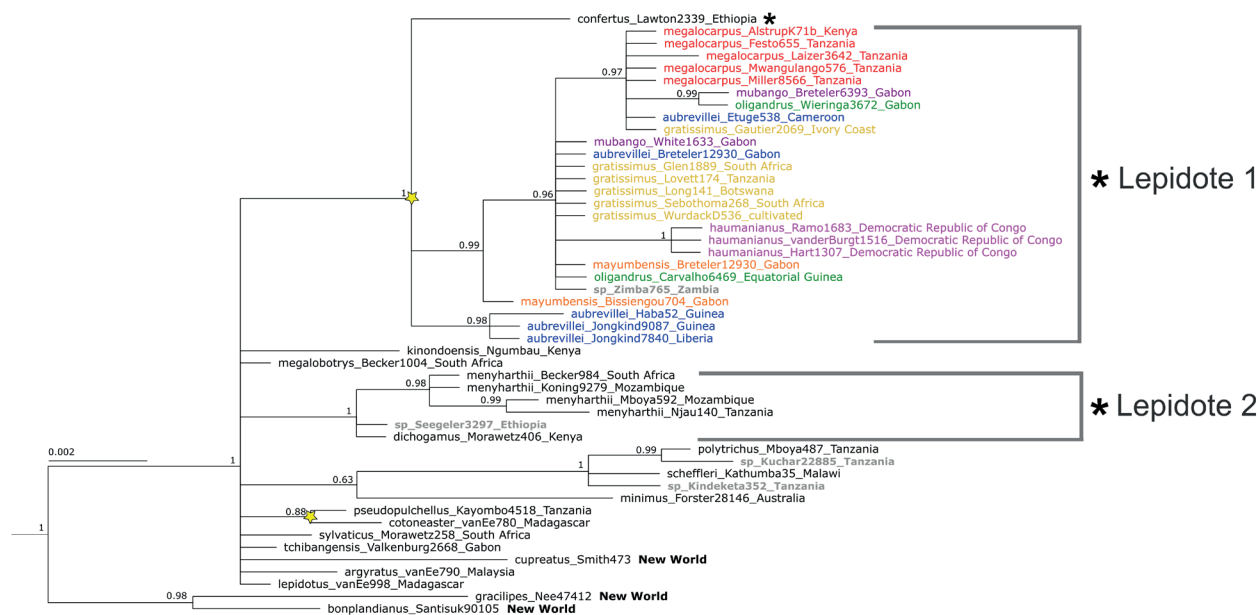


Fig. 4. Bayesian Maximum Clade Credibility (MCC) tree of the main African lepidote clade of *Croton* and related lineages based on *trnL*-F region. Asterisks indicate the presence of lepidote indument (*) and yellow stars on clade nodes mark well-supported incongruences (PP > 0.85) with respect to the ITS phylogeny. Specimens that were identified as part of the focal clade of this study (Lepidote1) are represented by different colors: *Croton aubrevillei* (blue), *C. gratissimus* (dark yellow), *C. haumanianus* (pink), *C. mayumbensis* (orange), *C. megalocarpus* (red), *C. mubango* (purple), *C. oligandrus* (green) and *Croton* sp. (grey). The most external outgroup (rooting taxon, *C. sampatik* from New World) was excluded from the figure for convenience.

Subclades formed exclusively by specimens identified as *Croton aubrevillei* and *C. haumanianus* were obtained in both analyses, with high statistical support (PP = 1 and PP = 0.99 for ITS; PP = 0.98 and PP = 1 for *trnL*-F respectively; Figs. 3, 4). Using ITS, both the Aubrevillei-clade and the Haumanianus-clade were recovered as part of the main polytomy of our focal lepidote clade (PP = 0.97 and PP = 0.99 respectively; Fig. 4). In the *trnL*-F analysis, the Aubrevillei-clade (PP = 0.98; Fig. 4) emerged within a polytomy together with *C. confertus* as well as the clade containing all other species of the focal lepidote group, while the Haumanianus-clade appeared within the latter (Fig. 4). In the ITS analyses, the majority of the specimens identified as *C. gratissimus* formed a subclade (Gratissimus-clade; PP = 0.97; Fig. 3), but this was not recovered as such in the *trnL*-F tree (Fig. 4). Two highly supported subclades formed by sequences of specimens of *C. megalocarpus* were obtained only in ITS (Megalocarpus1-clade, PP = 0.98; Megalocarpus2-clade, PP = 0.98; Fig. 3). The Megalocarpus2-clade came out embedded within the polytomy of the main clade (Lepidote1-clade; Fig. 3), while the Gratissimus-clade and the Megalocarpus1-clade were recovered sister to each other in the two analyses, and their clade in turn formed also a polytomy within the Lepidote1-clade, albeit with low support (PP = 0.53 in ITS; Fig. 3). In *trnL*-F, only one clade containing *C. megalocarpus* sequences was recovered (PP = 0.97, Fig. 4), which included individuals from the Megalocarpus1-clade obtained using ITS. However, this clade also included sequences from other species (*C. mubango*, *C. oligandrus*, *C. aubrevillei*, *C. gratissimus*) within a broad polytomy. No *trnL*-F sequence could be used in the *trnL*-F analysis from any of the individuals recovered in the Megalocarpus2-clade in the ITS analysis.

All specimens identified as *Croton haumanianus* were grouped in a single clade (Haumanianus-clade) in both analyses. Similarly, all specimens identified as *C. gratissimus* fell into the Gratissimus-clade in the ITS analysis along with a specimen identified as *C. aubrevillei* (Etuge & Thomas 538) from Cameroon and an undetermined specimen (Zimba & al. 765) from Zambia (Figs. 2, 3). In contrast, specimens of *C. aubrevillei* and *C. megalocarpus* were recovered as part of different clades, including the Aubrevillei-clade and the megalocarpus1/megalocarpus2-clades, respectively (Fig. 3). The sequences corresponding to *C. mubango*, *C. oligandrus* and *C. mayumbensis* did not show any consistent clustering in the plastid and nuclear phylogenetic trees (Figs. 3, 4). Some of these sequences were recovered directly anchored to the large polytomy of the main clade, while others were together in clades only recovered in either the ITS or the *trnL-F* trees (Figs. 3, 4). However, in both analyses, one small subclade was obtained with high statistical support (PP = 0.97 in ITS, Fig. 3; PP = 0.99 in *trnL-F*, Fig. 4) containing individuals ascribed to *C. oligandrus* and *C. mubango*, together with *C. aubrevillei* and *C. mayumbensis* in the ITS tree. Some specimens (Breteler & al. 12930, Bissiengou 703) were included in the analysis through two different sequences obtained independently for the same molecular marker from different duplicates which had been identified as different species by different researchers (see Appendix 3). These sequences are similar but unidentical and in some cases were recovered attached to the main clade polytomy (Breteler & al. 12930 in the *trnL-F* analysis, see Fig. 4) with similar branch length to specimens of other species.

Several lepidote species from continental Africa appeared outside of our focal clade, namely: *Croton confertus*, *C. dichogamus*, *C. kilwae*, *C. macrostachyus*, *C. menyharthii*, *C. pseudopulchellus* and *C. somalensis*. In the ITS analysis, *C. dichogamus*, *C. menyharthii* and one specimen identified as *C. pseudopulchellus* (Pocs 8692), together with *C. kilwae*, formed a highly supported clade (hereinafter Lepidote2-clade; PP = 1; Fig. 3). Another specimen identified as *C. pseudopulchellus* (Kayombo 4518) was recovered as closely related, but not part of this clade (Lepidote2). In the *trnL-F* analysis, the Lepidote2-clade received maximum support (PP = 1; Fig. 4) although we lacked sequences for *C. kilwae* and the *C. pseudopulchellus*_Pocs_8692. An incongruence between both trees is apparent in the position of Kayombo 4518, which appeared as sister to the Lepidote1-clade in the ITS phylogeny, but grouped with the Malagasy *C. cotoneaster* (PP = 0.88, Fig. 4) in the *trnL-F* tree. In the ITS phylogeny, both main African lepidote clades (Lepidote1 and Lepidote2) appeared independently embedded within two different clades with species from Madagascar in their basalmost nodes. Indeed, the Lepidote2-clade was nested within a moderately supported clade (PP = 0.83; Fig. 3), whose internal relationships were unresolved yet also included several Malagasy lepidote species such as *C. farinosus* or *C. lepidotus*.

The lepidote species *Croton confertus* and *C. somalensis* made a third well-supported clade (PP = 1, Fig. 3) together with an unidentified specimen (Lavranos & al. 24672) in the ITS phylogeny; this clade was not present in the *trnL-F* tree because of the lack of sequences for *C. somalensis* and the Lavranos & al. 24672 specimen, *C. confertus* appearing instead within a polytomy with the Lepidote1-clade (Fig. 4). Finally, *C. macrostachyus* was not recovered in any of the other African lepidote clades, forming instead a very well supported relationship (ITS tree, PP = 1; Fig. 3) with two stellate African species: *C. sylvaticus* and *C. megalobotrys*. The clade containing *C. macrostachyus*, *C. sylvaticus* and *C. megalobotrys* was recovered as more closely related to the species of Asian and Pacific distribution than to other African and Malagasy species (PP = 1; Fig. 3).

Some African specimens with lepidote trichomes that were unidentified in herbaria were found as part of the Lepidote1-clade (Zimba 765, Kindeketa 355), some others in the Lepidote2-clade (Seegeler 3297, Kuchar 22832) or the *Croton confertus*-*C. somalensis* clade (Lavranos 24672). A last group (Kuchar 22753, Kuchar 22885, Kindeketa 352) was not related to any of those lineages (Fig. 4). Finally, the few *Croton* species of Asian and Pacific distribution sampled here (*C. argyratus*, *C. lachnocarpus* and *C. minimus*) were recovered in the most basal nodes.

Geographic distribution data of the studied lepidote species

All the seven focal lepidote species of *Croton* sampled here showed a Sub-Saharan continental distribution yet there were differences in their chorology (Fig. 5). Specimens identified as *C. gratissimus* showed the widest distribution range, occupying most of Sub-Saharan Africa but skipping the humid forest areas of the Congo Region (Fig. 5B). Specimens identified as *Croton megalocarpus* seemed to be restricted to seasonally dry areas of Eastern Africa around the Rift except for a single specimen found deep in the rainforests of the Congo Basin (Harris & Fay 837) (Fig. 5F). Specimens of *C. aubrevillei* appeared to have a disjunct distribution in the westernmost humid forests north of the Gulf of Guinea and the western Congo Basin, while being absent from the less humid regions between Ghana and Nigeria (Fig. 5A).

Croton haumanianus, *C. mayumbensis*, *C. mubango* and *C. oligandrus* all shared a distribution in the Congo Basin, but *C. haumanianus* showed a more eastern distribution (Fig. 5C). Similarly, the available records of *C. mubango* had a more southern distribution, including more seasonal habitats and dry forests (Fig. 5G), while the ranges of *C. oligandrus* and *C. mayumbensis* occurrences overlapped in the more humid forests of the western Congo Basin (Figs. 5H, 5D). However, some isolated records (indicated with red circles in Figs. 5C, 5D, 5G, 5H) deviated significantly from the core distribution of the species in question, as well as some indeterminate lepidote specimens (Fig. 5I) overlapped the distribution of identified lepidote species.

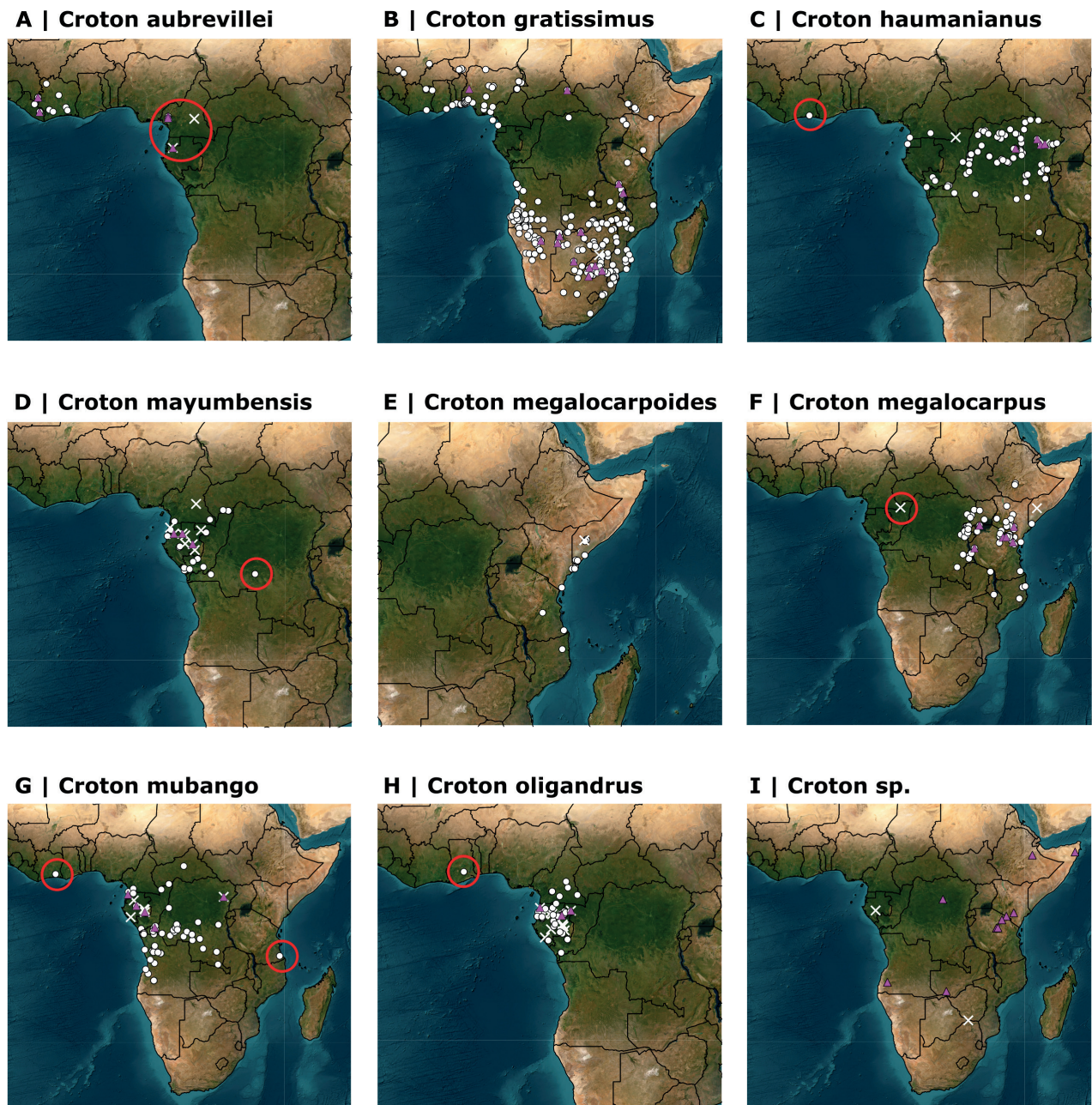


Fig 5. Maps showing the occurrence records of members of the focal lepidote group of African *Croton*. White circles represent the specimens retrieved from GBIF and herbaria; pink triangles indicate the specimens with DNA sequences included in the phylogenetic analyses; and white crosses highlight discrepancies in specimen identification across different herbaria. Records encircled in red are outside the geographic range of the species and are suspected misidentifications.

DISCUSSION

Limitations on phylogenetic resolution

This work represents a first approximation to the phylogeny of the main groups of lepidote species of *Croton* from continental Africa, a complex of species that had never been studied as a whole. Our results show a relatively low phylogenetic resolution regarding the internal structure of the focal group (Lepidote1-clade). Several of the main subclades have been identified, but internal relationships remain unknown. Phylogenies based on ITS and *trnL*-F data are common and generally informative in taxonomic studies of *Croton* (Riina & al. 2021a; Rossine & al. 2025), where *trnL*-F is good at giving resolution at the backbone level and ITS provides more resolution at shallower levels in the phylogeny (van Ee & al. 2011; Riina & al. 2021a). The low resolution of the results here presented can be explained, in part, by the numerous missing sequences in the *trnL*-F dataset. All samples used in this study came from herborized specimens with a wide disparity in their year of collection (1933-2010), some of them being relatively old. Herbarium sheets generally show more fragmented and degraded DNA than fresh samples dried in silica gel or recently pressed (Staats & al. 2011). This is reinforced by the evidence that amplification of *trnL*-F was much more difficult than that of ITS, and in fact amplification of *trnL*-F in a single fragment was impossible with the specimens used. Since *trnL*-F has a higher molecular weight than ITS, it is less likely to find the complete sequence of *trnL*-F than that of ITS in a highly fragmented genome (Särkinen & al. 2012). Low sequence variability between specimens within the focal lepidote group has also contributed to low resolution, especially for *trnL*-F. For example, two independent *trnL*-F sequences from the same specimen (Breteler & al. 12930, Fig. 4) are recovered directly on the main polytomy of the Lepidote1-clade with similar branch lengths to many other sequences from different specimens ascribed to other taxa, suggesting sequencing errors or artifacts due to poor DNA.

Strategies to improve phylogenetic resolution within the study clade could involve using a greater number of molecular markers (Cossard & al. 2016), or studying this same group by using genomic sequencing methods such as GBS (Fernández-Mazuecos & al. 2018; Martin-Hernanz & al. 2021) or targeted sequencing of predetermined genes (Villaverde & al. 2018; Herrando-Moraira & al. 2020). Genomic techniques are more efficient when it comes to recovering phylogenetic information from fragmented genomes than more traditional techniques such as Sanger sequencing, so they are much more appropriate for extracting information from herborized specimens (Alsos & al. 2020; Shee & al. 2020).

Identification of lepidote lineages of African Croton

Lepidote trichomes have evolved several times independently within *Croton* in Africa (Figs. 3, 4). This is not surprising since homoplasy in taxonomically relevant characters has long been known to be particularly widespread in *Croton* (Webster 1993; van Ee & al. 2011). Indeed, some relevant traits related to wood anatomy (Arévalo & al. 2017), secretory structures (Vitarelli & al. 2015) or, precisely, trichome morphology (Feio & al. 2018; Pinto-Silva & al. 2023) have been shown to display high evolutionary lability within the genus. While most studies are strongly focused on better-known New World lineages, our results show that lepidote trichomes are probably homoplastic within African *Croton* as well. As it has been proposed that lepidote trichomes constitute an adaptation to aridity by enhancing water retention and atmospheric water uptake (Vitarelli & al. 2016), evolutionary convergence towards this morphology between different African *Croton* lineages might be revealing of some common past or recent adaptations to similar environmental conditions.

The monophyletic character of our focal group (Lepidote1-clade) is strongly supported by the ITS tree, despite both low phylogenetic resolution and an incongruent topology due to the unexpected position of *C. confertus* in the *trnL*-F tree. Our results mostly support the hypothesis initially raised about the monophyly of the study group. The members of this clade can be broadly recognized by being trees with generally ovate to lanceolate, discolor leaves and lepidote trichomes covering most organs, yet these characters are also present in some other African species (i.e., *C. menyhartii* or *C. kilwae*) that belong to other lepidote clades. Whether *C. megalocarpoides*, which could not be sampled, also belongs to the Lepidote1-clade as suspected based on its very similar morphology to *C. megalocarpus* remains to be confirmed.

The relationship between the Lepidote1-clade and the Malagasy *Croton cotoneaster* conflicts with previous studies (van Ee & al. 2015; Haber & al. 2017). *C. cotoneaster* was found to be more closely related to other species of Malagasy distribution and those African species here assigned to the Lepidote2-clade instead of being related to *C. megalocarpus*.

and *C. gratissimus*. Moreover, the relationship between *C. cotoneaster* and the Lepidote1-clade found in our ITS tree also conflicts with our *trnL*-F tree, where this relationship is not found. Another incongruence between *trnL*-F and ITS trees is found in *Croton confertus*, a morphologically quite different species from both lepidote clades. Phylogenetic incongruence between nuclear and plastid markers is not new in *Croton* but had been reported before in several New World lineages (Riina & al. 2009; van Ee & al. 2011), yet the causes of these commonplace incongruences remain mostly unexplored. Heterotachy, hybridization or incomplete lineage sorting events could be some possible explanations for these inconsistencies (Som 2014; Naciri & Linder 2015).

The close relationship of *Croton confertus* with the Lepidote1 clade in the *trnL*-F tree leaves the placement of this lineage unclear. In contrast to the other lepidote species, both *C. confertus* and *C. somalensis* do contain both stellate and lepidote (sublepidote) trichomes, with longer rays that set them apart from the other African lepidote species. These two species also share a similar geographic distribution in Northeastern Africa (*C. confertus* is also present in the Arabian Peninsula), which is quite distinct from that of Lepidote1 species (Fig. 5). A future phylogenomic study should sample several specimens of *C. confertus* and *C. somalensis* in order to disentangle their relationship to the Lepidote1 clade.

Finally, unidentified specimens should be restudied using an integrative approach in order to revise their taxonomic placement, especially in the case of those whose phylogenetic positions indicate they might well pertain to new, undescribed species. In particular, their sampling in a future phylogenomic study of African *Croton* would be very useful at clarifying their actual relationships to other *Croton* species in Africa and particularly to other lepidote lineages, accelerating the process of their formal description.

Species delimitation within our focal group of African lepidotes

Croton aubrevillei.—The individuals that have been recovered in the Aubrevillei-clade come from two different countries, Liberia and Guinea, but from geographically very close localities (Fig. 5A) belonging to the same ecoregion, the Upper Guinea Forests (Olson & al. 2001). This ecoregion corresponds to a belt of humid forest with seasonal climate (Liu & al. 2016), which constitutes the northernmost and westernmost tropical rainforest in Africa (White 1979) and extends from Guinea and Sierra Leone to approximately the border of Ghana and Togo (Olson & al. 2001). Further east is the Dahomey Gap, a savannah enclave that extends south from the Sahel and reaches as far as the coastal regions of Togo and Benin (White 1979), separating the Upper Guinea Forests from the rest of the Central African rainforests. All individuals identified as *C. aubrevillei* outside of the Aubrevillei-clade were also collected in humid forest, but are located to the east of the Dahomey Gap. These individuals could be understood as misclassified due to their similarity in the morphological characters, since with both the phylogenetic and geographic evidence *C. aubrevillei* seems to constitute a well-defined taxon with a distribution restricted to the Upper Guinea Forests. That is in fact the area indicated in the original description of the species (Léonard 1958), whose type specimen is from Ivory Coast. A future phylogenomic study should sample individuals from both geographic areas (west and east of the Dahomey Gap) in order to test this taxonomic hypothesis.

Croton haumanianus.—This species seems a well-defined taxon with all the analyzed individuals correctly identified to species, except for one specimen identified as *C. mubango* (Hart 103; Fig. 3) in the Haumanianus-clade. This relative ease of identification of *C. haumanianus* compared to other members of the Lepidote1-clade is probably due to the presence of indehiscent fruits (Léonard 1957), a unique character within *Croton* as a whole. Although *C. haumanianus*, *C. mayumbensis*, *C. mubango* and *C. oligandrus* are species distributed throughout the Congo Forest (Figs. 5C, 5D, 5G, 5H), *C. haumanianus* has a much more northern and eastern distribution (Fig. 5C; Léonard 1957), while the other three species seem to be distributed further to the west or south according to current taxonomic knowledge. However, the specimens of *C. haumanianus* sequenced in this study do not represent well the overall distribution of the species. Sampling for a future phylogenomic study should sequence specimens across the entire species range to test if the monophyly found here actually corresponds to a well-delimited species or merely reflects a geographic bias.

Croton gratissimus.—This species constitutes a well-defined and easy to identify monophyletic taxon, despite its wide geographic distribution and notable phenotypic variability (Bamps 2009). Our data are insufficient to detect genetic differences that could be associated with the variability observed in morphological characters and/or geographically divergent populations across Africa. These differences might be found using phylogenomic data through a sampling covering both its geographic range and phenotypic variations.

Croton megalocarpus.—The specimens sampled might actually correspond to two different lineages. This is a surprising result, since these purportedly different clades have never been distinguished using morphological characters. Individuals within the Megalocarpus2-clade come from very close localities near swampy areas in the west coast of Lake Victoria, while individuals within the Megalocarpus1-clade come from a wide range of savanna and montane seasonal forest localities all along Kenya and Tanzania. The presence of characteristically large fruits has traditionally been considered the main diagnostic character of *C. megalocarpus* (Radcliffe-Smith 1987), but in light of our results this could be a homoplastic character. It is necessary to study the morphological differences between the individuals of these two clades using a morphometric approach. Specimens from the two clades in the ITS tree, as well as those specimens outside of them, should be included in future phylogenomic studies to test if there are two or more separate lineages currently identified as *C. megalocarpus*. If indeed they were two different, unrelated clades, this might be a case of true cryptic species (Shneyer & Kotseruba 2015), which could have conservation consequences (Delić & al. 2017).

Croton mayumbensis, *C. mubango*, *C. oligandrus*.—Taxonomic and phylogenetic uncertainty remains in this group of species. They may be artificial taxa that do not reflect the actual kinship relationships between different populations, but rather phenotypic variants with no taxonomic value. Further research based on both morphology and genomics is needed to fully clarify the taxonomic validity of these names and the phylogenetic relationship between lepidote *Croton* populations in the western Congo region. Several specimens from each species should be sampled for phylogenomic analysis including different areas in the countries where they apparently coexist (i.e., Cameroon, Congo, Equatorial Guinea, Gabon) to confirm if there is a taxonomic or a geographic signal. Additionally, specimens from the southern and eastern sides of the distribution of *C. mubango* should be also sequenced, where *C. mayumbensis* and *C. oligandrus* are absent, as no specimen from those areas could be included in our study. Given that these three species have been widely studied in phytochemistry and ethnopharmacology (Yamale & al. 2009; Guetchueng & al. 2018; Isyaka & al. 2020), taxonomic changes could modify some conclusions of those works (Bennett & Balick 2014). This underlines the importance of a clear taxonomy to accurately carry out applied studies with non-model plant species.

CONCLUSIONS

We confirm that the African *Croton* species with lepidote indument belong to several distinct lineages that are not closely related to each other. At least seven species (*C. aubrevillei*, *C. gratissimus*, *C. haumanianus*, *C. mayumbensis*, *C. megalocarpus*, *C. mubango*, and *C. oligandrus*) are part of the same clade (Lepidote1-clade). Internal relationships within the Lepidote1-clade are unresolved, but several species are shown to be monophyletic and likely constitute independent lineages. In some species, such as *C. aubrevillei*, our data suggest they occupy a more restricted area of distribution than previously assumed. In others, such as *C. gratissimus* and *C. haumanianus*, our phylogenetic results agree with the traditional species circumscriptions based on morphology. Yet in others, such as *C. megalocarpus*, there appear to be at least two separate lineages, perhaps cryptic but well differentiated molecularly. The taxonomic limits of the remaining three species (*C. mayumbensis*, *C. mubango*, *C. oligandrus*) could not be assessed with certainty with our data. Although our study is limited, it provides a solid starting point to guide the taxon sampling of future works aiming at establishing species limits in African *Croton* using phylogenomics along with other approaches including statistical morphometrics, and niche differentiation analysis.

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AUTHORSHIP CONTRIBUTION STATEMENT

Álvaro MUÑOZ-SÁNCHEZ: Conceptualization, Data curation, Investigation, Formal Analysis, Visualization, Writing—original draft. Ángela AGUADO-LARA: Data curation, Investigation, Visualization, Writing—review & editing. Paloma RUIZ DE DIEGO: Investigation, Writing—review & editing. Daniel M. TARAZONA OCAÑA: Data curation, Writing—review & editing. Isabel SANMARTÍN: Funding acquisition, Writing—review & editing. Patricia BARBERÁ: Conceptualization, Investigation, Supervision, Writing—review & editing. Ricarda RIINA: Conceptualization, Investigation, Formal Analysis, Funding acquisition, Supervision, Writing—original draft.

REFERENCES

- Aldasoro J.J., Cabezas F. & Aedo C. 2004. Diversity and distribution of ferns in sub-Saharan Africa, Madagascar and some islands of the South Atlantic. *Journal of Biogeography* 31: 1579–1604.
- Alsos I.G., Lavergne S., Merkel M.K.F., Boleda M., Lammers Y., Alberti A., Pouchon C., Denoeud F., Pitelkova I., Puşcaş M., Roquet C., Hurdu B.I., Thuiller W., Zimmermann N.E., Hollingsworth P.M. & Coissac E. 2020. The Treasure Vault Can be Opened: Large-Scale Genome Skimming Works Well Using Herbarium and Silica Gel Dried Material. *Plants* 9: 432.
- Arévalo R., van Ee B.W., Riina R., Berry P.E. & Wiedenhoeft A.C. 2017. Force of habit: shrubs, trees and contingent evolution of wood anatomical diversity using *Croton* (Euphorbiaceae) as a model system. *Annals of Botany* 119: 563–579.
- Bardon L., Chamagne J., Dexter K.G., Sothers C.A., Prance G.T. & Chave J. 2013. Origin and evolution of Chrysobalanaceae: insights into the evolution of plants in the Neotropics. *Botanical Journal of the Linnean Society* 171: 19–37.
- Bamps P. 2009. *Croton gratissimus* (Euphorbiaceae), nouveau pour la flore du Congo-Kinshasa. *Systematics and Geography of Plants* 79: 248–250.
- Bennett B.C. & Balick M.J. 2014. Does the name really matter? The importance of botanical nomenclature and plant taxonomy in biomedical research. *Journal of Ethnopharmacology* 152: 387–392.
- Berry P.E., Hipp A.L., Wurdack K.J., van Ee B.W. & Riina R. 2005. Molecular phylogenetics of the giant genus *Croton* and tribe Crotoneae (Euphorbiaceae sensu stricto) using ITS and *trnL-F* DNA sequence data. *American Journal of Botany* 92: 1520–1534.
- Berry P.E., Kainulainen K. & van Ee B.W. 2017. A Nomenclator of *Croton* (Euphorbiaceae) in Madagascar, the Comoros Archipelago, and the Mascarene Islands. *PhytoKeys* 90: 1–87.
- Bouman, R.W., Keßler, P.J., Telford, I.R., Bruhl, J.J., Strijk, J.S., Saunders, R.M. & van Welzen, P.C. 2021. Molecular phylogenetics of *Phyllanthus* sensu lato (Phyllanthaceae): Towards coherent monophyletic taxa. *Taxon* 70: 72–98.
- Caruzo M.B.R., Santos R.F., Feio A.C., Meira R.M.S.A & Riina R. 2016. Redefinition of *Croton macrobothrys* (Euphorbiaceae), a tree species from the Brazilian Atlantic Forest, with the description of a new subspecies. *Phytotaxa* 273: 51–58.
- Cheng T., Xu C., Lei L., Li C., Zhang Y. & Zhou S. 2016. Barcoding the kingdom Plantae: new PCR primers for ITS regions of plants with improved universality and specificity. *Molecular ecology resources* 16: 138–149.
- Cossard G., Sannier J., Sauquet H., Damerval C., Ronse de Craene L., Jabbour F. & Nadot S. 2016. Subfamilial and tribal relationships of Ranunculaceae: evidence from eight molecular markers. *Plant Systematics and Evolution* 302: 419–431.
- Couvreur T.L.P. 2015. Odd man out: why are there fewer plant species in African rainforests? *Plant Systematics and Evolution* 301: 1299–1313.
- Darriba D., Taboada G.L., Doallo R. & Posada D. 2012. jModelTest 2: more models, new heuristics and high-performance computing. *Nature methods* 9: 772.
- Delić T., Trontelj P., Rendoš M. & Iser C. 2017. The importance of naming cryptic species and the conservation of endemic subterranean amphipods. *Scientific Reports* 7: 3391.
- Doyle J. 1991. DNA protocols for plants. In Hewitt, G.M., Johnston, A.W.B. & Young, P.W. (eds.) *Molecular Techniques in Taxonomy* 283–293. Springer, Berlin, Heidelberg.
- Dumas P., Barbut J., Le Ru B., Silvain J.-F., Clamens A.-L., d'lençon E. & Kergoat G.J. 2015. Phylogenetic Molecular Species Delimitations Unravel Potential New Species in the Pest Genus *Spodoptera* Guenée, 1852 (Lepidoptera, Noctuidae). *PLoS ONE* 10: e0122407.
- Echeverría-Londoño S., Särkinen T., Fenton I.S., Purvis A. & Knapp S. 2020. Dynamism and context-dependency in diversification of the megadiverse plant genus *Solanum* (Solanaceae). *Journal of systematics and evolution* 58: 767–782.
- Feio A.C., Riina R. & Meira R.M. 2016. Secretory structures in leaves and flowers of two dragon's blood *Croton* (Euphorbiaceae): new evidence and interpretations. *International Journal of Plant Sciences* 177: 511–522.
- Feio A.C., Meira R.M. & Riina R. 2018. Leaf anatomical features and their implications for the systematics of dragon's blood, *Croton* section *Cyclostigma* (Euphorbiaceae). *Botanical Journal of the Linnean Society* 187: 614–632.
- Fernández-Mazuecos M., Mellers G., Vigalondo B., Sáez L.I., Vargas P. & Glover B.J. 2018. Resolving Recent Plant Radiations: Power and Robustness of Genotyping-by-Sequencing. *Systematic Biology* 67: 250–268.
- Govaerts R.H.A., Frodin D.G. & Radcliffe-Smith, A. 1999. World Checklist and Bibliography of Euphorbiaceae (and Pandaceae). Kew: Royal Botanic Gardens.
- Guetchueng S.T., Nahar L., Ritchie K.J., Ismail F.M.D., Evans A.R. & Sarker S.D. 2018. Ent-Clerodane Diterpenes from the Bark of *Croton oligandrus* Pierre ex Hutch. and Assessment of Their Cytotoxicity against Human Cancer Cell Lines. *Molecules* 23: 410.
- Haber E.A., Kainulainen K., van Ee B.W., Oyserman B.O. & Berry P.E. 2017. Phylogenetic relationships of a major diversification of *Croton* (Euphorbiaceae) in the western Indian Ocean region. *Botanical Journal of the Linnean Society* 183: 532–544.
- Hawkins B.A. 2001. Ecology's oldest pattern? *Trends in Ecology & Evolution* 16: 470.
- Herrando-Moraira S., Calleja J.A., Chen Y.S., Fujikawa K., Galbany-Casals M., Garcia-Jacas N., Kim S.C., Liu J.Q., López-Alvarado J. & López-Pujol J. 2020. Generic boundaries in subtribe Saussureinae (Compositae: Cardueae): insights from Hyb-Seq data. *Taxon* 69: 694–714.
- Hutchinson J. & Dalziel J.M. 1958. Euphorbiaceae. In: *Flora of West Tropical Africa*. Crown Agents, Millbank, London.
- Isyaka S.M., Langat M.K., Mas-Claret E., Mbala B.M., Mvingu B.K. & Mulholland B.A. 2020. Ent-abietane and ent-pimarane diterpenoids from *Croton mubango* (Euphorbiaceae). *Phytochemistry* 170: 112217.

- Ito Y., Yadav S.R., Chang Y.S., Tagane S., Li P. & Ohi-Toma T. 2022. Molecular species delimitation reveals underestimated diversity in the tree genus *Nothapodytes* (Icacinaceae). *Plant Systematics and Evolution*, 308, 1–11.
- Katoh K. & Standley D.M. 2013. MAFFT multiple sequence alignment software version 7: improvements in performance and usability. *Molecular Biology and Evolution* 30: 772–80.
- Kirschner P., Záveská E., Hülber K., Wessely J., Willner W., Schönschwetter P. & Frajman B. 2023. Evolutionary dynamics of *Euphorbia carniolica* suggest a complex Plio-Pleistocene history of understorey species of deciduous forest in southeastern Europe. *Molecular Ecology* 32: 5350–5368.
- Kreft H., & Jetz W. 2007. Global patterns and determinants of vascular plant diversity. *Proceedings of the National Academy of Sciences* 104: 5925–5930.
- Külkamp J., Riina R., Ramírez-Amezcuá Y., Iganci J.R., Cordeiro I., González-Páramo R., Lara-Cabrera S.I. & Baumgratz J.F.A. 2023. Systematics of Ditaxinae and related lineages within the subfamily Acalyphoideae (Euphorbiaceae) based on molecular phylogenetics. *Biology* 12: 173.
- Léonard J. 1957. Un nouveau *Croton* congolais utilisé comme arbre d'ombrage. *Bulletin Agricole du Congo Belge* 48: 79.
- Léonard J. 1958. Notes sur diverses euphorbiacées africaines des genres *Croton*, *Crotonogyne*, *Dalechampia*, *Grossera* et *Thecacoris*. *Notulae Systematicae* XXIII: 111–122.
- Levin G.A., Cardinal-McTeague W.M., Steinmann V.W. & Sagun V. G. 2022. Phylogeny, classification, and character evolution of *Acalypha* (Euphorbiaceae: Acalyphoideae). *Systematic Botany* 47: 477–497.
- Liu Z., Wimberly M.C. & Dwomoh F.K. 2016. Vegetation Dynamics in the Upper Guinean Forest Region of West Africa from 2001 to 2015. *Remote Sensing* 9: 5.
- Martín-Hernanz S., Velayos M., Albaladejo R.G. & Aparicio A. 2021. Systematic implications from a robust phylogenetic reconstruction of the genus *Helianthemum* (Cistaceae) based on genotyping-by-sequencing (GBS) data. *Anales del Jardín Botánico de Madrid* 78: e113.
- Masa-Iranzo I., Sanmartín I., Caruzo M.B.R. & Riina R. 2021. Skipping the Dry Diagonal: spatio-temporal evolution of *Croton* section *Cleodora* (Euphorbiaceae) in the Neotropics. *Botanical Journal of the Linnean Society* 197: 61–84.
- Miller M.A., Pfeiffer W. & Schwartz T. 2010. November 14. Creating the CIPRES Science Gateway for Inference of Large Phylogenetic Trees. Article presented at the Gateway Computing Environments Workshop (GCE), New Orleans, Louisiana.
- Mittermeier R.A., Turner W.R., Larsen F.W., Boorks T.M., Gascon C. 2011. Global biodiversity conservation: the critical role of hotspots. In Zachos F.E., Habel J.C., eds. *Biodiversity hotspots: distribution and protection of conservation priority areas*. Heidelberg, Germany: Springer.
- Moonlight P.W., Baldaszi L., Cardoso D., Elliott A., Särkinen T. & Knapp S. 2024. Twenty years of big plant genera. *Proceedings of the Royal Society B* 291: 20240702.
- Naciri Y. & Linder P.H. 2015. Species delimitation and relationships: the dance of the seven veils. *Taxon* 64: 3–16.
- Neale S., Goodall-Copestake W. & Kidner C.A. 2006. The evolution of diversity in *Begonia*. *Floriculture, ornamental and plant biotechnology* 4: 606–611.
- Olson D.M., Dinerstein E., Wikramanayake E.D., Burgess N.D., Powell G.V.N., Underwood E.C., D'Amico J.A., Itoua I., Strand H.E., Morrison J.C., Loucks C.J., Allnutt T.F., Ricketts T.H., Kura Y., Lamoreux J.F., Wettengel W.W., Hedao P. & Kassem K.R. 2001. Terrestrial Ecoregions of the World: A New Map of Life on Earth: A new global map of terrestrial ecoregions provides an innovative tool for conserving biodiversity. *BioScience* 51: 933–938.
- Pennington T.D. & Wise R. 2017. The genus *Sloanea* (Elaeocarpaceae) in America. DH Books, Milborne Port, United Kingdom.
- Pinto-Silva N.P., de Souza K.F., Marques-Silva O.L., Vitarelli N.C., Pereira A.P.N., Soares D.A., Sodré R.C., Medeiros D., Caruzo M.B.R., Carneiro Torres D.S., da Silva M.J., Meira R.M.S.A., Riina R. & Feio A.C. 2023. Trichomes in the megadiverse genus *Croton* (Euphorbiaceae): a revised classification, identification parameters and standardized terminology. *Botanical Journal of the Linnean Society* 203: 37–49.
- QGIS Development Team. 2020. QGIS 3.20.4. QGIS.org. Website: <https://qgis.org/en/site/> [accessed: 23 Nov. 2024].
- Radcliffe-Smith A. 1987. Euphorbiaceae, Part 1. In: R. M. Polhill (ed.), *Flora of Tropical East Africa*. A.A. Balkema, Rotterdam.
- Radcliffe-Smith A. 1996. Euphorbiaceae. In Pope G.V. (ed.), *Flora Zambesiaca*. Kew Publishing, London.
- Rambaut A. 2010. FigTree v1.3.1. Institute of Evolutionary Biology, University of Edinburgh, Edinburgh.
- Rambaut A., Drummond A.J., Xie D., Baele G. & Suchard M.A. 2014. Tracer v1.6. Institute of Evolutionary Biology, University of Edinburgh, Edinburgh.
- Richards P.W. 1973. *Africa, the "Odd Man Out"*. In Meggers B.J., Ayensu E.S. & Duckworth W.D. (eds.) *Tropical Forest Ecosystems in Africa and South America: A Comparative Review*. Smithsonian Institution Press. Washington D.C.
- Riina R., Berry P.E. & van Ee B.W. 2009. Molecular Phylogenetics of the Dragon's Blood *Croton* Section *Cyclostigma* (Euphorbiaceae): A Polyphyletic Assemblage Unraveled. *Systematic Botany* 34: 360–374.
- Riina R., van Ee B.W., Caruzo M.B.R., Carneiro-Torres D.S., dos Santos R.F., Berry P.E. 2021a. The Neotropical *Croton* sect. *Geiseleria* (Euphorbiaceae): Classification Update, Phylogenetic Framework, and Seven New Species from South America. *Annals of the Missouri Botanical Garden* 106: 111–166.
- Riina R., Villaverde T., Rincón-Barrado M., Molero J. & Sanmartín I. 2021b. More than one sweet tabaiba: Disentangling the systematics of the succulent dendroid shrub *Euphorbia balsamifera*. *Journal of Systematics and Evolution* 59: 490–503.
- Ronquist F., Teslenko M., van der Mark P., Ayres D.L., Darling A., Höhna S., Larget B., Liu L., Suchard M.A., Huelsenbeck J.P. 2012. MrBayes 3.2: Efficient Bayesian phylogenetic inference and model choice across a large model space. *Systematic Biology* 61: 539–542.

- Rosell J.A., Olson M.E., Weeks A., De-Nova J.A., Lemos R.M., Camacho J.P., Feria T.P., Gómez-Bermejo R., Montero J.C. & Eguiarte L.E. 2010. Diversification in species complexes: tests of species origin and delimitation in the *Bursera simaruba* clade of tropical trees (Burseraceae). *Molecular Phylogenetics and Evolution* 57: 798–811.
- Rossine Y., Riina R., Silva O.L. & Louzada R. 2025. Untangling the taxonomic knot of *Croton anomalus* (Euphorbiaceae), a Neotropical dry forest shrub. *PeerJ* 13: e19176.
- Sanger F., Nicklen S. & Coulson A.R. 1977. DNA sequencing with chain-terminating inhibitors. *Proceedings of the National Academy of Sciences* 74: 5463–5467.
- Särkinen T., Staats M., Richardson J.E., Cowan R.S. & Bakker F.T. 2012. How to Open the Treasure Chest? Optimising DNA Extraction from Herbarium Specimens. *PLoS ONE* 7: e43808.
- Sessa E.B., Juslén A., Väre H. & Chambers S.M. 2017. Into Africa: Molecular phylogenetics and historical biogeography of sub-Saharan African woodferns (*Dryopteris*). *American Journal of Botany* 104: 477–486.
- Shee Z.Q., Frodin D.G., Cámara-Leret R. & Pokorny L. 2020. Reconstructing the complex evolutionary history of the Papuasian Schefflera radiation through herbariomics. *Frontiers in Plant Science* 11: 258.
- Shneyer V.S. & Kotseruba V.V. 2015. Cryptic species in plants and their detection by genetic differentiation between populations. *Russian Journal of Genetics: Applied Research* 5: 528–541.
- Silva O.L.M., Riina R., & Cordeiro I. 2020. Phylogeny and biogeography of *Astraea* with new insights into the evolutionary history of Crotonaeae (Euphorbiaceae). *Molecular phylogenetics and evolution* 145: 106738.
- Staats M., Cuenca A., Richardson J.E., Vrieling-van Ginkel R., Petersen G., Seberg O. & Bakker F.T. 2011. DNA Damage in Plant Herbarium Tissue. *PLOS ONE* 6: e28448.
- Sodré R.C., Souza A.O., Alonso A.A. & da Silva M.J. 2019. Molecular, morphological, and anatomical data support a new species of *Croton* sect. *Geiseleria* (Crotonoideae, Euphorbiaceae). *Plant Systematic Evolution*. 305: 233–46.
- Som A. 2014. Causes, consequences and solutions of phylogenetic incongruence. *Briefings in Bioinformatics* 16: 536–548.
- Taberlet P., Gielly L., Pautou G., & Bouvet J. 1991. Universal primers for amplification of three non-coding regions of chloroplast DNA. *Plant Molecular Biology* 17: 1105–1109.
- Thaowetsuwan P., Ritchie S., Riina R. & Ronse De Craene L. 2020. Divergent developmental pathways among staminate and pistillate flowers of some unusual *Croton* (Euphorbiaceae). *Frontiers in Ecology and Evolution* 8: 253.
- Thaowetsuwan P., Riina R. & Ronse De Craene L.P. 2024. Floral morphology and development reveal extreme diversification in some species of *Croton* (Euphorbiaceae). *Journal of Plant Research* 137: 721–743.
- van Ee B.W., Berry P.E., Riina R. & Gutiérrez-Amaro J.E. 2008. Molecular Phylogenetics and Biogeography of the Caribbean-Centered *Croton* Subgenus *Moacrotion* (Euphorbiaceae s.s.). *The Botanical Review* 74: 132–165.
- van Ee B.W., Forster P.I. & Berry P.E. 2015. Phylogenetic relationships and a new sectional classification of *Croton* (Euphorbiaceae) in Australia. *Australian Systematic Botany* 28: 219–233.
- van Ee B.W., Riina R. & Berry, P.E. 2011. A revised infrageneric classification and molecular phylogeny of New World *Croton* (Euphorbiaceae). *Taxon* 60: 791–823.
- Villaverde T., Pokorny L., Olsson S., Rincón-Barrado M., Johnson M.G., Gardner E.M., Wickett N.J., Molero J., Riina R. & Sanmartín I. 2018. Bridging the micro- and macroevolutionary levels in phylogenomics: Hyb-Seq solves relationships from populations to species and above. *New Phytologist* 220: 636–650.
- Vitarelli N.C., Riina R., Caruzo M.B.R., Cordeiro I., Fúertes-Aguilar J. & Meira R.M.S.A. 2015. Foliar secretory structures in Crotonaeae (Euphorbiaceae): diversity, anatomy, and evolutionary significance. *American Journal of Botany* 102: 833–847.
- Vitarelli N.C., Riina R., Cassino M.F. & Meira R.M.S.A. 2016. Trichome-like emergences in *Croton* of Brazilian highland rock outcrops: evidences for atmospheric water uptake. *Perspectives in Plant Ecology, Evolution and Systematics* 22: 23–35.
- Vitarelli N.C., Somavilla N., Ferrari F.B., Silva M.R., Soares E.M., da Silva O.L.M. & Riina R. 2021. The Amazonian *Croton mollis* (Euphorbiaceae): morphology and leaf anatomy help to understand its preference for the extreme igapó habitat. *Flora* 281: 151878.
- Wagner N.D., Gramlich S. & Hörandl E. 2018. RAD sequencing resolved phylogenetic relationships in European shrub willows (*Salix* L. subg. *Chamaetia* and subg. *Vetrix*) and revealed multiple evolution of dwarf shrubs. *Ecology and Evolution* 8: 8243–8255.
- Webster, G. L. 1993. A provisional synopsis of the sections of the genus *Croton* (Euphorbiaceae). *Taxon*, 42: 793–823.
- Wen J., Nie Z.-L. & Ickert-Bond S.M. 2019. Advances in biogeography in the age of a new modern synthesis. *Journal of Systematics and Evolution* 57: 543–546.
- White F. 1979. The Guineo-Congolian Region and its relationships to other phytochoria. *Bulletin du Jardin botanique national de Belgique* 49: 11–55.
- Yamale S.C., Koudou J., Samb A., Heitz A. & Teulade J.C. 2009. Structural elucidation of a new furoclerodane from stem barks of *Croton mayumbensis* J. Leonard extracts. *International Journal of Physical Sciences* 4: 96–100.

APPENDIX 1. Voucher information and Genbank accession numbers of the sequences included in the phylogenetic analyses (Figs. 3, 4). Taxon; Collection Number; Locality; ITS; *trnL-F*. Sequences newly generated during this study correspond to the genbank numbers starting with PP and PQ. Missing data: –.

Croton argyratus Blume; van Ee 790A (MICH); Malasia; HM564075; HM564212. *Croton aubrevillei* J.Léonard; *Breteler & al. 12930 (MO); Gabon; PP925678; PP925633. *Croton aubrevillei* J.Léonard; Etuge & Thomas 538 (MO); Cameroon; PP925679; PP925632. *Croton aubrevillei* J.Léonard; Haba & Bilivogui 52 (MO); Guinea; PP925680; PP925634. *Croton aubrevillei* J.Léonard; Jongkind & al. 7840 (WAG); Guinea; PP925681; PP925636. *Croton aubrevillei* J.Léonard; Jongkind & al. 9087 (WAG); Liberia; PP925682; PP925635. *Croton aubrevillei* J.Léonard; Thomas 3074 (MO); Cameroon; PP925683; –. *Croton bonplandianus* Baill.; Santisuk 90-105; Thailand (cultivated); AB375094; AB375109. *Croton confertus* Baker; Lawton 2339 (K); Oman; KP878332; KP878417. *Croton cotoneaster* Müll.Arg.; van Ee 870B (MICH); Madagascar; –; KP878419. *Croton cupreatus* Croizat; Smith 473 (WIS); Ecuador; HM564077; HM564214. *Croton dichogamus* Pax; Gereau 6401 (MO); Tanzania; KP878339; –. *Croton dichogamus* Pax; Morawetz 406 (MICH); Kenya; KP878337; KP878421. *Croton farinosus* Lam.; van Ee 917 (MICH); Madagascar; KP878341; –. *Croton goudotii* Baill.; van Ee 968 (MICH); Madagascar; KY039611; –. *Croton gracilipes* Baill.; Nee 47412 (NY); Bolivia; EU586909; EU586962. *Croton gratissimus* Burch.; Berry 5781 (WIS); Australia (cultivated); AY971259; –. *Croton gratissimus* Burch.; Gautier & al. 2069 (MO); Ivory Coast; –; PP925637. *Croton gratissimus* Burch.; Glen 1889 (MO); South Africa; –; PP925638. *Croton gratissimus* Burch.; Hardy 5328 (MO); South Africa; PP925693; –. *Croton gratissimus* Burch.; Harris & Fay 2122 (MO); Central African Republic; PP925687; –. *Croton gratissimus* Burch.; Ekwuno 255 (MO-4052656); Nigeria; PP925685.1; –. *Croton gratissimus* Burch.; Long & Rae 141 (MO); Botswana; –; PP925640. *Croton gratissimus* Burch.; Long & Rae 333 (MO); Botswana; PP925689; –. *Croton gratissimus* Burch.; Long & Rae 644 (MO); Botswana; PP925690; –. *Croton gratissimus* Burch.; Lovett & Kayombo 174 (MO); Tanzania; PP925688; PP925639. *Croton gratissimus* Burch.; Patel 556 (MO); Malawi; PP925691; –. *Croton gratissimus* Burch.; Pienaar & Archer 1337 (MO); South Africa; PP925692; –. *Croton gratissimus* Burch.; Sebothoma 268 (MO); South Africa; PP925694; PP925641. *Croton gratissimus* Burch.; Westfall 1565A (MO); South Africa; PP925695; –. *Croton gratissimus* Burch.; Wurdack D536 (US); USA (cultivated); AY971214; –. *Croton gratissimus* Burch.; Zimba & al. 901 (MO); Zambia; AY971260; –. *Croton gratissimus* Burch.; Zimba & al. 901 (US); Zambia; PP925696; –. *Croton haumanianus* J.Léonard; Amsini 337 (DAV); Democratic Republic of the Congo; KP878343; –. *Croton haumanianus* J.Léonard; van der Burgt & al. 1516 (MO); Democratic Republic of the Congo; PP925701; PP925643. *Croton haumanianus* J.Léonard; Hart 1307 (MO); Democratic Republic of the Congo; PP925700; PP925644. *Croton haumanianus* J.Léonard; Lisowski 52350 (C); Democratic Republic of the Congo; PP925698; –. *Croton haumanianus* J.Léonard; Madidi 702 (MO); Democratic Republic of the Congo; PP925699; –. *Croton haumanianus* J.Léonard; Ramo 1683 (MO); Democratic Republic of the Congo; PP925697; PP925642. *Croton jatrophoides* Pax; Fakih 20 (MO); Tanzania; KP878348; –. *Croton kilwa* Radcl.-Sm.; Luke & al. 9949 (MO); Mozambique; KP878350; –. *Croton kinondoensis* G.W.Hu, Ngumbau & Q.F.Wang; Ngumbau s.n. (HIB); Kenya; MN504412; MN504420. *Croton lachnocarpus* Benth.; Newman 1186 (E); Thailand; AY971224; –. *Croton lepidotus* D.C.; van Ee 998 (MICH); Madagascar; M564085; HM564220. *Croton longipedicellatus* J.Léonard; Bingham 8777 (MO); Zambia; KP878351; –. *Croton macrostachyus* Hochst. ex Delile; A.T.B.P. 709 (WIS); Uganda; KP878352; –. *Croton mayumbensis* J.Léonard; Bissiegou & al. 704 (WAG); Gabon; MW263163; MW266702. *Croton mayumbensis* J.Léonard; Bissiegou & al. 704 (WAG); Gabon; PP925704; –. *Croton mayumbensis* J.Léonard; *Breteler & al. 12930 (MA); Gabon; PP925702; PP925645. *Croton mayumbensis* J.Léonard; *Breteler 15454 (M); Gabon; PP925703; –. *Croton megalobotrys* Mull.Arg.; Becker 1004 (MICH); South Africa; KP878357; KP878430. *Croton megalobotrys* Mull.Arg.; Troughton 328 (A); Zimbabwe; KP878356; –. *Croton megalocarpus* Hutch.; Alstrup K71b (C); Kenya; PP925705; PP925624. *Croton megalocarpus* Hutch.; Festo & Bayona 549 (MO); Tanzania; PP925708; –. *Croton megalocarpus* Hutch.; Festo & al. 655 (MO); Tanzania; PP925706; PP925625. *Croton megalocarpus* Hutch.; Friis & al. 4914 (C); Somalia; PP925707; –. *Croton megalocarpus* Hutch.; Gereau & al. 6347 (MO); Tanzania; PP925709; –. *Croton megalocarpus* Hutch.; Laizer & al. 3642 (MO); Tanzania; PP925710; PP925626. *Croton megalocarpus* Hutch.; Miller & al. 8566 (WAG); Tanzania; –; PP925628. *Croton megalocarpus* Hutch.; Mwangulango & al. 576 (MO); Tanzania; –; PP925627. *Croton megalocarpus* Hutch.; Simon & al. 28 (MO); Tanzania; KP878359; –. *Croton menyharthii* Pax; Becker 984 (MICH); South Africa; KP878363; KP878434. *Croton menyharthii* Pax; Koning 9279 (MO); Mozambique; KP878362; KP878433. *Croton menyharthii* Pax; Mboya 592 (MO); Tanzania; KP878338; KP878422. *Croton menyharthii* Pax; Njau & al. 140 (MO); Tanzania; KP878361; KP878432. *Croton menyharthii*; Vollesen 4239 (C); Tanzania; PP925711; –. *Croton minimus* P.I.Forst; Forster 28146 (WIS); Australia; HM564090; KP878436. *Croton mubango* Mull.Arg.; *Breteler 6393 (MO); Gabon; –; PP925629. *Croton mubango* Mull.Arg.; *Hart 103 (MICH); Democratic Republic of the Congo; PP925712; –. *Croton mubango* Mull.Arg.; Okitolemba 23 (BR); Democratic Republic of the Congo; PP925713; –. *Croton mubango* Mull.Arg.; López-Serrano 290514 (MA); Equatorial Guinea; PP925714; –. *Croton mubango* Mull.Arg.; White 1633 (MO); Gabon; PP925715; PP925631. *Croton oligandrus* Pierre ex Hutch.; *Carvalho 6469 (MA); Equatorial Guinea; PP925716; PP925646. *Croton oligandrus* Pierre ex Hutch.; Hladik 2351 (US); Gabon; PP925717; –. *Croton oligandrus* Pierre ex Hutch.; *Wieringa & al. 3672 (P); Gabon; PP925718; PP925630. *Croton polytrichus* Pax; Mboya 487 (MO); Tanzania; KP878380; KP878443. *Croton pseudopulchellus* Pax; Kayombo 4518 (MO); Tanzania; KP878381; KP878444. *Croton pseudopulchellus* Pax; Pocs 8692 (BP); Tanzania; OL378082; –. *Croton sampatik* Müll.Arg.; Riina 1447 (WIS); Peru; EF421792; EF408133. *Croton scheffleri* Pax; Kathumba & al. 35 (MO); Malawi; KP878388; KP878448. *Croton somalensis* Vatke & Pax ex Pax; Thulin & al. 3611 (WAG); Ethiopia; PQ152340; –. *Croton sylvaticus* Hochst.; Morawetz 258 (MICH); South Africa; KP878396; KP878451. *Croton tchibangensis* Pellegr.; Valkenburg 2668 (WAG); Gabon; MW263164; MW266701. *Croton* sp.; Kindeketa & al. 352 (MO); Tanzania; –; PP925648. *Croton* sp.; Kindeketa & al. 355 (MO); Kenya; PP925720; –. *Croton* sp.; Kuchar 22753 (MO); Tanzania; PP925722; –. *Croton* sp.; Kuchar 22832 (MO); Tanzania; PP925723; –. *Croton* sp.; Kuchar 22885 (MO); Tanzania; PP925721; PP925647. *Croton* sp.; Lavranos & al. 24672 (MO); Somalia; PP925677; –. *Croton* sp.; Seegeler 3297 (MO); Ethiopia; PP925724; PP925650. *Croton* sp.; Zimba & al. 765 (MO); Zambia; PP925719; PP925649.

APPENDIX 2. Specimens of the African lepidote *Croton* group for which PCR amplification failed for both of the genetic regions used in this study (ITS and *trnL-F*).

Croton gratissimus Burch.: Allen 43 (MO), Botswana; Müller & Biegel 2304 (MO), Botswana; Ngoni 252 (MO), Botswana; Smith 323 (MO-2654915), Botswana; Wild 5186 (MO), Botswana; Geerling & Bokdam 1977 (MO), Ivory Coast; Koning 7684 (MO), Mozambique; Zunguze & al. 590 (MO), Mozambique; Zunguze & al. 670 (MO), Mozambique; Smook 7543 (MO-5576290), Namibia; Smook 7591 (MO-5576289), Namibia; Meikle 820 (MO), Nigeria; Onwudinjoh 22372 (MO), Nigeria; Glen 1365 (MO), South Africa; Hildyard 46 (MO), South Africa; Maguire 3159 (MO), South Africa; Retief 620 (MO), South Africa. *Croton haumanianus* J.Léonard: Dhetchuvi 736 (MO), Democratic Republic of the Congo; Louis 2591 (PR), Democratic Republic of the Congo; Louis 3205 (NY), Democratic Republic of the Congo; Louis 6585 (M), Democratic Republic of the Congo. *Croton megalocarpus* Hutch.: Gillett 18555 (MO), Kenya; Perdue & Kibuwa 10176 (MO), Kenya; Groenendijk & al. 482 (MO), Mozambique; Bouxin 578 (MO), Rwanda; Mwasumbi 17523 (MO), Tanzania; Richards 26390 (NY), Tanzania. *Croton mubango* Mull.Arg.: Dubois 168 (M), Democratic Republic of the Congo; Hombert 542 (BR), Democratic Republic of the Congo; *Reitsma & Reitsma 1419 (MO), Gabon; *Reitsma & Reitsma 1535 (MO), Gabon; *Van der Maesen & al. 5879, Gabon. *Croton oligandrus* Pierre ex Hutch.: Guinea 445bis (MA), Equatorial Guinea; *Van der Maesen & al. 5879 (MA), Gabon; Enti A.R. 982 (MO), Ghana. *Croton* sp.: Greenway & Kibui 14797 (MO), Tanzania.

APPENDIX 3. Information of the herbarium specimens of the eight species of African lepidote *Croton* (Lepidote1-clade, Fig. 3) included in the map (Fig. 5). Coordinates in decimal format were obtained directly from GBIF, including some that represent country centroids. Abbreviations: s.d., occurrence without date; s.n., without collection number. Georeferenced specimens, including country centroids, and estimated elevations are included in squared brackets. Asterisks indicate cases of disagreement in taxonomic identification of the same collection in different herbaria.

***Croton aubrevillei* J.Léonard.**—CAMEROON. **East:** 12 km. N of Ndemba II, [4.74274, 13.3210], 670 m, 17 Jun. 1965, *Leeuwenberg 5934 (BR0000013187217, MO-2173452, P05477363). **Southwest:** Path from Ndilose to Mejelet, 05°04'N, 09°42'E [5.06666, 9.7], 1000 m, 09 Jun. 1987, Etuge & Thomas 538 (BR0000013187194, MO, WAG.1797408); at the base of Mount Koupe, 4°50'N, 9°1'E [4.83333, 9.68333], 850 m, 06 Feb. 1984, Thomas 3074 (BR0000013187200, MO-3147212, MO-3391329, P05477367). **GABON. Estuaire:** Crystal Mountains, Assok, 0°42'N, 10°21'E [0.7, 10.35], 540 m, 18 Sep. 1994, *Breteler & al. 12930 (BR0000016230965, C, MA-01-00851608, MO-6683143). **GUINEA. Nzérékoré:** Nimba Mountains, Forêt de la vallée de Gbaa, 7°40.94'N, 8°2.62'W [7.6824, -8.3937], 1015 m, 19 Dec. 2008, Haba & Bilivogui 52 (BR000005087501, FHO, MO-6277794, WAG.1796799); Nimba Mountains, 7°41.46'N, 8°23.28'W [7.691, -8.388], 870 m, 25 Jun. 2007, Jongkind & al. 7840 (BR0000016230972, MO, P05573869, WAG.1796800). **IVORY COAST.** [Country Centroid: 8.00, -5.500], 1933, Aubreville 2121 (P0547368). **Bas-Sassandra:** Amitioro Forest, [5.9893, -6.816947], 19 Jun. 1974, Ake Assi 12538 (K000461319, UCJ); Guédéyo, 30 km W of Soubri, [5.722, -6.2844], 02 Jun. 1964, Guillaumont 1844 (BR0000016230996). **Denguélé:** [5.96685, -7.22403], 21 Dec. 1963, National Florist Center s.n. (UCJ). **Lacs:** Anoumaba, [6.3333, -4.51667], 12–20 Nov. 1909, Chevalier 22399 (K000461317, MO-5681012, P05477363, P05477365, P05477366, P05545444). **Lagunes:** Near Agboville, [5.89583, -4.28333], Mar. 1957, De la Mensbruge s.n. (BR000006261726, BR000006261849, P00540329). **LIBERIA. Grand Gedeh:** Just East of the Putu Hills, 5°39.18'N, 8°10.22'W [5.653, -8.170333], 286 m, 17 Jan. 2010, Jongkind & al. 9087 (WAG.1796798); Putu Hills, East Range, 5°42.8'N, 8°09.3'W [5.7125, -8.155333], 255 m, 22 Jan. 2010, Jongkind & al. 9197 (WAG.1796797, WAG.1796798). **Nimba:** Crête, [6.81667, -8.78333], 900 m, 19 Dec. 1964, Adam 20186 (P05477369); National Forest, 18 miles N of Tapeta, [6.75, -8.86667, 254 m], 03 Feb. 1961, Voorhoeve 161 (BR0000016230972, M-0257205, MO-1829020, WAG.1796801, WAG.1796802, WAG.1796803, WAG.1796804).

***Croton gratissimus* Burch.**—ANGOLA. **Bengo:** Quiçama National Park, [-9.687500, 13.744722], 160 m, 11 Jun. 1966, Teixeira & al. 10548 (LISC053044). **Benguela:** railroads of Lobito [-12.364167, 13.535833], Jun. 1910, Gossweiler 4908 (COI65915); Canda, [-13.01894, 14.63787], 1730 m, 23 Jun. 1963, Teixeira & Andrade 6966 (LISC053041, LISC053092); Canda, [-13.01894, 14.63787], 1730 m, 29 Aug. 1963, Teixeira & Andrade 7196 (LISC053007, LISC053235); Ringoma, [-12.295286, 17.54467], Apr. 1860, Welwitsch 341 (BM000911129). **Cuando-Cubango:** Caiundo, [-15.725096, 17.449647], 1 Oct. 1964, Menezes 1215 (LISC053029); Cuangar, [-17.546667, 18.656944], 21 Sep. 1966, Mendes dos Santos 2451 (LISC053025); Cuangar, [-17.546667, 18.656944], 21 Sep. 1966, Mendes dos Santos 2452 (LISC053174); Caiundo, [-15.725096, 17.449647], 01 Oct. 1968, Menezes 1215 (BM001122532, LISC053029); Baixo Longa, [-15.677978, 18.649768], 16 Jul. 1966, Santos & Barroso 2208 (LISC053039). **Cunene:** Roçadas, [-16.744167, 14.974722], 05 Mar. 1972, Borges 335 (LISC053023, P05510355); Roçadas, [-16.744167, 14.974722], 10 Mar. 1972, Borges 345 (LISC053032, LISC053201, LISU, P05510354); [-16.510000, 15.435000], 9 Jan. 1973, Couto 351; Roçadas, 16°48'S, 15°10'E [-16.7, 15.166667], 1005 m, 27 Feb. 1974, Dechamps & al. 1264 (BR000006810085, LISC053002, WAG.1798342); Mucupe, [-16.386111, 14.887778], 7 Nov. 1963, Henriques 210 (BM001122482, LISC053033); Mucupe, [-16.386111, 14.887778], 1133 m, 22 Nov. 1963, Henriques 250 (BM001122483, LISC053011); Roçadas, [-16.744167, 14.974722], 24 Oct. 1970, Henriques 1263 (LISC053031, LISU-151193); Pereira d'Eça, [-17.066667, 15.733333], 25 Oct. 1955, Mendonça 4579 (LISC053018); Cuvelai, [-15.675833, 16.132500], 7 Nov. 1964, Menezes 1355 (BM001122454, LISC053026, P05510356); Mucupe, [-16.386111, 14.887778], 22 Oct. 1970, Menezes 3466 (BM001122487, LISC053027, P05510368); Chitado, [-17.313056, 13.905000], 23 Jan. 1962, Menezes & Henriques 141 (LISC053179); Chitado, [-17.313056, 13.905000], 23 Jan. 1962, Menezes & Henriques 156 (LISC053232); Curoca, [-17.000000, 13.666667], 19 Mar. 1973, Menezes & al. 4794 (LISC052994); Curoca, [-17.000000, 13.666667], 20 Mar. 1973, Menezes & al. 4801 (LISC052997); entre Roçadas e Centro de Estudos IIAA - Péu-Péu, [-16.7, 15.166667], 1120 m, 11 Nov. 1972, Raimundo & al. 1169 (BR0000016232129, LISC052998, WAG.1798341); 4 km from Roçadas to Mongua, [-16.747558, 15.012802], 05 Sep. 1970, Santos & Barroso 2803 (LISC053014); Roçadas, [-16.744167, 14.974722], 1100 m, 19 Mar. 1970, Silva 2925 (LISC053036); Cuamato, [-17.083056, 15.126944], 31 Oct. 1970, Sousa 29 (LISC053028). **Huíla:** [-14.695278, 15.00000], s.d., Antunes 263 (LISC053012); Gambos, [-15.741247, 13.890881], s.d., Antunes 709 (LISC053013); Chibemba, 15°48'S, 14°5'E [-15.8, 14.083333], 1330 m, 8 Mar. 1973, Bamps & al. 4075 (BR0000016232112, LISC053003, WAG.1798338); Quihita, [-15.380000, 13.964167], 23 Aug. 1963, Barbosa & Gouveia 10678 (LISC053006); Quihita, [-15.380000, 13.964167], 28 Jan. 1962, Barbosa & Moreno 10147 (LISC053046, LISC053047); Chibia, [-15.236389, 13.884444], 06 May 1971, Borges 207 (LISC052992, LISC053009, LISU); Bandeira, [-14.916944, 13.492500], 05 Mar. 1972, Borges 342 (LISC053035, LISC053200); Lubango, [-14.916944, 13.492500], 23 Jan. 1972, Couto 3 (LISC052993); Quihita, 15°27'S, 13°59'E [-15.45, 13.983333], 1280 m, 25 Feb. 1974, Dechamps & al. 1237 (BR00000681139, LISC053005, L.1059934, WAG.1798343, U 0076045, U 0051938); Quihita, between Bandeira and Roçadas, 15°27'S, 13°59'E [-15.45, 13.983333], 1280 m, 25 Feb. 1974, Dechamps & al. 1238 (BR000006811204, BR000006811396, LISC053004); Gambos, [-15.741247, 13.890881], s.d., Dekindt 840 (BR0000016052642); Cuvango, [-14.465556, 16.292222], 16 Nov. 1905, Gossweiler 2256 (COI00065945, LISC053173); Huíla, [-14.695278, 15.00000], 31 Aug. 1963, Henriques 165 (LISC053024); Bandeira, [-14.916944, 13.492500], 04 May 1965, Henriques 380 (LISC053042); 9 km from Quilengues to Chongoroi, [-14.0101, 14.06532], 19 Nov. 1955, Mendes 705 (LISC053020); Jua, [-15.235556, 13.511111], 15 Jul. 1963, Menezes 486 (LISC053154); Chibemba, [-15.753056, 14.076111], 05 Aug. 1963, Menezes 570 (LISC053168, LISC053175); Chibemba, [-15.753056, 14.076111],

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05 Aug. 1963, Menezes 575 (BM001122498, LISC053152, LISC053158); Chibemba, [-15.753056, 14.076111], 06 Aug. 1963, Menezes 598 (LISC053151, LISC053159); Alto Cunene, [-14.751807, 15.006388], 12 Oct. 1963, Menezes 881 (LISC053149, LISC053156); Alto Cunene, [-14.751807, 15.006388], 23 Oct. 1963, Menezes 882 (LISC053169, LISC053176); Chitado, [-17.313056, 13.905000], 14 Nov. 1963, Menezes 952 (LISC053150, LISC053157); Chibia, [-15.183056, 13.698889], 16 Mar. 1970, Menezes 3267 (LISC053037); Chibemba, [-15.753056, 14.076111], 30 Oct. 1970, Menezes 3477 (LISC053148); Chiange, [-15.741247, 13.890881], 10 Nov. 1970, Menezes 3521 (LISC053147); Gambos, [-15.741247, 13.890881], 16 Nov. 1970, Menezes 3542 (BM001122489, LISC053019); Mulondo, [-15.642778, 15.197222], 08 Nov. 1971, Menezes 3949 (LISC053000); Mulondo, [-15.642778, 15.197222], 11 Nov. 1971, Menezes 3996 (LISC052999); Chimbolele, [-15.550000, 14.266667], 03 Sep. 1963, Rocha 7 (LISC053177); Huila, [-14.695278, 15.00000], 09 Nov. 1955, Santos 104 (LISC053022); Impulo, [-13.901389, 13.676389], 10 Nov. 1959, Santos 214 (LISC053017); Jua, [-15.235556, 13.511111], 10 Jan. 1952, Santos 827 (LISC05303); Rio da Areia, Chimbemba, [-15.75275, 14.0773], 11 Nov. 1970, Santos & Barroso 2841 (LISC053001); Pocolo, [-15.799722, 13.801389], 12 Nov. 1970, Santos & Barroso 2851 (LISC053178). **Kwanza-Sul**: Quilenge, [-10.260833, 14.689444], 1937, Humbert s.n. (P05510348). **Luanda**: Viana, [-8.905278, 13.375000], Aug. 1930, Gossweiler 9232 (LISC053172); Viana, [-8.905278, 13.375000], 23 Nov. 1935, Gossweiler 10520 (COI00065940, COI00065941, COI00065942); Viana, [-8.905278, 13.375000], 130 m, 23 Nov. 1935, Gossweiler 10520b (LISC053170, LISC053171, COI00065943, COI00065944); Viana, [-8.905278, 13.375000], 23 Nov. 1935, Gossweiler 10520c (COI00065938, COI00065939); Bruco, [-15.112500, 13.178056], 850 m, 02 Dec. 1941, Gossweiler 12948 (BR0000016232136, COI00065922, LISC053030); Viana, [-8.905278, 13.375000], 7 Nov. 1955, Mendes 480 (LISC053015); Luanda, [-8.916667, 13.339167], 02 Apr. 1958, Monteiro & al. 33 (LISC053016); Viana, [-8.905278, 13.375000], 150 m, 08 Apr. 1958, Monteiro & al. 39 (LISC053045); Viana, [-8.905278, 13.375000], 140 m, 1 Apr. 1966, Teixeira & al. 10200 (LISC053038). **Namibe**: Chitundo-Hulo, [-15.931333, 12.872065], 1955, Boss 5755 (BM0110481); Moçamedes, [-15.196111, 12.152222], 13 Oct. 1961, Henriques & Moreno 8 (LISC053040, LISU); Lola, [-14.301389, 13.613056], 25 Oct. 1962, Henriques & Moreno 75 (LISC053034); Between Moçamedes and Villa Arriaga, [-14.993111, 12.735077], 500-600 m, 1937, Humbert 16517 (BM001122530, P05510344, WAG.1797871); Serra da Chela, [-15.5000299, 13.4951301], 13 Jul. 1967, Menezes & al. 2984 (LISC053008); 20 km from Caraculo to Moçamedes, [-15.012816, 12.474455], 19 May 1962, Santos 1065 (LISC053181); Surroundings of Villa Arriaga, [-14.766389, 13.348889], 23 Dec. 1955, Torre 8297 (LISC053021); Villa Arriaga, [-14.766389, 13.348889], 24 Dec. 1955, Torre 8306 (LISC053010). **BENIN. Atlantique**: Abomey, 7 km from Porto Novo [6.448333, 2.355556], 17 Jan. 1910, Chevalier 22756 (K, P05477839). **Littoral**: Marche Gbegamey, 6°21'83"N, 2°24'45"E [6.363833, 2.407500], 36 m, 25 Apr. 2011, Towns 23 (WAG.1571797, WAG.1571798). **Mono**: Lokossa, 6°37'N, 1°42'E [6.616667, 1.7], 23 Feb. 1999, Essou & al. 1560 (BR0000016232358, MO-6630814, WAG.1797421). **Ouémé**: Sèmè-Kpodji, [6.394444, 2.581667], 21 Aug. 1998, Adjakidjè & Adjoko 2039 (WAG.1797422, WAG.1797423); Porto-Novo, 6°29'N, 2°37'E [6.483333, 2.616667], 25 Jun. 1970, König 811 (A-6459428, WAG.1797869). **BOTSWANA. Central**: Orapa, [-21.311389, 25.376389], 20 Mar. 1974, Allen 43 (MO-2649832); Between Tlalamabele and Mosu, [-21.251875, 26.200303], 07 Jan. 1974, Ngoni 152 (MO-2655893). **Ghanzi**: 10 km SW of Kuke, [-23.316667, 24.483333], 1000 m, 07 Mar. 1987, Long & Rae 141 (MO-3262640). **Kgatlang**: Mochudi, [-24.17, 26.08], 01 Jan. 1914, Harbor 6637 (US1172624). **North-West**: Gwihaba Hills, [-19.976607, 21.352116], 980 m, 17 Mar. 1987, Long & Rae 333 (MO-3844654); Tsodilo Hills, [-18.750000, 21.766667], 1010 m, 04 Apr. 1987, Long & Rae 644 (MO-3262642); Tsodilo Hills, [-18.757444, 21.737509], 1080 m, 02 May 1975, Müller & Biegel 2304 (BR0000016232365, LISC, MO-2656046, WAG.1798316); Ngamiland, [-20.5, 22.5], 930 m, 25 Mar. 1961, Richards 14855 (LISC); Nxauna Pan, 18°1.7'S, 23°8.1'E [-18.028333, 23.135000], 1 Jan. 1973, Smith 323 (BR0000016232334, LISC, MO-2654915); Kwando mainstream, 18°3'S, 23°19.5'E [-18.050000, 23.325000], 15 Nov. 1980, Smith 3573 (LISC); Maun-Toten road, [-20.228860, 23.189381], 10 Mar. 1965, Wild & Drummond 6841 (BR0000016232372, LISC). **South-East**: Lobatse, 25°13'S, 25°38'E [-25.216667, 25.633333], 1100-1400 m, 15 Sep. 1985, Stronkhorst 5 (WAG.1798358); Lobatse, 25°15'S, 25°35'E [-25.25, 25.583333], 1400 m, 28 Nov. 1985, Stronkhorst 122 (WAG.1798359, WAG.1798360). **Southern**: Dikomu di Kai, [-24.863825, 24.615523], 26 Feb. 1960, Wild 5186 (MO-1768373). **CAMEROON. Far North**: Koza, 20 km NE of Mokolo, [10.868333, 13.881944], 23 Sep. 1964, Bounougou 148 (BR0000016232020); 35 km W from Maroua to Mokong, [10.577193, 14.034672], 09 May 1974, Fotius 18963 (BR0000016232037); Maroua, [10.590833, 14.315833], 22 Feb. 1946, Vaillant 1021 (P05510316); Hosséré Ziver, [10.833333, 13.8], 13 Nov. 1989, Villiers 4582 (BR00000926092, P05510320, WAG.1797398). **North**: Tinguélin, 9°24'N, 13°25'E [9.4, 13.38333], 16 Oct. 1976, Geerling & Mayouo 5693 (WAG.1797434); Tinguélin, 9°24'N, 13°23'E [9.4, 13.38333], 21 Oct. 1976, Geerling & Mayouo 5696 (BR0000016232006, M-0257201, MO-6630819, WAG.1798339); 10 km N from Garoua, Tinguélin, [9.410961, 13.400101], 05 Sep. 1964, Letouzey 6661 (BR0000016232013); Tinguélin, [9.3, 13.4], 400 m, 12 Dec. 1964, Raynal 12423 (MO-5744539, P05510324, P05481658, WAG.1797339); Tinguélin, 9°24'N, 13°29'E [9.4, 13.483333], 19 Jun. 1975, Wit 3102 (WAG.1798340). **South**: Campo-Ma'an, 2°22'24"N, 9°49'18"E [2.373333, 9.821667], 20 m, 16 Mar. 2000, Elad & al. 1417 (WAG.1798337). **CENTRAL AFRICAN REPUBLIC. Vakaga**: Mt. Toussoro, [9.166667, 23.216667], 1330 m, 01 Nov. 1989, Harris & Fay 2122 (MO-04647549, WAG.1797430). **DEMOCRATIC REPUBLIC OF THE CONGO. Bas-Uele**: Mabali, [3.898056, 23.506111], 01 Mar. 1985, Nsola 803 (BR0000013187163). **Haut-Katanga**: Gombela, on the base of the Kundelungu, [-10.708285, 27.813487], 1000m, 01 Apr. 1971, Lisowski 27044 (BR00000510491); Kafubu Preserve, ca. 70 km ENE Lubumbashi, 11°32'S, 28°05'E, 1120 m, 15 May 2016, Meerts & Hasson 788 (BR0000024396653, BRLU0011644). **EQUATORIAL GUINEA. Bioko Norte**: Malabo, Riaba, [3.384444, 8.758889], 22 Jul. 1987, Carvalho 2992 (MA-01-00680104). **ETHIOPIA. Gambela**: Bebeko to Dima, 6°33.70'N, 35°10.8'E [6.561667, 35.18], 675 m, 13 Jan. 2009, Friis & al. 13255 (WAG.1798321); towards Puguido and Gambella, 6°34'N, 34°58'E [6.56667, 34.96667], 650 m, 18 Jan. 2000, Friis & al. 9729 (V-557256, WAG.1797429). **Somali Region**: 6 km W of El Kur towards El Leh, 3°46.61'N, 39°26.33'E [3.776833, 39.438833], 1050 m, 19 Nov. 2010, Friis & al. 13762 (WAG.1950446). **South Ethiopia Regional State**: between Key-Afer and Turmi, 5°21.60'N, 36°35.2'E [5.36, 36.586667], 1300 m, 29 Nov. 2011, Friis & al. 14278 (WAG.1950426); Mago National Park, 5°47'N, 36°18'E [5.78333, 36.3], 550 m, 22 Dec. 1998, Friis & al. 9590 (WAG.1797428). **GHANA. Greater Accra**: Accra, 5°32.78'N, 0°13.17'W [5.546333, -0.219500], 17 m, 03 Jul. 2010, Andel & al. 5654 (WAG.1798354); Accra, 5°34.54'N, 0°11.53'W [5.55, -0.216667], 34 m, 08 Aug. 2010, Andel & Elhaam 6016 (WAG.1798355). **Volta**: Xevi, 6°17.1'N, 0°55.7'E [6.285333, 0.9285], 80 m, 26 Aug. 2010, Andel & al. 6051 (WAG.1798353). **IVORY COAST. Abidjan**: Youpougon, [5.333333, -4.083333], 11 Mar. 2003, Tere s.n. (CSRS). **Savanes**: Gue Auto, 9°13'N, 4°11'W [9.216667, -4.183333], 09 Feb. 1968, Geerling & Bokdam 1977 (BR0000016231955, MO-2422434, WAG.1797424). **Zanzan**: Bouna, [9.137500, -2.950000], 07 Jul. 1958, Aké Assi s.n. (UCJ); Ferkessedougou, 9°23'N, 4°11'W [9.383333, -4.183333], 11 Oct. 1992, Gautier & al. 2069 (CSRS, G, MO-5611610). **KENYA. Eastern**: Eastern Kibwesi, [-2.416667, 37.916667], 1000 m, 01 Dec. 1905, Scheffler 1 (AMD.65950, L.0234514, W, WAG.1796744). **MALI. Kayes**: Cirque de Kitaba, 13.05, -9.53, 24 Jan. 2004, Birnbaum 730 (BRLU, P04787236). **Koulikoro**: Road from Bamako to Siby, 12°23'N, 8°30'W [12.383333, -8.5], 04 Feb. 1973, N'Golo 1250 (WAG.1797425). **Mopti**: Ende, Faille de Tieli, 14.18, -3.55, 22 Feb. 2004, Birnbaum 761 (BRLU, LISC). **MALAWI**: [Country Centroid: -13.5, 34.0], s.d., Greenway 2279 (NY). **Central**: Kasungu, [-13.000000, 33.416667], 1060 m, 07 May 1970, Brummit 10436 (LISC). **Northern**: Karonga, 33°41'E, 9°59'S, [-9.983333, 33.683333], 915 m, 06 Jun. 1989, Brummit 18385 (MO-426048); Rumphu, [-11.018611, 33.857222], 16 Aug. 1980, Patel 556 (MO-4055629). **Southern**: Mpatamanga Gorge, [-15.722428, 34.727456], 13 May 1961, Leach & Rutherford 10829 (LISC, K004449076). **MOZAMBIQUE. Cabo Delgado**: Ancuabe, [-12.983333, 39.883333], 600 m, 05 Aug. 1983, Groenendijk & Dungo 509 (WAG.1798344). **Gaza**: Massingir, [-23.939096, 32.031088, 158 m], 24 Jul. 1982, Matos 5076 (LISC); Massingir, [-23.939096, 32.031088], 24 Jul. 1982, Matos 5082 (LISC); area of the Massangena post - M.C.T. work area - road number 6, after 27 km, [-21.533333,

APPENDIX 3. Contd.

32.95], 01 Aug. 1973, Correia & Marques 3135 (WAG.1798325, WAG.1798326). **Inhambane:** Govuro, [-21.277500, 34.740833], 1974, Correia & Marques 9161 (WAG.1797949, WAG.1797950); Mavume, [-23.481667, 34.558889], Aug. 1938, Gomes e Sousa 2156 (BR0000016232327, LISC, MO-1880067); Pomene, 22°55'S, 35°35'E, [-22.966462, 35.555014], 23 Sep. 1980, Jansen & al. 7461 (BR0000016232303, MO-4001519, WAG.1798350, WAG.1798349); Zavala, [-24.671590, 34.700728], 30 Aug. 1975, Moura & al. 318 (LISC); Pomene, [-22.965833, 35.554722], Dec. 1971, Tinley 2260 (LISC); Between Funhalouro and Vilanculos, [-22.130992, 35.220636], 43 m, s.d., Torre 2928 (LMA16902). **Maputo:** Bela Vista, [-26.340556, 32.667222], 02 Dec. 1968, Balsinhas 1332 (LISC); Bela Vista, [-26.340556, 32.667222], 6 Aug. 1957, Barbosa & Lemos 7765 (LISC); Namaacha, [-26.283333, 32.533333], 14 May 1967, Ferreira & Ferreira 56 (WAG.1797952); Porto Henrique, [-26.3, 32.348892], 21 Aug. 1948, Gomes e Sousa 3764 (MO-188067); Chinhanguanine, [-25.285556, 32.510000], 28 Nov. 1979, Koning 7684 (MO-4055539); Porto Henrique, [-26.3, 32.348892], 19 Aug. 1942, Mendoça 8 (LISC070052); Between Umbeluzi and Porto Henrique, [-26.163687, 32.366302], 23 Aug. 1944, Mendoça 1848 (LISC070050, LISC070051); Magude, [-25.023889, 32.651389], 30 Nov. 1944, Mendoça 3183 (LISC069990); Ressano Garcia, 305 m; [-25.442778, 31.995278], 25 Dec. 1897, Schlechter 11958 (BR0000006261801); Maputo, [-25.965278, 32.583056], 1100 m, 29 Mar. 1983, Silva & al. 99 (WAG.1797433); Between Bela Vista and Umbeluzi, [-26.20857, 32.52274], 20 Nov. 1940, Torre 2079 (LMA, LISC069996); Between Funhalouro and Vilanculos, [-22.945668, 34.467346], 21 May 1941, Torre 2710 (LISC069995, LISC069994); Between Umbeluzi and Bela Vista, [-26.20857, 32.52274], 14 Apr. 1944, Torre 6419 (LISC070047); Surroundings of Boane and Umbeluzi, [-26.041667, 32.325277], 17 Nov. 1944, Torre 6844 (LISC070048, LISC070049); Maputo, [-25.965278, 32.583056], 04 Mar. 1968, Torre 17797 (LISC); Umbelenzi and Namaacha, [-26.039914, 32.200781], Jul. 1944, Torre s.n. (LISC069993); Catuane, [-26.836389, 32.284444], 30 Sep. 1983, Zunguze & al. 590 (BR0000016232310, MO-4055208, P05510276); Goba, [-26.199722, 32.138333], 17 Oct. 1983, Zunguze & al. 670 (MO-4055213, WAG.1797953). **Sofala:** Chemba, [-17.164722, 34.887778], 430 m, 14 May 1971, Torre 18396 (LISC). **Tete:** near Estima [-15.737222, 32.771944], 17 May 1972, Bond E48 (LISC); c. km 148 from Ferro, [-16.375375, 34.382525], 17 May 1948, Mendoça 4275 (LISC069991); c. km 148 from Ferro, [-16.375375, 34.382525], 17 May 1948, Mendoça 4305 (LISC069992); Cahora Bassa, [-15.566667, 32.7], 230-290 m, 10 Apr. 1972, Pereira & Correia 1936 (WAG.1798348, WAG.1798347); Cahora Bassa, [-15.566667, 32.7], 375-420 m, 19 Apr. 1972, Pereira & Correia 2141 (WAG.1797951); 13 km from the crossing between Tete-Changara road to Chioco, [-16.466178, 32.29435], 200 m, 14 Feb. 1968, Torre 17587 (LISC); Songo, [-15.595833, 32.764722], 860 m, 01 Feb. 1973, Torre 19001 (LISC); Magoe, [-15.806111, 31.750833], 350 m, 13 Feb. 1970, Torre 17952 (LISC). **Zambezia.** Boroma, [-17.445278, 35.659722], s.d., Menyhart 4348 (WU). **NAMIBIA.** **East Kavango:** Popa Falls, [-18.118008, 21.584055], 09 Mar. 1958, Merxmüller & Giess 2027 (BR00000681140); Andara, 18°S, 21°E [-18.066667, 21.450000], 23 Apr. 1977, Müller & Giess 521 (PRE, WAG.1798367). **Erongo:** Spitzkoppe, [-21.839722, 15.201389], 13 Aug. 1962, Giess 3990 (W); Karibib, Okomitundu, [-21.933333, 15.833333], 1400 m, 07 Dec. 1958, Haelbich 1679 (L.2211207); Okavango River bank, [-18.116667, 21.633333], 01 Oct. 1966, Tinley 1534 (WAG.1797433). **Khomas:** Portsmouth, [-23.100000, 16.416667], 30 Aug. 1972, Merxmüller & Giess 28100 (LISC, WAG.1798365). **Kunene:** Kaokoveld, 17°S, 14°E, 15 Apr. 1968, Giess 9318 (MO-2342017); Orumana, [-18.257222, 13.895278], 26 Jan. 1958, Merxmüller & Giess 1381 (BR00000681072). **Omaheke:** Witvlei, 22°25'S, 18°30'E [-22.416667, 18.5], 30 Jun. 1967, Hoogh 19 (WAG.1798356). **Oshana:** Amboland, [-18, 16], 1900 m, Rautanen 308 (W). **Oshikoto:** Namutoni, 18°S, 16°E [-18.806944, 16.941111], 29 Jan. 1969, Giess 10571 (WAG.1798357); Tsumeb, [-19.248333, 17.713333], 29 Mar. 1968, Kers 2811 (LISC); Ovamboland, [-18.000000, 16.000000], 1006 m, 1948, Loeb & Koch 423 (BR0000016232341); Etosha Pan, 19°S, 18°E [-19.047114, 15.844465], 08 May 1991, Smook 7543 (MO-5576290, PRE-776668); 42.9 km N of Charl Marias Dam in direction of Ondongwa, 18°S, 15°E [-18.6048798, 15.5047608], 11 May 1991, Smook 7591 (MO-5576289, PRE-776670). **Otjozondjupa:** Waterberg plateau, [-20.369167, 17.328056], 61 m, 05 Apr. 1971, Coppejans 598 (BR00000681041, WAG.1798364); Okahandja, [-21.981389, 16.902773], 1300 m, Jan. 1900, Dinter 224 (BR00000681022, L.0234494, L.0234495, U.0258914, WAG.1797532, WAG.1798363); Okahandja, [-21.981389, 16.902778], Aug. 1902, Dinter s.n. (BR00000681055); On road between Otavi and Outjo, 19°33'34.8"S, 16°51'57.7"E [-19.559667, 16.866028], 1463 m, 10 Mar. 1997, Germishuizen 9624 (PRE-0829220, WAG.1797432); Grootfontein, [-19.573056, 18.100278], 15 Apr. 1967, Giess 9831 (W); Grootfontein, [-19.573056, 18.100278], 04 May 1967, Giess 10134 (LISU, W); Grootfontein station, [-19.573056, 18.100278], 02 Apr. 1989, Pienaar & Archer 1337 (MO-3889034, PRE 743458); Waterberg Plateau Park, 20°S, 17°E [-20.369167, 17.328056], 22 Mar. 1984, Retief 1480 (PRE, WAG.1798329); Otjosondju, [-21.259167, 17.884722], 1300 m, 03 Jun. 1964, Seydel 4026 (BR00000681074, LE, WAG.1798317); Otjosondju, [-21.259167, 17.884722], 1300 m, 15 Jun. 1966, Seydel 4320 (WAG.1798361); Otjosondju, [-21.259167, 17.884722], 1300 m, 23 Sep. 1966, Seydel 4439 (MO-2008121, WAG.1798362); Between Otjiwatongo and Otavi, [-20.05, 17.0], 1400-1500 m, 01 Mar. 1959, Werdermann & Oberdieck 2360 (WAG.1797534, WAG.1797535). **NIGER.** **Dosso:** Birni N'Gaouré, [13.081667, 2.910833], 26 Sep. 1976, Lavie 1034 (MPU). **Tillabéri:** Niamey-Dosso, [13.266667, 2.666667], 26 Feb. 1932, Chevalier 43746 (MO-5681010, P, WAG.1798322); Fogodji, 13°4'3"N, 2°13'34"E [13.067500, 2.226111], 27 Aug. 1994, [Unknown s.n.]. (B10-0416329). **NIGERIA.** [Country Centroid: 10.0, 8.0], 1949-1950, Meikle 820 (K, MO-1700247). **Anambra:** Imo, [5.483611, 7.033056], 01 Sep. 1981, Ekwuno & al. 255 (FHI96270, MO-4052656); Awka, [6.249058, 7.114838], 29 Oct. 2010, Ugwuozor s.n. (NAUH). **Cross River:** Calabar, [4.979599, 8.337359], 10 Jun. 1981, John s.n. (LUIH); Ikom, [5.966667, 8.75], 30 Jul. 1973, Lowe 2653 (K004447752, FHI). **Katsina:** Daddara, [13.089791, 7.39135], 19 May 1949, Onwundinjoh 22372 (FHI, MO-1657664). **Kogi:** Nupe, [7.920000, 7.460556], 1859, Barter 3323 (K000347408, P00540331). **Lacs:** Market Lacs, 6.53595, 3.391988, 01 Oct. 2014, Adeola 6289 (LUH); Isheri Rd., 6.647679, 3.365582, 6 Mar. 2010, Kadiri & Eniola 3464 (LUH); Egbada, 6.591435, 3.290947, 2 Sep. 2009, Kadiri & Odewo 939 (LUH); Ikorodu, 6.70708, 3.502874, 15 Apr. 2016, Longe 6968 (LUH); Idi-Araba, 6.525258, 3.361124, 17 Oct. 2005, Odewo 60 (LUH); Idi-Araba, 6.525258, 3.361124, 16 Aug. 2007, Odewo s.n. (LUH); Ikorodu, 6.70708, 3.502874, 25 Jul. 2016, Odewo 7293 (LUH); Ajegungle, 6.619123, 3.504127, 31 Mar. 2016, Oladipo 4729 (LUH). **Ogun:** Ifo, 6.818822, 3.191783, 23 Sep. 2013, Akipelumi 5974 (LUH); Ogun, 6.978858, 3.438929, 27 Mar. 2002, Funmi 4760 (LUH); Ijebu Ilisan, 6.823221, 3.925675, 27 Feb. 2010, Kadiri 2682 (LUH); Aregbe, 7.180082, 3.4115, 05 Mar. 2010, Kadiri 1671 (LUH); Mowe, 6.810556, 3.436389, 03 Dec. 2010, Kelechi 3425 (LUH); Ijebu Ogere, 6.93504, 3.63542, 27 Feb. 2010, Oyalaja 1633 (LUH). **Ondo:** Ore, 6.74569, 4.87748, 15 Feb. 2008, Kadiri 3273 (LUH). **Oyo:** Ibadan, 7.377746, 3.89725, 02 Jan. 2009, Daramola 938 (LUH); Gambari, Ibadan, 7.141532, 3.845173, 12 Aug. 1948, Obaseki 23806 (LUH); Iyere, 7.391603, 3.9948, 09 Mar. 2010, Okorie 1929 (LUH). **Plateau:** Jos, [9.928333, 8.891944, 1430 m], 08 Mar. 1971, Tuley 2195 (K); Jos, 9.666667, 8.666666, 20 Apr. 1973, Wit & Daramola 2836 (LUH). **SOUTH AFRICA.** [Country Centroid: -28.99853, 25.092539], 1842, Burchell 2493 (BM001122509, F, G00311226, G00386237, L.2211210, L.2211211, M-0110369, P04786697, W0076163); [Country Centroid: -28.99853, 25.092539], 1840-1842, Zeyher 1513 (BM001122511). **Gauteng:** Pretoria, [-25.744722, 28.187778], 30 Apr. 1936, Bredell 6 (W); Pretoria, [-25.744722, 28.187778], Aug. 1904, Burt-Davy 1849 (PRE, W); Pretoria, [-25.744722, 28.187778], 05 Mar. 1935, Dyes 3135 (W); Wonderboom, [-25.693611, 28.191667], 1300 m, 02 Sep. 1933, Humbert 10543 (P05510246); Hartebeestpoort, [-25.740448, 27.889658], 914 m, 6 May 1938, Lam & Meeuse 4880 (W); Hartebeestpoort, [-25.740448, 27.889658], 01 Aug. 1925, Lotsy & Goddijn 377 (L.2211208); Wonderboom, [-25.7, 28.166667], 03 Dec. 1916, Robertson 2230 (WAG.1798331); Pretoria, [-25.744722, 28.187778], 1200 m, 20 Mar. 1956, Schlieben 7895 (BR0000016232457). **Kwazulu-Natal:** Weenen, Tugela River Valley, 28°S, 30°E, 700 m, 14 Nov. 1989, Balkwill & Balkwill 5030 (B, E, LISC, MO-5576269, RSA); Natal, [-29.00, 30.00], s.d., Gerrard 1460 (W); Mkuze Natal Reserve, 32°15'S, 27°40'E [-32.250000, 27.666667], 200 m, 27 Jan. 1982, Goetghebeur 4370 (BR0000016232389, GENT, PRE); Pongola, 27°S, 31°E [-27.378056, 31.618889], Jan. 1972, Nel 246 (WAG.1798330); Pretoria, [-25.746111, 28.187222], 13 Mar. 1931, Norlindh & Weimark (1720297); 21 km from Greytown on road to Muden, 28°S, 30°E [-28.976164, 30.426668], 22 Jan. 1985, Pienaar 405 (PRE,

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W-04256); Mooi River, [-29.208056, 29.994444], 610 m, Nov. 1944, Sim 2855 (BM001122524). **Limpopo:** Waterberg Range, Thabazimbi District, 30 km west of Vaalwater, on the farm Elandshoek, 24°S, 27°E, 1340 m, s.d., Balkwill & Balkwill 4338 (E, K, LISC, M, MO-3844681); North of the Soutpansberg, on the farm Davenham 740 MS, [-22.93715, 29.80778], 01 May 1995, Balkwill & Balkwill 9313 (B, J, M, MO-3844682, RSA); prope Warm Bath in ditone Waterberg, [-24.205000, 27.978611], 1097 m, Jan. 1906, Bolus 11162 (BR0000006810887); Pietersburg, [-23.904444, 29.468611], 17 Oct. 1930, Fries & al. 2018 (LISC); Waterberg, [-24.205000, 27.978611], 1341 m, 22 Sep. 1920, Galpin 8845 (BRLU); Mutale, 22°S, 31°E [-22.448417, 31.079028], 08 Nov. 1984, Glen 1365 (MO-4075896, PRE-0667422, WAG.1798328); Waterberg, between Marakeli and Hopdal, 24°S, 27°E [-24.205000, 27.978611], 26 Mar. 1980, Hardy 5328 (MO-4055411, WAG.1798334); 83 km from Warmbad on road to Thabazimbi, 24°S, 27°E [-24.87164, 27.565001], 12 Feb. 1981, Herman 203 (BR00000681105, MO-4223703); Thabazimbi, 24°S, 27°E [-24.591389, 27.411389], 25 May 1979, Hildyard 46 (MO-4075901); Pietersburg, [-23.904444, 29.468611], 1380 m, 25 Jan. 1982, Lambinon & Reekmans 82/50 (BR00000681154); Warmbad, [-24.883333, 28.283333], 1200 m, 15 Jan. 1982, Leonard 7273 (BR00000681107); Potgietersrus District, 23°S, 28°E, 18 Sep. 1958, Maguire 3159 (B, CM, E, LISC, M, MO-3905748, WU); Turfloop, [-23.883333, 29.766667], 24 Oct. 1963, Rechinger 4571 (W); Zoutpansberg, [-23.008333, 29.768889], 1100 m, 03 Oct. 1955, Schlieben 7294a (BR0000016232464); Waterberg, [-24.783333, 28.35], 1150-1250 m, 05 Jan. 1959, Werdermann & Oberdieck 1622 (WAG.1797533); 35 mi. S of Louis Trichardt to Pietersburg, 23°S, 29°E [-23.520665, 29.718165], 1500 m, 07 Jul. 1969, Werger 987 (W); Waterberg, Nyhoffsbult Farm, [-24.205000, 27.978611], 14 Feb. 1983, Westfall 1565A (MO-4075946, PRE); Chuniespoort, [-24.228889, 29.496667], 16 Apr. 1936, Yalpin s.n. (LD). **Mpumalanga:** Transvaal, [-25.475000, 30.969167, 673 m], 05 Apr. 1962, Bernardi 9018 (LE); Kruger National Park, 25°03'14"S, 31°34'33"E, [-25.051111, 31.575833], 313 m, 09 Dec. 2005, Maurin & al. 547 (WAG.1487668); Goederede, 25°S, 29°E [-25.300, 29.05], 16 Mar. 1981, Retief 620 (MO-4075886, PRE, WAG.1798332); Transvaal, pr. Nazareth [-25.475000, 30.969167], 1500 m, 13 Feb. 1894, Schlechter 4478 (BR000000681121, RO, W); Lydenburg, [-25.095833, 30.443889], 19 Apr. 1960, Schlieben & Strey 8390 (W); 25 km from Rossenekal on road to Steelpoort, 24°57'51.5"S, 29°57'53.3"E [-24.964306, 29.964806], 853 m, 08 Apr. 1997, Seborthoma 268 (MO-5599282, PRE). **North-West:** Magaliesberg, Mount Grade, Conference Centre, [-25.768056, 27.706111], 1350 m, 29 Jul. 2017, Breteler 16196 (BR0000026785226); Pilanesberg National Park, 25°S, 27°E [-25.262500, 27.091389], 1200 m, 22 Sep. 1991, Dehning 7/91 (WAG.1798327); Magaliesberg, 25°S, 27°E [-25.768056, 27.706111], 1400 m, 25 Feb. 1990, Glen 1889 (MO-3827983, PRE, WAG.1798320); Gold Ridge, 26°S, 25°E [-26.242222, 25.255278], 31 May 1983, Gubb 10713 (WAG.1798323). **Northern Cape:** Griqualand West, Klipfontein, [-28.998530, 25.092539], 19 Jun. 1812, Burchell 2154 (BM001122510, F, GH-00444256, K000422613, L.2211212, M-0110368, M-0110369, S07-14581, S07-14582, W0076163); Luckhoff, 20 km SE of Witsand Nature Reserve, 28°43.732'S, 22°29.487'E [-28.728867, 22.491450], 1258 m, 12 Nov. 2002, Venter 9874 (WAG.1798312). **Western Cape:** Langeberg, 27°S, 22°E, [946 m], 29 Oct. 1983, Gubb 10707 (PRE-779309, WAG.1798324). **TANZANIA. Arusha:** Arusha National Park, [-3.25, 36.75], 1525 m., 25 Nov. 1970, Richards 26390 (NY). **Mbeya:** Mbozi, 8°54'S, 33°12'E [-8.9, 33.2], 1200 m, 06 May 1991, Lovett & Kayombo 174 (MO-04998095, WAG.1797431). **Singida:** 3 km NW Makiungu jct, 4°50'0"S, 34°51'40"E [-4.833333, 34.861111], 1720 m, 02 Sep. 2001, Kuchar 24767 (MO-5235317). **UGANDA. Northern:** Moroto, [2.534444, 34.666389], s.d., Brasnett B.74 (BR0000016232075); Karamoja District, Kaabong, [3.514789, 34.133752], 17 Sep. 1950, Dawkins 644 (BR0000016232044); Karamoja, mt. Moroto, [3.379167, 33.991389], 1372 m, 13 Sep. 1956, Hardy & Nally B10799 (BM001122534, BR0000016232082, BR0000016232099); Karamoja District. Kasuneri Estate, Moroto, [2.534444, 34.666389], Apr. 1972, Wilson 2114 (BR0000016232105). **ZAMBIA. Copperbelt:** Kitwe, [-12.802222, 28.213056], 19 Aug. 1959, Fanshawe F5115 (BRLU). **Eastern:** on crest of Muchenje escarpment on the St. Jameson to Nesfa road, [-12.325, 31.535], 26 May 1961, Angus 2892 (BR0000006811389). **Lusaka:** Kapongo, Old Lusaka Yacht Club, 15°46'S, 28°22'E [-15.76666, 28.36666], 1000 m, 05 Jun. 1996, Bingham & al. 11038 (MO, MRSC); near Zambesi Escarpment sign, [-16.278111, 29.983806], 26 Feb. 1961, Rutherford-Smith 671 (BR0000016232167). **Southern:** near Zambezi R. at Livingstone [-17.841944, 25.854167], 07 Jan. 1953, Angus 1116 (BR0000006810405); Kafue River Road Bridge, [-15.838252, 28.237070], 12 May 1957, Angus 1582 (BR000000681106); Mazabuka district, near Kabanda, [-15.968400, 28.064540], 01 May 1953, Bainbridge 12/53 (BR0000016232143, WAG); Livingstone district, in the R. Zambezi near Katombora, [-17.841944, 25.854167], 24 Aug. 1947, Brenan 7748 (BR0000016232150); along D.375, between Gwembe and Mutantilo, -16.52035, 27.65183, 1197 m, 28 Feb. 2013, Maurin & al. 4162 (WAG.1576827); 11 km S from Livingstone, [-17.95140, 25.8278], 900 m, 16 Apr. 1965, Symoens 11454 (M-027211); Songwe Gorge, 17°56'S, 25°51'E [-17.93333, 25.85000], 960 m, 19 Feb. 1997, Zimba & al. 901 (MO-059385, US). **Western:** Sesheke district, Sisisi forest near Masese, [-16.982778, 23.875278], 23 Dec. 1952, Angus 1011 (BR0000006810078); Barotse, [-15.0, 24.0], Aug. 1921, Borle 301 (BR0000006810283); Kalabo district, in the Lukona local forest, 3.3 km W from Lukona Basic School, 15°24'7.3"S, 22°49'31.4"E, [-15.383333, 22.866667], 1140 m, 20 Mar. 1996, Luwiika & al. 357 (WAG.1798352). **ZIMBABWE. East Mashonaland:** Urungwe, [-17.630556, 31.793333], 30 Aug. 1955, Lovemore 418 (LISC); Mtoko district, [-17.396944, 32.226667], 19 Feb. 1953, Phelps 52 (BR0000016232259); Urungwe, South bank of River Mauore, [-17.630556, 31.793333], 610 m, 27 Feb. 1958, Phipps 913 (BR0000016232235). **Manicaland:** Melsetter district, near bank of Odzi river, south of Hot Springs Hotel, [-19.850000, 32.800000], 29 Dec. 1948, Chase 1434 (BR0000006810610, NY); Umtali district, banks of the Wengesi River, Sun Valley Farm, [-18.970556, 32.670833], 731 m, 18 Dec. 1954, Chase 5370 (BR0000006811532); Melsetter, [-19.850000, 32.800000], 06 Nov. 1974, Mavi 1579 (WAG.1798315). **Masvingo:** 3 miles S of Mateke Hills, [-21.840143, 31.045459], 640 m, 05 May 1958, Drummond 5585 (LISC); Chilimanzi, [-19.581944, 30.745000], 11 May 1957, Woemald 5051 (BR0000016232242). **Midlands:** Mavuradona, Kopje Top, Great Dyke, 16°30'S, 30°55'E [-16.5, 30.916667], 01 Apr. 2000, Baudesson & al. 756 (BR0000009063235, WAG.1798313); Belingwe, [-20.583333, 30.016667], 26 Feb. 1931, Norlindh & Weimarck 5158 (WAG.1798311). **North Matabeleland:** Victoria Falls Trust area, between Maramba River and Victoria Falls, 17°S, 25°E [-17.971605, 25.844924], 888 m, 23 May 1963, Bainbridge 789 (LISC); Victoria Falls, [-17.932778, 25.830556], 12 Dec. 1972, Berghen 37 (BR0000016232280, WAG.1798314); Wankie National Park, [-19.166667, 26.500000], 914-1219 m, 06 Dec. 1966, Clark 440 (BR0000016232211); Nymandlovu, [-19.7054, 28.3543], 14 Sep. 2002, Guala & Lewis 3029 (US-3666653); near Victoria Falls, [-17.916667, 25.85], 30 Oct. 1938, Lanjouw 1102 (U.1256112, U.1256113); Khami ruins, near Bulawayo, [-20.15, 28.433333], 02 Nov. 1938, Lanjouw 1151 (U.1256110, U.1256111); Victoria Falls, [-17.932778, 25.830556], 880 m, 21 Nov. 1979, Neube 66 (LISC); Bulalima-Mangwe Distr., Dombodema Mission Station, [-20.4, 27.616667], 09 Nov. 1972, Norrgrann 266 (WAG.1798366); Wankie National Park, [-19.166667, 26.500000], 1006 m, 26 Feb. 1967, Rushworth 246 (LISC). **South Matabeleland:** Beitbrigde, about 4 miles NE of Pazhi-Limpopo confluence, Sentinel Ranch, [-22.216667, 30.000000], 24 Mar. 1959, Drummond 5975 (BR000000681039, LISC); Beitbrigde, Chitupadzi Dip Camp area, [-22.216667, 30.000000], 18 Mar. 1967, Mavi 232 (BR0000016232204); Gwanda Distr., Luwemuyu Kopfe near Ntepe, [-20.936111, 29.006944], 04 Feb. 1965, Norris-Rogers 649 (BR0000016232228); Matopo, [-20.583333, 28.666667], Jun. 1951, Plowes 1149 (K004449150, LISC); Beitbrigde, [-22.216667, 30.000000], May 1967, Symes 67/M/19 (LISC); Shashi-Limpopo Junction, [-22.1868, 29.3740], 02 Feb 1973, *White 10094 (LISC). **West Mashonaland:** Copper Queen, à environ 100 km à l'ouest de Chinoyi, 17°31'00"S, 29°19'30"E [-17.35097, 29.29474], 900 m, 06 Apr. 2000, Baudesson & al. 854 (BR0000009064201); Shabani, [-20.326667, 30.066389], 28 Jan. 1973, Biegel 4188 (LISC); Distr. Kariba, [-16.516667, 28.800000], 19 Sep. 1963, Whellan 2042 (WAG.1798318); 3 miles South of Pemba, [-16.56661, 27.362474], 17 Jan. 1952, White 1944 (BRLU); Shabani, [-20.326667, 30.066389], 17 Mar. 1964, Wild 6416 (BR0000016232297, LISC).

Croton haumanianus J.Léonard.—CAMEROON. **South:** Campo Ma'an, Ipono, 2°19'58"N, 9°50'28"E [2.332778, 9.841111], 10 m, 18 Apr. 2002, Elad & al. 1516 (WAG.1798292, WAG.1798293). **CENTRAL AFRICAN REPUBLIC. Sangha:** Ndakan, 2°22'N, 16°12'E [2.36666, 16.2], 350 m, 02 Jun. 1988, *Harris & Fay 837 (MO-6566560). **DEMOCRATIC REPUBLIC OF THE CONGO. Bas-Congo:** Lula, [-5.372222, 16.013889], 16 Feb. 1921, Claessens 189 (BR0000013376536, BR0000013376543); Mobwasa, [2.652222, 23.052778], Dec. 1913, Reygaert 1421 (BR0000013386672). **Bas-Uele:** Buta, [2.785556, 24.729722], May 1921, Claessens 670 (BR0000013376529, K004447946); Mobwasa, [2.652222, 23.052778], May 1913,

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De Giorgi 841 (BR0000013376451); Bas-Uele, [2.800000, 24.733333], 06 Mar. 1955, Dewulf 767 (BRLU); Bambesa, [3.445503, 25.696166], 29 Apr. 1952, Gérard 180 (BR0000013376147); Bambesa, [3.445503, 25.696166], 20 Dec. 1952, Gérard 426 (BR0000013376130); Tupwko, [4.432222, 25.847222], 03 Feb. 1954, Gérard 1144 (BR0000013386849, K004447951); Tupwko, [4.432222, 25.847222], 03 Jan. 1957, Gérard 2683 (BR0000013386856); Bambesa, [3.445503, 25.696166], 16 May 1957, Gérard 2839 (BR0000013376116); Tupwko, [4.432222, 25.847222], 01 Dec. 1959, Gérard 4277 (BR0000013386863); Tupwko, [4.432222, 25.847222], 10 Feb. 1961, Gérard 4900 (BRLU); Basape, [4.785833, 26.589722], 700 m, Jan. 1946, Germain 693 (BR0000013386870); Mobwasa, [2.652222, 23.052778], Feb. 1913, Lemaire 105 (BR0000013385118); Mobwasa, [2.652222, 23.052778], 15 May 1913, Lemaire 162 (BR0000013385149); Mobwasa, [2.652222, 23.052778], Jun. 1913, Reygaert 352 (BR0000013386665); Kotili, [2.871018, 24.523867], 11 Dec. 1925, Robyns 1155 (BR0000013386689, BR0000013386696, BR0000013386702, K004447944, P04786540); La Kulu, [3.4666, 23.7666], s.d., van den Brande 250 (BR0000013386771). **Equateur:** Bansakusu, [1.220833, 19.801944], Jun. 1934, Dubois 391 (BR0000013376284, BR0000013376291); Djoa, [-0.412222, 18.196389], 17 May 1958, Évrard 4099 (BR0000013376239); Mondjo, [0.350000, 19.268611], 22 Sep. 1958, Évrard 4871 (BR0000013376222); Bikoro, [-0.732778, 18.133889], Dec. 1920, Goossens 2319 (BR0000013386665); Lukolela, Forêt de Mompoto, [-1.060278, 17.181944], 13 Jul. 1959, Toka 139 (BR0000013386740). **Haut-Katanga:** Gombela, base of Kundelungu, [-10.769722, 27.787778], 1000 m, 01 Apr. 1971, Lisowski 47352 (BR0000013385217, POGZ). **Haut-Uele:** Asonga Hill, 2°6'57.7"N, 27°30'33.5"E [2.116028, 27.509306], 1060 m, 29 Jul. 2011, van der Burgt & al. 1516 (BR0000015830043, EPU, K, MO-6683147, P, WAG.1953736, YBI); Doruma, [4.716111, 27.681944], 702 m, Jan. 1936, Graer 478 (BR0000013386825, M-0257215). **Ituri:** Réserve de Faune à Okapis, Bapukeli, [1.384864, 29.703923], 01 Aug. 1952, Mayens 19 (BR0000013385491); Epulu, Ituri Forest, 1°25'N, 28°35'E [1.416667, 28.583333], 750 m, 04 Aug. 1991, Hart 1307 (BR0000013384937, MO-4365006); Ituri Forest, 1°25'N, 28°35'E [1.416667, 28.583333], 750 m, 25 Apr. 1996, Hart 1683 (MO-5019983); Kibali-Ituri, entre Irumu et Mambasa, [1.4, 29.45], 01 Oct. 1931, Lebrun 4186 (BR0000013385057, BR0000013385064, WAG.1798300); Réserve de Faune à Okapis, 1°19.967'N, 28°1.467'E [1.332783, 28.024450], 543 m, 12 May 2004, Madidi 702 (LISC, MO-04848192); km 614 from Stanleyville to Irumu, in the river bridge, [1.384864, 29.703923], 01 Aug. 1952, Mayens 19 (BR0000013385491); Epulu, 1°25'N, 28°35'E [1.416667, 28.583333], 761 m, 25 Apr. 1996, Ramo 1683 (BR0000013384944); Samloko affil. Tetule, [1.559167, 30.252222], 850 m, 05 Jul. 1954, de Witte 10634 (BR0000013376383). **Kinshasa:** Barumbu [-4.316667, 15.316667], 12 Nov. 1913, Bequaert 1158 (BR0000013376635, BR0000013376642, K004447945); Barumbu [-4.316667, 15.316667], Dec. 1920, Claessens 29 (BR0000013376550, BR0000013376574). **Kwilu:** Kisangi, [-5.519722, 18.939167], 17 May 1979, Lisowski 52486 (BR0000013385231, K004447952, WAG.1798305). **Lomami:** Kibunge, [-6.216667, 24.666667], 18 Apr. 1959, Bamps 548 (BR0000013376659, K004447954); Musa, [-5.935833, 26.170833, 772], 1913, De Giorgi 1198 (BR0000013376437). **Mai-Ndombe:** Koli, [-1.366667, 18.066667], 19 Oct. 1933, Corbisier-Baland 1702 (BR0000013376505); Koli, [-1.366667, 18.066667], 06 Oct. 1932, Corbisier-Baland 2070 (BR0000013376475); Nioki, [-2.720278, 17.690000], Apr. 1941, Flamigni 9018 (BR0000013376192); Panza II, [-2.383333, 18.083333], Jun. 1953, Gilbert 14271 (BR0000013385323). **Maniema:** Kiundu, [-2.943611, 25.922222], 10 Jul. 1957, Gaillez 83 (BR0000013376178); Kibombo, [-3.900000, 25.916667], 08 Dec. 1958, Gaillez 161 (BR0000013376161); Kindu, Katoko-Kombe, [-2.943611, 25.922222], 15 Apr. 1959, Gaillez 274 (BR0000013376154); Moyengo, [-2.8, 26.2], 18 Aug. 1959, Léonard 5894 (BR0000013385170, M-0257216). **Mongala:** Dundusana, [2.946389, 22.261944], Jul. 1913, De Giorgi 1141 (BR0000013376444); Yambata, [2.428889, 21.962778], 1914, De Giorgi 1673 (BR0000013376420); Bumba, [2.18771, 22.46827], May. 1921, Goossens 2948 (BR0000013384845); Yambata, [2.428889, 21.962778], 21 Nov. 1913, Montchal 109 (BR0000013386627, BR0000013386634); Dundusana, [2.946389, 22.261944], 1913, Mortehan 40 (BR0000013386641); D'Sana-Mombongo, [2.950000, 22.616667], 7 Apr. 1914, Vermoesen 244 (BR0000013386795). **North Kivu:** entre Walikale-Lubutu, [-1.430278, 28.075000], 20 Jan. 1915, Bequaert 6688 (BR0000013376604). **Northern Ubangi:** Gbo Sassa, près Karawa, [3.331944, 20.300833], 05 Mar. 1955, Évrard 385 (BR0000013376253); Likimi, [2.831111, 20.748333], 30 Apr. 1910, Walchain 311 (BR0000013385507). **South Kivu:** Bunyakiri, [-2.097778, 28.588333], 950 m, 6 May 1958, Gutzwiller 1853 (BR0000013384906); Bunyakiri, [-2.097778, 28.588333], 1000 m, 02 Mar. 1959, Léonard 3246 (BR0000013385163, K004447950, P04786542); Shabunda, Nzowo, [-2.583333, 28.083333], 1180 m, 13 Apr. 1959, Léonard 3841 (BR0000013385156, L.2211197, WAG.1798302); alentours du poste de Miki, MGL Sud, [-3.366389, 28.659167], 1980 m, 5 Dec. 1947, Michelson 721 (C); vallée de la Belanzovi, en dessous du Mont Kaseru, [-2.5, 28.0], 660 m, 2 Feb. 1949, Michelson 897 (BR0000013386603, BR0000013386610); Ironga, 77 km on road Kavumu-Walikake, 2°3'S, 28°25'E [-2.05, 28.483334], 925 m, 20 Aug. 1955, Pierlot 763 (BR0000013386658); Route Kavumu-Walikale, vers km 107, [-2.100000, 28.916667], 800-900 m, 27 Jan. 1959, Troupin 9398 (BR0000013386764). **South Ubangi:** Gemena, [3.256389, 19.772222], 21 Jul. 1955, Évrard 1404 (BR0000013376246); entre Gemena et Karawa, [3.2, 20.116667], Dec. 1930, Lebrun 1896 (BR000001338503, WAG.1798303); Likimi, [2.831111, 20.748333], Dec. 1913, Lemaire 117 (BR0000013385125); Likimi, [2.831111, 20.748333], Dec. 1913, Lemaire 151 (BR0000013385132); Likimi, [2.831111, 20.748333], 05 May. 1910, Mallchair 345 (BR0000013385514). **Tshopo:** Yangambi, [0.767500, 24.439722], 26 Jun. 1963, Bolema 1153 (BR0000013376581, P-00887046); Yangambi [0.767500, 24.439722], 01 Feb. 1960, Devred 4028 (BR0000013376413, WAG.1798307, WAG.1798308); Bania Lecoula, [0.194167, 25.528889], s.d., Dewèvre 1153 (BR0000013376406); Yangambi, [0.767500, 24.439722], 23 Sep. 1950, Donis 2793 (BR0000013376369, WAG.1798304); Yangambi [0.767500, 24.439722], 23 Sep. 1950, Donis 2794 (BR0000013376352, WAG.1798297); Yangambi [0.767500, 24.439722], 11 Sep. 1951, Donis 3105 (BR0000013376345); Yangambi [0.767500, 24.439722], 21 Dec. 1951, Donis 3239 (BR0000013376338); Yangambi [0.767500, 24.439722], Oct. 1959, Donis 3359 (BR0000013376321); Yangambi, [0.767500, 24.439722], Jan. 1938, Gilbert 902 (BR0000012183814); Yangambi, [0.767500, 24.439722], May 1938, Gilbert 1130 (BR0000013384821); Yangambi, [0.767500, 24.439722], May 1938, Gilbert 1151 (BR0000013384814, LISC); Yangambi, km 5 E.C. T1, [0.767500, 24.439722], 470 m, 27 Jul. 1959, Jeanty 76 (BR0000013384968); Km 20, route Kisangani vers Bengamisa; sentier vers l'Ouest: 5 km jusque la Lindi, 0°40'N, 25°10'E [0.666667, 25.166667], 12 Nov. 1977, Lejoly 2103 (BR0000013385101); Yangambi, 0°48'N, 24°28'E [0.800000, 24.466667], s.d., Lejoly 5105 (BR0000013385095, BRLU, K, WAG.1798298); Yangambi, Lusambila, [0.767500, 24.439722], 09 May 1947, Léonard 1200 (BR0000013385200, K004447955); Yangambi, [0.767500, 24.439722], 26 Sep. 1947, Léonard 1448 (WAG.1798319); Yangambi, [0.767500, 24.439722], 02 Apr. 1956, Liben 1640 (BR000000988420); Banalia, rive droite de l'Aruwimi, [1.565815, 25.333040], 23 Nov. 1977, Lisowski 47352 (BR0000013385217); Yangambi, [0.785, 24.529], 29 Apr. 1979, Lisowski 52350 (BR0000013385224, C); Kisangani, [0.515278, 25.190833], 17 May 1979, Lisowski 52486 (BR0000013385231); Yangambi, km. 5 route de Ngazi, [0.766667, 24.45], 23 Oct. 1935, Louis 350 (BR0000013261108, BR0000013385248); Yangambi, Réserve botanique de l'Issaloe, [0.767500, 24.439722], 11 Sep. 1936, Louis 2591 (BR0000013261092); Route de Yangambi-Bengamisa, au Km 40 de Weko [0.622253, 24.647098], 470 m, 9 Nov. 1936, Louis 2821 (BR0000013261085); Yangambi, à 11 km au N. du fleuve, [0.8535, 24.44114], 470 m, 12 Dec. 1936, Louis 2956 (BR0000013261078,

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BR0000013385286); Yangambi, 11km from the River, [0.867339, 24.399037], 470 m, 02 Feb. 1937, Louis 3205 (BR0000013261054); Yangambi, Réserve-flore-Isalowe, plateau de la Lusambila [0.766667, 24.466667], 470 m, 09 Jul. 1937, Louis 4373 (BR0000013261030, BR0000013385309); Yangambi, Réserve-flore-Isalowe, [0.76667, 24.45], 470 m, 10 Sep. 1937, Louis 5976 (BR0000013261016, BR0000013385316, L.2211198); Yangambi, Réserve-flore-Isalowe, [0.766667, 24.45], 470 m, 13 Nov. 1937, Louis 6585 (BR0000013260996, M-0257213, P04786541); Yaosuka, plateau de la Lusambila [0.757254, 24.496060], 470 m, 11 Mar. 1938, Louis 8385 (BR0000013385354); Yangambi, réserve flore Isalowe, [0.766667, 24.45], 470 m, 01 Jun. 1938, Louis 9631 (BR0000013385361, BR0000013385385, LISC); Yangambi, Réserve flore Isalowe, [0.766667, 24.45], 470 m, 17 Jul. 1938, Louis 10392 (BR0000013385392, BR0000013385408); Yangambi, cirques sources Mbutu, [0.830812, 24.473345], 470 m, 30 Jul. 1938, Louis 10588 (BR0000013385415, BR0000013385422) Yangambi, plateau de l'Isalowe, [0.766667, 24.45], 470 m, 30 Sep. 1938, Louis 11485 (BR0000013385446, K004447940); Yangambi, Réserve flore Isalowe, [0.766667, 24.45], 470 m, 04 Oct. 1938, Louis 11507 (BR0000013385453, BR0000013385460, WAG.1798301); Yangambi, plateau de l'Isalowe, [0.767500, 24.439722], 470 m, 30 Sep. 1938, Louis 17485 (WAG.1798299); Yangambi, [0.767500, 24.439722], 08 Oct. 1955, Maudoux 3232 (BR0000013385521); chemin Buta à Banalia, entre Tezoni et Kole, [2.192664, 25.244758], 12 Jan. 1926, Robyns 1352 (BR0000013386719, BR0000013386733); Isangi, à 3 km route Yaosuka, [0.779444, 24.270278], 05 Feb. 1951, Toussaint 863 (BR0000013386757). **Tshuapa:** Village Balanga (route de Lokofe-Ikumaloki) au Nord de la Tshuapa, [-1.166841, 23.550013], s.d., Bermejo 126 (BR0000013376598); Boitsma, 1°9'S, 21°57'E [-1.150000, 21.950000], 24 Feb. 1991, Dhetchuvi 736 (BR0000013376376, MO-4245368, P-04786543, WAG.1798296); Boende, [-0.281389, 20.880278], 01 Jun. 1941, Hulstaert 389 (BR0000013384951); Boende, s/Yati riv., [-0.216667, 20.866667], s.d., Dubois 298 (BR0000013376314); Ikela s/Tshuapa [-1.166841, 23.550013], May 1937, Dubois 850 (BR0000013376277); Ikela sur Tshuapa, [-1.05, 23.36667], s.d., Dubois 51937 (L.2211199); Yalikungu, [-0.650556, 22.607778], 12 Jan. 1959, Évrard 5527 (BR0000013376215); Boende, [-0.281389, 20.880278], Sep. 1913, Goossens 5071 (BR0000013384869, BR0000013384876); Boende, [-0.281389, 20.880278], 01 Jun. 1941, Hulstaert 389 (BR0000013384951); Boende, [-0.281389, 20.880278], Oct. 1951, Gorbatoff 50 (BR0000013384883, BR0000013384890); Ikela, [-1.049444, 23.366667], Sep. 1910, Jespersen 14 (BR0000013384982); Musa, [2.663056, 19.297778], 1925, Jespersen 35 (BR0000013384999); Mondombe, [-0.777778, 22.753056], Apr. 1925, Jespersen 175 (BR0000013385002); Opala, vallée de la Lomami, [-0.507500, 24.228889], 470 m, Feb. 1939, Louis 14134 (BR0000013385477, BR0000013385484); 32 km route Ubundu [-0.142433, 25.355051], Jul. 2011, Tshibamba 22 (BR0000013386818). **EQUATORIAL GUINEA. Litoral:** Ndote Nord, environments of village Jandje, [1.433333, 9.516667], 29 Aug. 1997, Lisowski M-81 (BATA, BRLU). **IVORY COAST. Péhé:** Toulépleu, [5.38988, -4.12032], 20 Apr. 1968, National Florist Center s.n. (UCJ). **REPUBLIC OF THE CONGO. Brazzaville:** Mikatou, [-4.278056, 15.135278], 20 Jun. 1964, Bouquet 114 (IEC007262). **Kouilou:** Malélé, [-4.41778, 12.13472] 27 Jan. 1987, Foresta 1244 (P04786538); Holle, [-4.533333, 12.150000], Jan. 1950, Trochain 8315 (IEC007281). **Lekoumou:** Komono, 3°10'S, 13°E [-3.166667, 13.0000], 19 Jan. 1968, Bouquet & Sita 2379 (IEC007260); Sibiti, [-3.681667, 13.349722], Jan. 1930, Koechlin 524 (IEC007254). **Niari:** Mossendjo, [2.9497, 12.7042], 14 May 1970, Hallée 1841 (IEC007258). **Pool:** Moutampa, [-4.511220, 15.035149], May 1950, Koechlin 1271 (IEC007255).

Croton mayumbensis J.Léonard.—CAMEROON. **East:** 12 km N of Ndamba II, [4.85, 13.43333], 670 m, 17 Jun. 1965, *Leeuwenberg 5934 (WAG.1798563; WAG.1798564); 10 km N of Welele, 2°41'N, 15°22'E [2.683333, 15.366667], 500 m, 18 Mar. 1987, Manning 1583 (WAG.1797406). **South:** Nlonacko, 2°26'N, 10°21'E [2.43, 10.43], 500 m, 12 Dec. 1998, de Wilde & al. 12162 (M-0257225, S, WAG.1798562). **CENTRAL AFRICAN REPUBLIC. Lobaye:** Boukoko, [3.90435, 17.91793], s.d., Tisserant 525 (BR0000015832689, P); Boukoko, [3.90435, 17.91793], s.d., Tisserant 713 (BR0000015832658, P); Boukoko, [3.90435, 17.91793], s.d., Tisserant 1021 (BR0000015832672, P); Boukoko, [3.90435, 17.91793], s.d., Tisserant 7184 (BR0000015832665, P); Ngotto, Forêt de Baboundji, [-3.890814, 14.452606], 26 Jul. 1984, Yalibando 94/35 (BRLU); Ngotto, forêt de Baboundji, 4°N, 17°11'E [4.000000, 17.183333], 605 m, 13 Feb. 1999, Yongo 11 (BRLU). **DEMOCRATIC REPUBLIC OF THE CONGO. Bas-Congo:** M'Bamba, [-4.923611, 15.499167], 1921, Nannan 102 (BR0000015832566). **Kasai:** Mwaka, Bena Longo, [-4.866389, 21.6333], 525 m, 10 Mar. 1959, Dechamps 128 (BR0000015832580). **EQUATORIAL GUINEA. Litoral:** Bata-Senge-Mitom-Emangós, road km 33, [1.567590, 9.817926], 29 Aug. 1997, *Carvalho 6469 (BATA); Mbambala River, 1°16'N, 9°54'E [1.266667, 9.900000], 22 Aug. 1997, Nguema & Lejoly 27 (BRLU). **GABON. Estuaire:** Libreville, 0°24.17'N, 9°27.30'E [0.402778, 9.455], 78 m, 27 Jun. 2012, Towns 692 (WAG.1951219); Crystal Mountains, Assok, 0°42'N, 10°21'E [0.7, 10.35], 540 m, 18 Sep. 1994, *Breteler & al. 12930 (MA-01-00851608). **Ngounié:** Waka Park National, [-1.05, 11.16666], 13 Dec. 2006, Boussenguin-Nongo 107 (MO-6343427); NE Waka East Ikobe, 01°10'14"S 011°06'01"E, [-1.1706000, 11.1003000], 551 m, 28 Apr. 2005, MBG Transect Leal & al. 1363 (BRLU); Samba Magotsi, Ossimba, [-1.048056, 11.18333], 401 m, 13 Oct. 2012, Towns & Ongoda 1264 (LBV). **Haut-Ogooué:** 6 km Moanda-Franceville, 1°33'S, 13°15'E, [-1.55, 13.25], 10 Sep. 1970, *Breteler 6393 (K004447961). **Ogooué-Ivindo:** Koumameyong, 0°30'N, 11°55'E [0.500000, 11.916667], 15 Nov. 1987, *Louis 2526 (MO-6582919); 33 km on road Mekambo to Madjingio, 1°11.30'N, 14°7.59'E [1.188333, 14.126500], 550 m, 28 Dec. 2000, *Wieringa & al. 3672 (K004447959, M-0257223, MA-01-00867179). **Ogooué-Lolo:** c. 65 km SSW of Bogue, near Makande, 0° 41' S, 11° 55' E, [-0.683333, 11.916667], 19 Feb. 1999, *Breteler & al. 15147 (K004447958); Bambidie, 0°44'S, 12°58'E [-0.733333, 12.966667], 300 m, 12 Nov. 1999, *Breteler 15454 (K004447960, MO-6582926). **Woleu-Ntem:** 6 km SSW of Mitzie FOREENEX, 0°43.8'N, 11°32.1'E [0.730556, 11.535056], 508 m, 06 Nov. 2009, *Bissengou 704 (LBV, M-0257233, MO-6630816). **REPUBLIC OF THE CONGO. Kouilou:** Ménengué, Kayes, [-4.36389, 11.81889], 15 Apr. 1991, Dowsett-Lemaire 1575 (BR0000015832627); Bena, [-4.016667, 11.783333], 08 Oct. 1990, Lisowski B-7137 (BR0000015832641, WAG.1798565); Bamba, [-4.197500, 12.542222], s.d., Sargos 216 (BRLU). **Lekoumou:** Missassa, 2°46'37"S, 13°28'23"E [-2.776944, 13.639722], 09 Oct. 2009, Cheek & al. 15479 (IEC-025722, K). **Niari:** route de Mossendjo, forêt près du village Nyanga, à 45 km environ de Komono, 3°10'S, 13°E [-3.166667, 13.000000], 19 Jan. 1968, Bouquet & Sita 2379 (BR0000015832597, IEC-007259). **West Cuvette:** P.N Odzala, [0.891944, 14.838333], 24 Aug. 1994, Dowsett-Lemaire 1768 (BR0000015832634); P.N Odzala, [0.891944, 14.838333], Aug. 1994, Dowsett-Lemaire 1953 (BR0000013376680); P.N Odzala, [0.891944, 14.838333], 17 Apr. 1995, Kouka 261 (BRLU); National Park of Odzala, [0.891944, 14.838333], 14 May 1996, Kouka 539 (BRLU); National Park of Odzala, [0.891944, 14.838333], 29 Jan. 1996, Lejoly 96/372 (BRLU).

Croton megalocarpoides Friis & M.G.Gilbert.—KENYA. **North Eastern:** Boni Forest Reserve, 8 Km E of Mangai, 01°44'S, 41°14'E, [-1.733333, 41.233333], 10 m, 25 Nov. 1988, Luke & Robertson 1503 (EA, K004448505, MO-3767479); Boni Forest, +/- 20 km. W. of Kiunga, 01°40'S 41°10'E [-1.66666, 41.16666], Oct. 1980, Muchiri 458 (MO); 24 km from SE on border Road, [-1.5, 41.43333], 5 m, Mar. 1973, Oxtoby 15342 (EA, K004448129). **Coast:** Bodhei to Basuba, 01°43'S, 41°00'E, [-1.716667, 41.0], 30 m, 28 Jul. 2006, Festo & al. 2718 (A-6462294; EA; K3044268; MO-6462294, NHT); Diani forest, Robinson Club Baobab, 04°20'S, 39°34'E [-4.33333, 39.56666], 10 m, 07 May 1986, Robertson (Chambers) 4155 (EA); Diani forest, Robinson Club Baobab, 04°20'S, 39°34'E [-4.33333, 39.56666], 10 m, 22 Oct. 1986, Robertson (Chambers) 4342 (EA); Mundane Range, 10 km E of Mareremi, 1°42'30"S, 41°22'E [-1.708333, 41.366667], 60 m, 25 Nov. 1988, Robertson & Luke 5551 (EA, K004448504, MO-4240975, US); K7, Diani Forest, 04°20'S, 39°34'E [-4.33333, 39.56666], 10 m, 20 Feb. 1991, Robertson 6442 (K000453334, MO); **MOZAMBIQUE. Cabo Delgado:** Quirimba National Park, pt 495-pt 496, 12°47'S, 39°38'E [-12.783333, 39.633333], 260 m, 09 Dec. 2003, Luke & al. 9956 (EA, K004449217, LMA, MO-5796403). **SOMALIA. Bay:** 2°14'N, 42°41'E [2.233333, 42.683333], 270 m, 19 Feb. 1982, *Beckett & White 1558 (K004448128); 2°22'N, 42°59'E [2.36667, 42.98333], 300-630 m, 30 Feb. 1982, Beckett 1697 (K004448127); Bur Mun, 2°15'N, 43°1'E [2.25, 43.0167], 275 m, 29 May 1987, Friis & al. 4862 (C, K004448126); El Magu, [2.078056, 42.803056], 1913, Paoli 646 (F, K). **Lower Juba:** 4 km of Goba on rd to Badade, 0°47'S,

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41°41'E [-0.783333, 41.683333], 30 m, 27 Jun. 1983, Gillet & al. 25058 (EA, K004448125, WAG.1798482); 97 km of Kismaayo, 0°40'S, 41°43'E [-0.666667, 41.716667], 50 m, 6 Jun. 1987, Friis & al. 4914 (C, K004448130); Barbak, [-0.5, 41.5], 19 Jul. 1929, Senni 233 (FT); Mamo Juda, [0.159444, 42.760000], 7 Jul. 1929, Senni 379 (FT); Ghersi, [-0.583333, 41.750000], 03 Jul. 1929, Senni 403 (FT). TANZANIA. **Lindi:** Mnazimoja-Mtwara road, 10°13'S, 39°51'E [-10.216667, 39.85], 100 m, 02 Mar. 1991, Bidgood & al. 1763 (BR0000015833105, DSM, K000453333, NHT). **Morogoro:** Mwanihana Forest Reserve, above Sanje village, 7°50'S, 36°55'E, [-7.8, 36.9], 500 m, 24 Sep. 1984, Thomas 3727 (K000453332, MO-3298623).

***Croton megalocarpus* Hutch.**—CENTRAL AFRICAN REPUBLIC. **Sangha:** Ndakan (Gorilla Study Camp), [2.36667, 16.2], 02 Jun. 1988, *Harris & Fay 837 (MICH-1542967). DEMOCRATIC REPUBLIC OF THE CONGO. **Haut-Katanga:** Between Kiubo and Lusinga, Muvule, [-9.166667, 27.2], 20 Aug. 2017, Meerts & Hasson 860 (BR0000020768102). **Ituri:** Semliki Valley, East of Beni, [0.86225, 30.02104], 800-1000 m, Jul. 1929, Humbert 9003 (BR0000013188191, P05477415, P05477416); Zone de Mambasa, Teturi, [1.049994, 29.144049], 800-1000 m, 01 Nov. 1989, Ichikawa 61 (BR0000015833198); Djugu, [1.9191, 30.5025], 1700 m, 10 Jul. 1946, Taton 155 (BR0000015833228). **North Kivu:** Lacs Mokoto [-1.22024, 29.01777], 01 Sep. 1937, Ghesquière 5055 (BR0000015833242); Piste près de Mumo, Kirumbu, Masisi Territory, [-1.260622, 28.895996], 1900 m, 14 Aug. 1958, Gutzwiller 1960 (BR0000016150324); Kahe Terr. Masisi, [-1.4, 28.81667], 1750 m, 20 Jan. 1959, Léonard 2641 (BR0000015833297, BRLU); Burungu, [-1.33845, 29.028678], 1700 m, Jul. 1943, Michelson 413 (BR0000015833327); Mwenda-Katuka [0.41183, 29.76954], 30 Jun 1948, Robyns 3274 (BR0000013188184, WAG); Banyaruanda, region Mushari (Rutshuru), [-1.186667, 29.446667], 2300 m, 21 Dec. 1951, Spitaels 325 (BR0000015833303). **Orientale:** Djugu, [1.933333, 30.5], 21 Mar. 1952, Smeyers 189 (WAG.1798480). **South Kivu:** Mulenge, [-3.106, 28.993], 900 m, Mar. 1995, Bashonga 243 (BR000000968678); Mulungu, [-2.9, 27.93333], May. 1945, Hendrickx 3316 (BR0000015833259); alentours du poste de Miki, MGL Sud, [-3.366389, 28.659167], 1980 m, 5 Dec. 1947, Michelson 721 (BR0000015833310, C); Forêt Tschinganda, km 42 route Kavumu-Walikale, 2°12'S, 28°37'E [-2.200000, 28.616667], 1900 m, 23 Aug. 1958, Pierlot 2461 (BR0000016150294); Kalehe, Numbi-Katandale, 2°14'S, 28°53'E [-1.783333, 28.883333], 2250 m, 03 Mar. 1959, Pierlot 2698 (BR0000016150300, BRLU); km 29, route MGL Tshigoma-Nywararonga, [-2.03333, 28.76667], 2200 m, 10 Jun. 1959, Pierlot 3124 (BR0000015833334); Kalehe, km 52,7 nouvel axe, routier Bukavu-Stanleyville, 2°14'S, 28°38'E [-2.233333, 28.633333], 2115 m, 05 Aug. 1959, Pierlot 3231 (BR0000016150317). **Tanganyika:** Nzawa, [-6.85, 29.6], 28 Nov. 1921, Delevoy 399 (BR0000006772574); Tanganyika, [-6.7381, 28.3363], s.d., Conf of Forest 376 (AAH-00444229); Mont Zawa, [-6.89965, 29.61036], 1689 m, 24 Jun. 1954, Delvaux 536 (BR0000015833341); Mont Zawa, [-6.89965, 29.61036], 1689 m, 25 Jun. 1954, Delvaux 572 (BR0000015833358); Monts Malimba, 70 km N. Albertville, [-7.53333, 29.5, 879 m] 11 Dec. 1956, Delvaux 709 (BR0000016150270, BR0000016150287). ETHIOPIA. **Bale:** Awasa, 7°02.94'N, 38°29.69'E [7.049, 38.49483], 1700 m, 05 Dec. 2013, Friis & al. 15027 (WAG.1953886). **Sidama:** Irgalem, [6.750000, 38.416667], 03 Dec. 1990, Haugen 1828 (K). KENYA. [Country Centroid: 1.0, 38.0], 11 Dec. 1971, Duvigneaud 22C (BR0000015833082, BRLU). **Embu:** [-0.539722, 37.457222], 1280 m, 11 Feb. 1964, Brunt 1451 (BR0000015832979; K004448469). **Kiambu:** Karura Forest, [-1.238107, 36.829650], 18 Dec. 1969, Perdue & Kibuwa 10176 (MO-2265347). **Kitui:** 12 km N Zombe, [-1.34504, 38.23347], 16 Dec. 1987, Alstrup K71b (C); Mutomo hill, 1°51'S, 38°13'E [-1.85, 38.216667], 900-1000 m, 25 May 1968, Gillet 18555 (MO-2265354). **Kwale:** Diani forest, 4°20'S, 39°34'E [-4.333333, 39.566667], 10 m, 20 Feb. 1991, Robertson 6442 (US-3226768). **Machakos:** Mbiuni, [-1.2, 37.4], 01 Oct. 1980, Fliervoet s.n. (WAG.1798487). **Marsabit:** Mt. Kulal, [2.666667, 36.833333], 800-2700 m, 01 Jan. 1982, Schultka 88 (WAG.1798481). **Meru:** Ncoroiboro, 0°8.05'N, 37°36.59'E [0.134167, 37.609833], 1761 m, 29 May 2001, Oijen & Feijen 119 (WAG.1798491). **Nairobi:** Masai Lodge, 36°48'E, 1°23'S, [-1.38333, 36.8], 1600 m, 01 Feb. 1979, Bamps 6423 (WAG.1798489); Nairobi, [-1.283333, 36.816667], 30 Aug. 1963, Verdcourt 3722A (BR0000015833013, BR0000015833020, BR0000015833037). **Nyanza:** Kakamega Forest Station, 0°14'0"N, 34°51'45"E [0.233333, 34.8625], 1600 m, 17 Sep. 1949, Geesteranus 6261 (L.2203493, MO-1715655, US-2247308, WAG.1798485); Kakamega Forest, 0°13'N, 34°54'E [0.216667, 34.9], 07 Jan. 1968, Perdue & Kibuwa 9489 (BR0000015833075, EA, LISC). **Nyeri:** Mt. Aberdare [cultivated] [-0.411733, 36.669378], 20 Dec. 1921, Fries 162 (WAG.1798488). **Taita Taveta:** Ngangao Forest, [-3.37, 38.33], 1700-1875 m, 16 May 1958, Faden & al. 527 (US-3088797). MALAWI. **Central:** Dedza, [-14.377778, 34.333056], 09 Aug. 1961, Chapman 1436 (K). **North:** Mussisi forest, [-10.0279, 33.6568], 1760-1850 m, 04 Jun. 1983, Dowsett-Lemaire 766 (BR0000015833174, K); Taita Hills, [-3.404167, 38.327778], s.d., Roelen 62 (BR0000005596850). MOZAMBIQUE. **Cabo Delgado:** Qassanga, 12°50'S, 40°18'E [-12.8333, 40.30], 30 May 1959, Gomes Sousa 4471 (K); Ancuabe, 12°59'S, 39°52'E [-12.983333, 39.866667], 350-450 m, 03 Aug. 1983, Groenendijk & Dungo 482 (MO-6473830; WAG.1798483); Ancuabe, [-12.989167, 39.898056], 600 m, 05 Aug. 1983, Groenendijk & Dungo 509 (MO-3112865); NW of Pemba, 12.79783°S, 40.41709°E [-12.79783, 40.41709], 116 m, 29 Apr. 2008, Müller & al. 4009 (K-000738869). **Nampula:** [-15.116389, 39.266389], 1947, Campos-Andrada 952 (LISU). RWANDA. **Butare:** Cyanguu, forêt de Nyungwe, plantation de Gisakura [-2.529915, 29.278197], 2000 m, 06 May 1971, Bouxin 578 (BR0000015833365, L.2203492, MO-3261104). **Western:** Gishwati, [-1.815946, 29.352060], 2180 m, 05 Nov. 1985, Habicarente 739 (BRLU). SOMALIA. **Bay:** 2°14'N, 42°49'E [2.233333, 42.83333], 270 m, 19 Feb. 1982, *Beckett & White 1558 (MO-4056658, MOG). **Badhaadhe:** 4 km S of Goba on road to Badade, Locality L 143, 0°47'S, 41°41'E [-0.783333, 41.683333], 30 m, 27 Jun. 1983, Gillet & al. 25058 (WAG.1798482). TANZANIA. **Arusha:** Monduli, 3°16'50.3"S, 36°27'13.9"E [-3.280639, 36.453861], 1740 m, 04 Jul. 2020, Clement & al. 53 (NHT); Essimngori Forest Reserve, 3°25'46"S, 36°5'54"E [-3.43, 36.1], 1520 m, 14 Apr. 2000, Festo & al. 655 (MO-5776013, S); Endabash River, Lake Manyara National Park, [-3.600000, 35.600000], 975 m, 08 Nov. 1963, Greenway & Kanuri 10992 (BR0000015833129, K); Arusha National Park, [-3.25, 36.783333], 21 Dec. 1972, Harris & al. 6563 (WAG.1798490); Arumeru Distr., Ngaramtoni, [-3.305000, 36.800833], 1400 m, 12 Dec. 1977, Magogo 1631 (BR0000015833167, NHT); Them River Basin, between Sanawari Bridge and Clock Tower Bridge, 3°22'7"S, 36°41'45"E [-3.36861, 36.69583], 1400 m, 01 Apr. 2004, Mboya 1051 (MO); Suye Hill, ca. 3 km SE of Arusha, just N of the Old Moshi Road, 3°22'26"S, 36°42'48"E [-3.37388, 36.71333], 1450-1520 m, 26 Jun. 1996, Miller & al. 8566 (MO, WAG.1798484); Ngorongoro, Mamahau Valley, 3°21'S, 35°36'E [-3.35, 35.6], 1500 m, 15 Nov. 1995, Mwasumbi 17523 (MO-6636729); Olmolong Ward, 2°16'59"S, 31°5'5"E [-2.283056, 31.084722], 1133 m, 06 Jun. 2008, Njau & al. 1514 (NHT); Momela National Park, [-3.219087, 36.848982], Dec. 1964, Procter 2845 (EA); Rongai, [-2.9380902, 37.4574899], 08 Dec. 1968, Shabani 253 (BR0000015833136); Ngorongoro Conservation Area, [-3.2089, 35.4628], 12 Nov. 1997, Simon & al. 28 (NHT); Essimngori Forest Reserve, 3°25'27"S, 36°6'16"E [-3.424167, 36.104444], 1940 m, 13 Apr. 2000, Simon & al. 500 (MO-6565830); Digodigo, -2.1144, 35.78889, 24 Jul. 2016, Sitoni & al. 87/7808 (NHT); Suia Hill, [-3.383333, 37.116667, 1524 m], 12 Jul. 1953, Watkins 624 (TFD); Ngorongoro Saddle, [-2.688325, 35.536594], 1584.96 m, 20 Jan. 1955, Willan 264 (TFD). **Kagera:** Minziro Forest Reserve, 1°5'S, 31°31'E [-1.083333, 31.516667], 1130 m, 31 Jan. 2000, Festo & Bayona 549 (MO-5165339, NHT); Minziro Forest Reserve, 1°5'S, 31°33'E [-1.083333, 31.55], 1130 m, 28 Nov. 1999, Gereau & al. 6347 (MO-04975440, MO-5192638). **Kigoma:** Kibwesi, [-6.49532, 29.966], 1000 m, 21 Jun. 1906, Scheffler 172 (P-05477417, WAG.1798486). **Kilimanjaro:** Lerangwa, [-2.890032, 37.331854], 11 Nov. 1993, Grimshaw 931013 (NHT); Same, [-4.083179, 37.737917], 06 Oct. 1925, Hawing 376 (O); Sanya sawmill, [-3.383333, 37.116667, 893 m], 30 Mar. 1931, Wye 2269 (TFD); Moshi, [-3.351185, 37.329312, 1584.9 m], 10 Oct. 1925, Hughes 166 (TFD); South Pare Mountains, Chome Forest Reserve, Shengena Forest, 4°21'58"S, 38°0'36"E [-4.366111, 38.01], 1450 m, 29 Nov. 1999, Mwangulango & al. 576 (MO-6561459); Kilimanjaro Forest reserve, [-3.184833, 37.099056], 1707 m, 12 Oct. 1960, Steele 97 (NHT); Moshi, [-3.3500, 37.333], 05 Mar. 1920, Swynnerton s.n. (BM-001122430). **Lindi:** Milola, 9°55'53"S, 39°26'23"E [-9.931389, 39.439722], 255 m, 01 Nov. 2005, Kindeketa & al. 2609 (MO-6566546). **Manyara:** Hanang Nature Reserve, 4°28'49"S, 35°23'1"E [-4.480278, 35.383611], 2060 m, 22 Jun. 2017, Mwangoka & al. 9312 (MO-6878747). **Rukwa:** Tongwe East Forest Reserve, 5°29'37"S, 30°33'59"E [-5.493559, 30.56632], 1390 m, 23 Apr. 2009,

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Laizer & al. 3642 (MO-6487414). **Tanga:** Near Boma, Lushoto [-4.794889, 38.293001, 1371 m], 12 Jul. 1953, Ngonyani 66 (TFD). **Tanganyika:** Longil Glade Ngurdoto National Park, [-3.280180, 36.916056], 1493 m, 20 Oct. 1965, Greenway & Kanuri 12175 (BR00000015833150). **UGANDA.** **Central:** Entebbe, [0.056111, 32.479444], 1189 m, Jan. 1935, Chandler 1263 (BR00000015832986, K). **Western:** Bunyoro, Bundongo Forest, [1.783333, 31.583333], Apr. 1935, Eggeling 1706 (BM, FHI, MO-17000803); Ankole, Kalinzu C.F.R., [-0.2499, 30249973], 1524-1829 m, 30 Oct. 1962, Styles 175 (BR00000015833006, K004448459).

Croton mubango Müll.Arg.—ANGOLA. **Benguela:** Between Caporolo and Chongori, [-13.427444, 13.890917], 930 m, 02 Apr. 1973, Raimundo & al. 1390 (BR00000015833570, LISC053088); Benguela, [-12.576111, 13.405278], 10 m, 1864, Welwitsch 348 (BM001122533, G00311231, P00540354). **Cabinda:** Buco-Zau, [-4.795000, 12.546667], 170 m, 26 Oct. 1916, Gossweiler 6789 (COI00065923, LISC053095); Buco-Zau, [-4.795000, 12.546667], 170 m, 18 Jun. 1959, M.E.F.A. 463 (LISC053098, LISC053099, LISC053100, LISC053101). **Huíla:** [-14.695278, 15.000000], s.d., Dekindt 709 (MPU); [-14.695278, 15.000000], 2 Jun. 1937, Exell & Mendoca 2493 (BM01122499); [-14.695278, 15.000000], 01 Oct. 1955, Mendes 263 (LISC053085); Cela, [-11.421667, 15.123333], 1400 m, 13 Oct. 1963, Teixeira & Andrade 7486 (LISC053086). **Kwanza-Norte:** Cazengo, [-9.329831, 14.897461], 29 Sep. 1909, Gossweiler 4507 (COI00065925, LISC053096, MO-1599627, S); Cazengo, [-9.329831, 14.897461] Dec. 1980, Gossweiler 4790 (COI00065924); Kwanza-Norte, [-8.911111, 14.888611], 29 Dec. 1964, Mendes dos Santos 1242 (BM001122433, LISC053083); Between Golungo [Alto] and Camame, [-9.062937, 14.888440], 1000 m., 24 Nov. 1969, Raimundo & al. 58 (LISC053082); Golungo Alto, 4 km, [-9.0835, 14.7266], 550 m, 15 Jun. 1970, Raimundo & al. 287 (LISC053080); Between Cariamba and Banga, [-8.673709, 15.180629], 1000 m, 25 Aug. 1970, Raimundo & al. 358 (LISC053078); N'Dalantando, [-9.297778, 14.911389], 750 m, 28 Dec. 1963, Silva 406 (LISC053097). **Kwanza-Sul:** Capiri, [-10.740833, 14.306389], Feb. 1983, Gossweiler 9972 (COI00065921, LISC053094, US-1579456). **Luanda:** Luanda, [-8.836667, 13.234167], 1937, Exell & Mendoca 22 (LISC053093); Chitato, [7.366389, 20.815556], 01 Apr. 1964, Martins 100 (LISC053084). **Malanje:** [-9.540000, 16.340833], 1703, Almeida 3 (LISC053089, LISC053090, LISC053091); [-9.540000, 16.340833], Sep. 1887, Marques 27 (BR00000015833556); [-9.540000, 16.340833], Nov. 1887, Marques 201 (BRLU, LISU); [-9.540000, 16.340833], Oct. 1879, Mechow 2866 (M-0257227); Between Casuso e Soqueco, [-9.34968, 15.797657], 1100 m, 14 Jul. 1970, Raimundo & al. 320 (LISC053079). **Uige:** entre Quitexe e o Rio Dange, [-8.095250, 15.179301], 29 Aug. 1970, Raimundo & al. 386 (BR00000015833563). CAMEROON. **Centre-South:** Campo Reserve, 2°23'N 10°3'E [2.383, 10.05], 112 m, 1976, Bililong & Bullook 345 (K004447832). CENTRAL AFRICAN REPUBLIC. **Lobaye:** Région de Mbaïki, Station Centrale de Boukoko, [3.904167, 17.917778], 21 Feb. 1948, Tisserant 713 (BR00000013242824, P05477402); Boukoko, [3.904167, 17.917778], 1948, Tisserant 1021 (BR00000013187743). **Sangha:** Dzanga-Sangha Reserve, [2.83333, 16.45], 434 m, 8 Mar. 1989, Carroll 1947 (MO-3850296). DEMOCRATIC REPUBLIC OF THE CONGO. **Équateur:** Tumba, [-0.744954, 17.927610] Aug. 1913, Verschueren XVI (BR00000015833761, BR00000015833778). **Kongo Central:** Kiwembo, [-4.733611, 14.934722], Nov. 1924, Vanderyst 13456 (BR00000015833754); Kimpangu, [-5.859167, 15.008889], 05 Apr. 1989, Breyne 5712 (BR00000015833693); Mbanza-Ngungu, [-5.258333, 14.858333], 08 Jan. 1960, Compere 1126 (BR00000013187767); M'vuazi, [-5.320000, 15.101944], 21 May 1948, Devred 207 (BR00000013187774); M'vuazi, [-5.320000, 15.101944], 26 Sep. 1952, Devred 1242 (BR00000013187781); Luki, [-5.747778, 12.882500], 10 Sep. 1947, Donis 1448 (BR00000013760960); Luki, [-5.633333, 13.066667], 2 Oct. 1948, Donis 2022 (BR00000013280376); Luki, [-5.747778, 12.882500], 21 Dec. 1948, Donis 2250 (BR00000013280383, K); Mbanza-Ngungu, [-5.258333, 14.858333], 02 Jan. 1957, Dubois 165 (M-0257228); Kimpangu [-5.859167, 15.008889], 02 Jan. 1957, Dubois 168 (BR00000013187842); Mbanza-Ngungu, [-5.258333, 14.858333], 11 Jan. 1957, Dubois 169 (BR00000013187835, WAG.1798409); Luki, [-5.747778, 12.882500], 08 Dec. 1954, Hombert 165 (BR00000013187866); Luki, [-5.747778, 12.882500], 18 Apr. 1956, Hombert 222 (BR00000013187798); Luki, [-5.747778, 12.882500], 10 Oct. 1957, Hombert 407 (BR00000015833631); Luki, [-5.747778, 12.882500], 18 Nov. 1959, Hombert 542 (BR00000013187859, WAG.1798406); Luki, [-5.747778, 12.882500], 08 Dec. 1959, Hombert 565 (WAG.1798407); Mbanza-Ngungu, [-5.258333, 14.858333], 08 Apr. 2005, Nsimumdele 129/1309 (BR000000938856); Kasangulu [-4.783611, 15.346389], 15 Feb. 1982, Okitolembu 23 (BR00000013187750, WAG.1798410); Luki, [-5.633333, 13.066667], 12 Oct. 1953, Wagemans 688 (BR6102010834676, L.2203423); Luki, [-5.633333, 13.066667], 18 Nov. 1953, Wagemans 728 (BR6102010863966); Luki, [-5.633333, 13.066667], 220 m, 16 Jan. 1957, Wagemans 1302 (BR61020837707); Luki, [-5.633333, 13.066667], 01 Mar. 1953, Wagemans 1887 (BR); Luki, [-5.633333, 13.066667], 20 Jun. 1957, Wagemans 1961 (BRLU); Boma, [-5.850833, 13.053611], 03 Mar. 1959, Wagemans 2158 (BRLU). **Haut-Katanga:** Lubumbashi, [-11.660833, 27.479167], 1200 m, 18 Oct. 1982, Malaisse 12421 (BR00000013187712); Mukana, [-9.242222, 27.204444], 03 Jul. 1988, Pauwels 7167 (MO-4360240, WAG.1798408). **Haut-Lomami:** Kapulumba, [-5.746111, 22.416389], 1913, Sparano 95 (BR00000015834027); Luluabourg, [-5.896111, 22.416389], 1930, Vanderyst 21351 (BR00000015834102). **Kwango:** Popokabaka, village Kongo, [-5.6922, 16.5853], 01 May 1970, Breyne 849 (BR00000015833686); Popokabaka, I.N.E.R.A. Zihulu, [-5.6922, 16.5853], 06 Nov. 1977, Breyne 3241 (BR00000015833914, MO-6474521); Mawanga, 6°00'S, 17°20'E [-6, 17.333333], 29 Apr. 1953, Callens 4055 (BR00000015833921, WAG.1798404); Feshi, [-6.116667, 18.166667], s.d., Duvigneaud 1063 (BRLU). **Kwilu:** Lutshima, [-5.41667, 19.033], 28 May 1948, Duvigneaud 929C (BRLU); Kikwit, 5°2'S, 18°48'E [-5.033333, 18.8], 18 Mar. 1991, Maesens 343 (WAG.1798403); Ipamu, [-4.159444, 19.631389], Jun. 1921, Vanderyst 9450 (BR00000015834034); between Ipamu and Kikwit, [-4.6095, 19.2479], Jul. 1921, Vanderyst 9926 (BR00000015834065); Ipamu, [-4.159444, 19.631389], Sep. 1921, Vanderyst 10726 (BR00000015834072); between rivers Lubue and Kamsha, [-3.9452, 19.4449], Oct. 1922, Vanderyst 12521 (BR00000015834089); Idiofa, [-4.965833, 19.591389], Oct. 1922, Vanderyst 12646 (BR00000015834096). **Lomami:** Gandajika, [-6.745000, 23.953056], 10 Apr. 1953, Charlier A38 (BR00000015834119). **Maniema:** Namoya, Kakula Hill, 4°0.48'S, 27°33.24'E [-4.008000, 27.554000], 990 m, 15 Apr. 2008, Bytebier & Luke 2960 (BR0000005044542). **Sankuru:** Sankuru, [-3.520833, 23.600278], Nov. 1921, Ghesquière s.n. (BR00000015833938). GABON. **Haut-Ogooué:** 6 km. Moanda-Franceville 1° 33' S, 13° 15' E, [-1.55, 13.25], 10 Sep. 1970, *Breteler 6393 (BR00000015833549, MO-4310650). **Nyanga:** [3.0, 11.0], 25 Apr. 2008, Nsimundele 2134 (BR0000005042845); Doudou mountains, 2°32'S, 10°30'E [-2.533333, 10.5], 27 Aug. 1985, *Reitsma & Reitsma 1419 (LBV, MA-01-00463499, MO-4057312, NY03993635, NY04101212). **Ogooué-Ivindo:** Lope Reserve, 0°15'S, 11°40'E [-0.25, 11.66666], s.d., White 348 (MO-4987389); Lope Reserve, [-0.441111, 11.524722], 06 Jan. 1997, White 1633 (MO-6450687). **Ogooué-Lolo:** c. 10 km E. of Lifouta Gare, 1°4'S, 13°14'E [-1.066667, 13.233333], 26 Nov. 1993, *Breteler & al. 12360 (BR00000015833532, MO-6246806); 21 km SE of Lastoursville, 0°58'S, 13°5'E [-0.966667, 13.083333], 440 m, 26 Nov. 1988, *van der Maesen & al. 5879 (BR0000005068689, MA-01-00842585, MO-6466925). **Woleu-Ntem:** Chantier Rougier Océan, 0°43'N, 11°6'E [0.716667, 11.1], 22 Sep. 1985, *Reitsma & Reitsma 1535 (LBV, MA-01-00463659, MO-3795584, NY03993636, WAG.1798528). EQUATORIAL GUINEA. **Provincia Litoral:** área de Machinda, poblado de Ovong, [2.083056, 10.999167], 29 May 2012, López-Serrano 2905114 (MA unmounted). IVORY COAST. **Lagunes:** Apété, [5.825833, -4.110278], 18 Feb. 1957, Aubréville 116 (MO-5730166, P). REPUBLIC OF THE CONGO. **Brazzaville:** Brazzaville, [-4.266667, 15.283333], 06 May 1950, Koehliin 1271 (U.1255975). TANZANIA. **Kilimanjaro:** Lutamba Lake, [-10.0307, 39.47204], 200-250 m, 30 Nov. 1934, Schlieben 5671 (BM001122457, P-05477418).

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***Croton oligandrus* Pierre ex Hutch.**—ANGOLA. **Cabinda:** Maiombe, [-4.640904, 12.764968], 1936, Flamigni 17 (BRLU); Maiombe, [-4.640904, 12.764968], 28 Oct. 1957, M.E.F.A. 131 (LISC053104, LISC053105, LISC053106, LISC053107, LISC053108, LISC053109, LISU37944, LISU37945, LISU37946); Maiombe, [-4.640904, 12.764968], 1957, M.E.F.A. 135 (LISC053110, LISC053111, LISU54793); Maiombe, [-4.640904, 12.764968], 1957, M.E.F.A. 141 (LISC053102, LISC053103, LISU54792). CAMEROON. **Centre:** Yaoundé, [3.866667, 11.516667], Jan. 1914, Mildbraed 8000 (BR0000018701456, K004447838); Yaoundé, [3.866667, 11.516667], 06 May 1958, Letouzey s.n. (LISU); Eloumden, 10 km from Yaoundé, [3.81939, 11.4353], 07 Feb. 1956, Mpom 193; Yaoundé: [3.866667, 11.516667], 1896, Zenker 739B (BR0000018701432, S). **East:** 14 km. E of Dimako, [4.383333, 13.7], 670 m, 08 Feb. 1966, Leeuwenberg 7791 (WAG.1797643, WAG.1797644); Yokadouma, [3.366667, 15.016667], 03 Jun. 1963, Letouzey 5209bis (BR0000013187903, K004447839, WAG.1797645); National Park of Deng-Deng, 5°13'13"N, 12°26'51"E [5.220203, 13.447593], 20 Jul. 2014, IRD 1144 (BRLU, YA); Réserve de faune du Dja, Mékas, 3°11'N, 12°33'E [3.183, 12.55], 661 m, 12 Jan. 1995, Sonké 1419 (BR0000013187897, BRLU). EQUATORIAL GUINEA. **Litoral:** Bata-Senge-Mitom-Emangós, road km 33, [1.567590, 9.817926], 29 Aug. 1997, *Carvalho 6469 (MA-01-00520823). **Centro Sur:** Evinayong, [1.450000, 10.566667], Jun. 1945, Guinea 445 bis (MA-01-00701166). GABON. [Country Centroid: -1.000000, 11.750000], 1896, Klaine 71 (AAH00444239, BR0000013187873, BR0000013187880, K000347420, K000347421, K000347422, K000347423, LE, MO-1591778, P00346011, P00346012, P00346013, P00346014, P00346015, P00346016, P00346017, NY, S); [Country Centroid: -1.000000, 11.750000], s.d., Soyaux 3 (BR0000018701463). **Estuaire:** Crystal Mountains, 0°42'N, 10°21'E [0.7, 10.35], 540 m, 18 Sep. 1994, *Breteler & al. 12930 (WAG.179852); Libreville, [0.402778, 9.455], 18–20 Apr. 1971, Gilles 48 (P05477744); Libreville, [0.402778, 9.455], Nov. 1976, Klaine 556 (BR0000016052659, K, P05477730, P05477731, P05477732); Libreville, [0.402778, 9.455], 30 Aug. 1901, Klaine 2764 (K004447841); OLAM concession at Awala, south of the North Conservation Zone (HCV), 00°05'59"N, 10°06'35"E [0.0997500, 10.1098000], 36 m, 18 Mar. 2020, MBG transect 4103 (BRLU, LBV); Kango, 00°11'34"N 10°07'17"E [0.1927200, 10.1214300], 34 m, 18 Jun. 2020, MBG transect 4558 (BRLU, LBV); Komo-Mondah, Malibe I, 0°58.70'N, 9°34.60'E [0.978333, 9.576667], 30 Jul. 2012, Quiroz-Villarreal & al. 1318 (WAG.1798514, WAG.1798515); Douagneng Forest, 0°19.71'N, 9°59.17'E [0.328472, 9.986083], 23 Aug. 2012, Quiroz-Villarreal & al. 1463 (LBV, WAG.1798513); Libreville, [0.402778, 9.455], 16 Jun. 2012, Towns 666 (LBV); Libreville, [0.402778, 9.455, 78 m], 24 Jul. 2012, Towns 1032 (LBV); Tchimbelle-Kinguele, [0.330556, 10.098056], 20 Jul. 2012, Towns 929 (LBV). **Haut-Ogooué:** km 6 Moanda-Franceville, 1°33'S, 13°15'E [-1.55, 13.25], 10 Sep. 1970, *Breteler 6393 (WAG.1798529, WAG.1798530); Est (environ 3 km) du village Lémanassa, sur la route menant vers la frontière Gabon-Congo, 2°00'03"S, 12°56'27"E [-2.00089, 12.94071], 711 m, 24 Mar. 2023, MBG transect 9724 (BRLU, LBV); Northwestern of Sassamongo, 00°56'25"N, 13°23'38"E [0.9401800, 13.3938600], 491 m, 26 Jan. 2024, MBG transect 13389 (BRLU, LBV). **Ngounié:** Moghoulou, [-1.401389, 11.351111], 03 May 1928, *Le Testu 6070 (BR0000016052680, P05510252, P05510255, P05510256). **Nyanga:** Tchibanga, [-2.933056, 10.981667], 19 Oct. 1900, Le Testu 1426 (BR0000016052666, BR0000018701449, MO-2764234, NY); Tchibanga, [-2.933056, 10.981667], 19 May 1913, Le Testu 1611 (BR0000016052659, K, P05477730, P05477731, P05477732); Tchibanga, [-2.933056, 10.981667], 03 Jul. 1919, Le Testu 1612 (B100591558, BR0000016272637, BR0000016272673, K, P05477728, P05477729, P05477733); Doudou mountains, 2°32'S, 10°30'E [-2.533333, 10.5], 27 Aug. 1985, *Reitsma & Reitsma 1419 (WAG.1798532). **Ogooué-Ivindo:** Makokou, National Park Ivindo, 00°30'44"N, 12°48'09"E [0.512278, 12.802583], 519 m, 14 Mar. 2019, Barberá 2632 (LBV, MO); Makokou, 00°50'56"N, 12°51'40"E [0.848881, 12.861211], 500 m, 16 Mar. 2019, Barberá 2681 (BR, BRLU, LBV, MO, P, WAG); Makokou, [0.573611, 12.864167], 02 Feb. 1961, Hallé 1040 (P05477743); Bélinga, [1.088889, 13.199444], 900 m, 14 Jun. 1966, Hallé 3896 (P05477742); Ipassa-Makokou, [0.5167, 12.8], Sep. 1971, Hladik 1361 (P05477741); Ipassa-Makokou, [0.5167, 12.8], 02 Sep. 1971, Hladik 1377 (P05477740); Ipassa-Makokou, [0.5167, 12.8], 500 m, 14 Jul. 1972, Hladik 2351 (P05477745, US-2639352); Koumameyong, 0°30'N, 11°55'E [0.5, 11.916667], 15 Nov. 1987, *Louis 2526 (WAG.1798519); Bord de route entre Makokou et Ipassa, 00°32'20"N, 12°49'30"E, [0.5389750, 12.8249280], 483 m, 20 Apr. 2022, MBG Transect 8224 (BRLU, LBV); Bord de route entre Makokou et Ipassa, 00°31'34"N, 012°48'26"E, [0.5260020, 12.8072270], 508 m, 21 Apr. 2022, MBG Transect 8251 (BRLU, LBV); Bord de route entre Makokou et Ipassa, 00°32'9"N, 012°49'7"E, [0.5357980, 12.8185280], 497 m, 23 Apr. 2022, MBG Transect 8336 (BRLU, LBV); Alentours du village Agnang, 00°25'59"N, 12°17'47"E, [0.4329480, 12.2964870], 499 m, 6 May 2022, MBG Transect 8624 (BRLU, LBV); Alentours du village Agnang, 0°25'03"N, 12°16'47"E, [0.4175850, 12.2797170], 489 m, 7 May 2022, MBG Transect 8666 (BRLU, LBV); Alentours du village Agnang, 00°25'22"N, 12°18'03"E, [0.4227580, 12.3009600], 491 m, 7 May 2022, MBG Transect 8791 (BRLU, LBV); Alentours du village Agnang, 00°26'18"N, 12°20'21"E, [0.4383630, 12.3391770], 485 m, 11 May 2022, MBG Transect 8847 (BRLU, LBV); Alentours du village Agnang, 00°25'36"N, 12°17'46"E, [0.4267430, 12.2959870], 491 m, 11 May 2022, MBG Transect 9002 (BRLU, LBV); Village Massaha, 00°44'51"N, 13°12'11"E, [0.7475780, 13.2029970], 564 m, 2 Dec. 2023, MBG Transect 11642 (BRLU, LBV); Ancien village de Zazo I, 00°43'28"N, 13°09'52"E, [0.7243790, 13.1645280], 528 m, 3 Dec. 2023, MBG Transect 11685 (BRLU, LBV); Ancien village de Malembe, 00°43'31"N, 13°09'59"E, [0.7253890, 13.1662980], 527 m, 4 Dec. 2023, MBG Transect 11685 (BRLU, LBV); Ancien village de Ibenga, 00°39'46"N, 13°15'25"E, [0.6628860, 13.2569930], 540 m, 14 Dec. 2023, MBG Transect 12187 (BRLU, LBV); Ancien village de Membaze, 00°39'47"N, 13°15'28"E, [0.6628880, 13.2578370], 554 m, 16 Dec. 2023, MBG Transect 12227 (BRLU, LBV); Ancien village de Mekao, 00°45'13"N, 13°14'21"E, [0.7534970, 13.2390330], 609 m, 17 Dec. 2023, MBG Transect 12293 (BRLU, LBV); North-West of Sassamong, 00°56'25"N, 13°23'38"E [0.9401800, 13.3938600], 491 m, 26 Jan. 2024, MBG transect 13389 (BRLU, LBV); Lopé Reserve, 0°15'S, 11°40'E [-0.25, 11.666666], 200 m, 15 Sep. 1993, White 1041 (WAG.1798525); 14.5 km on road Mékambo to Madjingio, 1°4.13'N, 14°2.89'E [1.068833, 14.048167], 500 m, 25 Dec. 2000, Wieringa 3575 (WAG.1798527); 3 km on road Mekambo to Madjingio, 1°11.30'N, 14°7.59'E [1.188333, 14.126500], 550 m, 28 Dec. 2000, *Wieringa & al. 3672 (MO-6630807, P, WAG.1798526). **Ogooué-Lolo:** c. 10 km of Lifouta Gare, 1°S, 13°E [-1.00, 13.00], 26 Nov. 1993, *Breteler & al. 12360 (WAG.1798517); c. 65 km SSW of Bogué, near Makande, 0°41'S, 11°55'E, [-0.683333, 11.916667], 19 Feb. 1999, *Breteler & al. 15147 (WAG.1798516); Bambidie, 0°44'S, 12°58'E [-0.733333, 12.966667], 300 m, 12 Nov. 1999, *Breteler 15454 (WAG.1798523, WAG.1798524); Makande, 0°40.39'S, 11°54.35'E [-0.678333, 11.91], 23 Feb. 1999, Hallé 4598 (WAG.1798520); 5 km ouest de Maranda, 01°47'12"S, 12°34'45"E [-1.786573, 12.579305], 10 Mar. 2022, MBG Transect 7999 (BRLU, LBV); 21 km SE of Lastoursville, 0° 58' S, 13° 5' E, [-0.966667, 13.083333], 440 m, 26 Nov. 1988, *van der Maesen & al. 5879 (WAG.1798531). **Woleu-Ntem:** 6 km SSW of Mitzie FOREENEX, 0°43.8'N, 11°32.1'E [0.730556, 11.535056], 508 m, 06 Nov. 2009, *Bissengou 704 (WAG.1798518); Okano Department, 00°36'03"N, 011°39'19"E [0.6009140, 11.6552300], 354 m, 24 Feb. 2024, MBG Transect 13954 (BRLU, LBV); Chantier Rougier Océan, 0°43'N, 11°6'E [0.716667, 11.1], 22 Sep. 1985, *Reitsma & Reitsma 1535 (WAG.1798528); Oveng, [1.576944, 11.570556], 05 Aug. 2012, Towns 941 (LBV); Ebomane, [2.10.82'N, 12°4.17'E [2.180278, 12.069444], 564 m, 14 Aug. 2012, Towns 1212 (LBV, WAG.1950876, WAG.1950877). GHANA. **Eastern:** Ejuanema Hill, [6.578262, -0.762300], Jan. 1973, Enti 982 (MO-2208383). REPUBLIC OF THE CONGO. **Lekoumou:** Massassa, 2°48' 10"S, 13°38' 20"E [-2.802778, 13.638889], 517 m, 09 Oct. 2009, Nkouka & al. 810 (IEC).

***Croton* sp.**—ANGOLA. **Huila:** Chibia, [-15.176765, 13.649108], 1300–1400 m, 6 Jun. 1937, Exell & Mendonça 2672 (BM001122498). DEMOCRATIC REPUBLIC OF THE CONGO. **Tshopo:** Yangambi, [0.767500, 24.439722] 31 Jan. 1963, Menavanza 150 (BR0000016006614). ETHIOPIA. **Harerge:** 8 km from Wotter on the road to Gara Mulatta, 09°19'N, 41°50'E, [9.3166667, 41.8333333], 1775 m, 5 May 1973, Seegeler 3297 (MO-6586438). GABON. **Ngounié:** Moghoulou, [-1.401389, 11.351111], 06 Sep. 1926, *Le Testu 6070 (BM001122461, K). KENYA. **Kitui:** Mutomo hill, 01°51'S, 38°13'E [-1.850000, 38.216667], 900–1000 m, s.d., Unknown s.n. (WAG.1797880). **Rift Valley:** Namanga Hill Forest Reserve, 02°30'32"S,

APPENDIX 3. Contd.

36°47'14"E [-2.5088800, 36.7872200], 1820 m, 29 Apr. 2000, Kindeketa 355 (MO-5180718, NHT). SOMALIA. **Bari:** 150 km NE of Gardo on road to Iskusiuban, 09°55'N, 50°09'E [9.9167, 50.1500], 610 m, 14 Nov. 1987, Lavranos & al. 24672 (MO-4056188). TANZANIA. **Arusha:** Selela Forest Reserve, 03°13'33"S, 35°55'11"E [-3.2258334, 35.9197223], 1040 m, 15 Apr. 2000, Kindeketa & al. 352 (MO-6566552). **Singida:** WSW of Makiungu jct. Rolling hills on broad plateau, 04°51'20"S, 34°51'20"E [-4.8555556, 34.8555556], 1720 m, 22 Jan. 2000, Kuchar 22753 (MO-6566516); NW of Makiungu jct., 04°48'50"S, 34°53'E [-4.813889, 34.883333], 1690 m, 27 Jan. 2000, Kuchar 22832 (MO-6566515); 5½ km E of village, 04°46'50"S, 35°09'10"E [-4.7805556, 35.1527778], 1610 m, 29 Jan. 2000, Kuchar 22885 (MO-6566514). ZAMBIA: Mulobezi, 16°52'37"S, 25°6'24.3"E [-16.876944, 25.10675], 1020 m, 04 Mar. 1996, Zimba & al. 765 (MO-6561433). ZIMBABWE. **South Matabeleland:** Shashi-Limpopo Junction, [-22.1868, 29.3740], 02 Feb 1973, *White 10094 (MO-4335361).