# The Description of a Charismatic New Palm Species in the Amazon

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**This article profiles a new species, *Mauritiella disticha*, recently described from the Arc of Deforestation in the Brazilian Amazon.**

Palms are common in the Amazon, comprising almost half of the 20 most abundant tree species in the region (ter Steege et al. 2013). Palms are indicators of current and past Amazonian ecosystems, such as flooded forests (*igapó* and *várzea*), non-flooded, clay soil forests (*terra-firme*), white-sand soil ecosystems (*campina*) and estuarine environments (Bernal et al. 2011, Bogotá-Ángel et al. 2021). Curiously, many of the most abundant palm species in the Amazon – such as *Euterpe precatoria*, *E. oleracea*, *Oenocarpus bataua* and *Astrocaryum murumuru* – are used by human populations and their distributions have been associated with pre-Columbian indigenous settlements (ter Steege et al. 2013, Levis et al. 2017). Crucial as sources for food and material, the palm family (Arecaceae) is a proxy for forest conservation and a target of botanical and ecological studies. Palms are diverse and ecologically and socially important in the Amazon, but despite their high abundance, there is still diversity to be discovered. One example is a charismatic palm species we recently described, *Mauritiella disticha* Prata, Oliveira, Cohn-Haft, Emilio and Bacon (Torres Jiménez et al. 2021), a plant with extraordinary ornamental potential.

*Mauritiella disticha* is characterized by its distichous phyllotaxy, where its leaves are arranged in a fan-like shape (Fig. 1), a beautiful pattern not present in any other species of the genus: *M. aculeata*, *M. armata*, *M. macroclada*, and *M. pumila* (for a recent review on *Mauritiella* see Bernal & Galeano 2010). It was this conspicuous characteristic that caught our attention and suggested it was a species new to science. Another important character that defines this species is the size of the scales on

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1. A fruiting individual of *Mauritiella disticha* found on the Transamazonia road in southern Amazon in 2008. Photo by A.V.G. Oliveira.

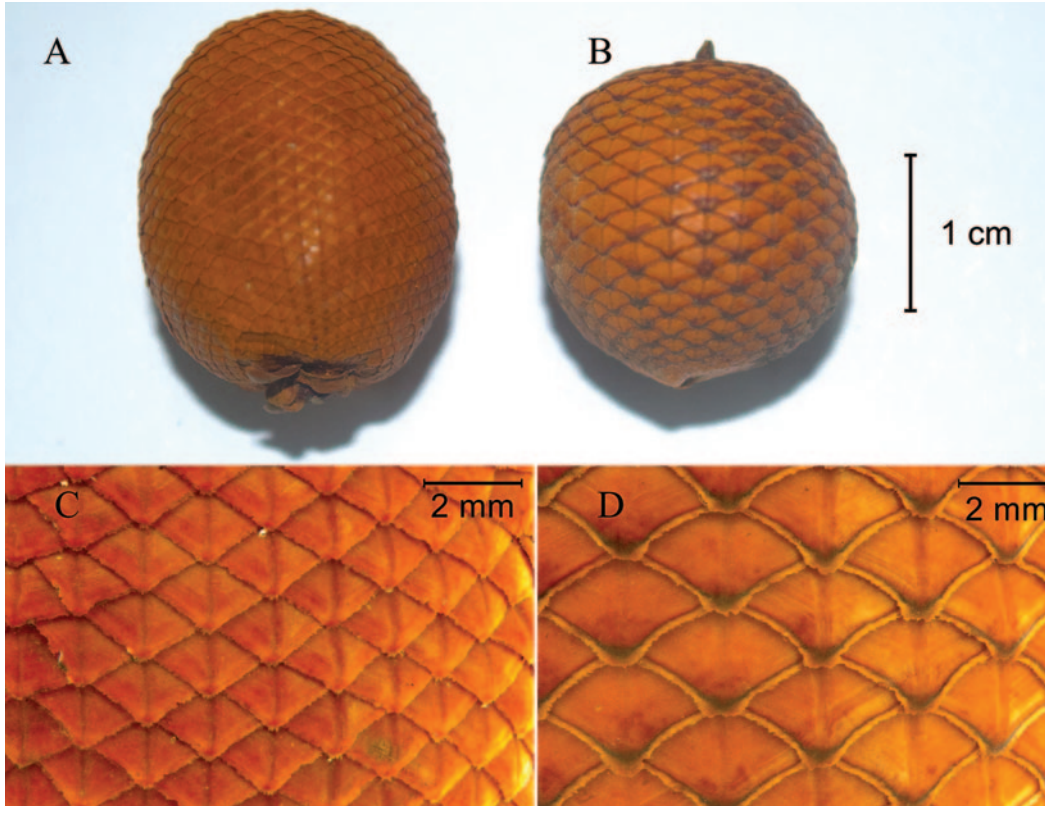
the fruits, which are the smallest in the genus. However, this characteristic was just more recently observed during the species description process (Fig. 2).

Interestingly, the new species co-occurs with *Mauritiella armata*, one of the most widespread species in the genus, which indicates that they are reproductively isolated, thus reinforcing the hypothesis that this is a new species. Ecologically, *M. disticha* is characterized by its narrow distribution strictly associated with white-sand habitats in southern Amazonia. Phylogenetically, *M. disticha* was found to be the early divergent species in the genus, meaning it is sister to a clade (group) including all other species in *Mauritiella*, corroborating our hypothesis of *M. disticha* as an independent lineage. All the evidence, taken together, was considered in the process of species delimitation.

The history of discovering *Mauritiella disticha* is relatively recent. Curiously, the species was first detected independently by different researchers, on the BR-319 road in 2007 and on the Transamazonia road in 2008. The plant was first observed by a local field assistant, Manoel Pereira, who attributed its distichous phyllotaxy to a plant disease. The first male flowering plant was collected and photographed in 2007, but this collection was lost at INPA herbarium before its incorporation. One year later, a fruiting individual of the new species was found hundreds of kilometers southward from its first record. One of the photographic records (Fig. 1) of this plant, taken by A. Oliveira, was published in the book *Flora Brasileira: Arecaceae (Palmeiras)* (Lorenzi et al. 2010), although unfortunately no mention was made of the author of the picture. Until that moment, the species remained impossible to be described after its only voucher was lost.

In 2010, we went on a field expedition of 30 days collecting plants from Porto Velho to Manaus in the BR-319 road, where botanical samples from around 500 species from different families were collected (all of them incorporated into INPA and NY herbarium), including a new collection of *Mauritiella*

2. Images comparing size, shape and color of the scales in fruits of *Mauritiella disticha* (A, C) and *M. armata* (B, D). *Mauritiella disticha* has smaller scales compared to all other species in the genus, which is a diagnostic characteristic of the species. Photos from E. Prata.



3. A male flowering individual of *Mauritiella disticha* on the BR-319 road, from which we collected the voucher INPA 239004 in 2010. Photo by E. Prata.

*disticha*. We collected a male individual bearing inflorescences (Figs. 3 & 4), the voucher of which is currently on loan at the NY herbarium (INPA 239004). One year later (2011), we made new collections in the region along the Transamazonia road of southern Amazonia, including samples from flowering male, female and fruiting plants (Figs. 5 & 6). These were deposited at the INPA herbarium, including the type specimen (INPA 299235).

*Mauritiella disticha* is endemic to white-sand soils ecosystems (WSE) in southern Amazonia (*campinas* and *campinaranas*; Fig. 7). White-sand ecosystems are characterized as vegetation islands varying from open grasslands to low forests, on nutrient-poor, acid-sandy soils, saturated by the outcropping of the water table or well-drained, usually scattered in the landscape in a matrix of terra-firme (clay/silt soil) forests. The flora of the WSE is less species-rich than the surrounding terra-firme forests, but it is remarkably high in endemism (Guevara et al. 2016, Fine & Baraloto 2016, Capurucho et al. 2020). When close to roads, these habitats are usually burned by voluntary or accidental fires, or destroyed by land occupation, including for sand mining for construction materials, when close to towns and cities. All observations of the species were made along roads that crossed intact or degraded patches of those habitats. Unfortunately, the geographic distribution of *M. disticha* occurs in one of the most threatened regions in Amazonia, the "Arc of Deforestation," a huge area along the Transamazonia road (Fearnside & de Alencastro Graça 2006, Andrade et al. 2021). It is important to point out the imminent possibility of reconstruction and paving the BR-319, a 885 km road connecting two Amazonian capitals (Manaus and Porto Velho) constructed in the 1970's that became impassable in 1988. This would significantly increase the illegal occupation and deforestation of the region by land grabbers (*grileiros*), illegal miners (*garimpeiros*) and loggers (Fearnside & de Alencastro Graça 2006, Andrade et al. 2021).

*Mauritiella disticha* was known only from our six collections from four populations across the middle Madeira river basin. Recently, we were contacted by Mr. Pierre-Olivier Albano, who kindly shared with us his interesting record and photos of *Mauritiella disticha*. He and his colleague Jean-Michell Chaillet found a population of *M. disticha* in the Cuieras river, in the lower Negro river (Figs. 8), during an expedition of a group of people from the Association Fous de Palmiers, in 2017 (Front Cover). From a biogeographic and conservation point of view, this record is interesting because it extends the known distribution of the species to the north of the

4. The inflorescences of a male flowering individual of *Mauritiella disticha* on the BR-319 road, from which we collected the voucher INPA 239004 in 2010. Photo by E. Prata.

5. The flowers of a male individual of *M. disticha* on the Transamazonia road in 2011. Photo by E. Prata.

Amazon river. We argue its distribution to be considered rare, as it is a conspicuous plant never formally registered before by botanists, although collections had been made in these regions. Our preliminary Red List assessment suggested its status to be vulnerable (VU; Torres Jiménez et al. 2021).

Even with multiple morphological characters and good vouchers (at NY and INPA herbarium), the species remained undescribed for more than ten years. In part, this illustrates how long the species description process can be, especially in remote regions such as Amazonia, where the combination of high species diversity, large geographic distances, complicated logistics, few resources for science and small number of taxonomists make things more complicated for botanists and for scientists in general. Unfortunately, this is the reality of many other Amazonian countries in Latin America, and this should be seriously considered by progressive regional governments concerned with conservation and sustainable development.

In this context, the process of species description gained momentum with collaboration. We extracted DNA from four *M. disticha* individuals (see Fig. 8) and other 118 individuals from 42 species within Lepidocaryeae (approximately 82% of the tribe). We then sequenced sections (genes) of the genome. Each gene accumulates changes (evolves) independently and contributes to seeing the full picture of how species are related. Identified by Heyduk et al. (2016) and Loiseau et al., (2019), these 146 genes include between 48,965 to 355,729 nucleotides (DNA building blocks). Of around 50,000 nucleotides that we found vary between our samples, we kept 26,337 that vary within *Mauritiella* species and that helped us establish if *M. disticha* individuals are more closely related to each other than to other species in the genus (i.e., if it corresponds to a monophyletic group including a common ancestor and all its descendents).

Our analyses comparing genes and their variant nucleotides consistently grouped all *M. disticha* samples together. These samples are genetically more similar to each other than to other species, supporting the hypothesis that – based on distichous phyllotaxy and other morphological and ecological characters as discussed above – *M. disticha* is a distinct species. *Mauritiella disticha* is closely related (sister to) to a group containing all other *Mauritiella* species. Within the subtribe Mauritiinae, all *Mauritiella* species are more closely related to *Mauritia* than to *Lepidocaryum*. The genetic similarities between species and subtribes mirror the morphological traits shared by them. Based on the morphological descriptions summarized in

6. A flowering individual of *Mauritiella disticha* bearing female inflorescences on the Transamazonia road in 2011. Photo by E. Prata.

Dransfield et al. (2008), *Mauritiella* and *Mauritia* both have catkin-like staminate rachillae and equal width leaf segments but differ in e.g. habit (solitary individuals in *Mauritia* and clustered ones in *Mauritiella*) and spines (lacking in *Mauritia* and present in *Mauritiella*). Moreover, *Mauritiella* shares with *Mauritia* and *Lepidocaryum* its northern South American distribution and its reduplicate, palmate-shaped leaves (Dransfield et al. 2008).

We found, described and named it as a species new to science, *Mauritiella disticha*, combining morphological, ecological and genetic evidence in the process of species delimitation. This work brought important insights such as: How such a culturally and economically important plant group on which local communities depend is still poorly known in Amazonia? How important are national and international collaborations for science,

7. The white-sand soil (*campina*) ecosystem in Southern Amazon with the occurrence of *Mauritiella armata* (in the back), *Mauritia carana* (in the right) and *Mauritiella disticha* (in the center). Photo by E. Prata.

especially under the current scenario of underfunded science in Brazil (and even more in the Amazon) (Escobar 2018, Franzolin et al. 2020)? Species description in Amazonia is not a simple task, given the large geographic dimensions, the accessibility and the lack of taxonomists. Like *M. disticha*, many more species remain undescribed or understudied and at risk of becoming extinct before being discovered. This serves as an urgent call for conservation of Amazonian forests, its species and inhabitants, represented by a palm species only recently discovered but already vulnerable to extinction. Finally, we urge for the assessment of the genetic diversity within *M. disticha* populations and other palm species to inform conservation strategies and prioritize areas of high diversity (both inter- and intra-specific) for protection.

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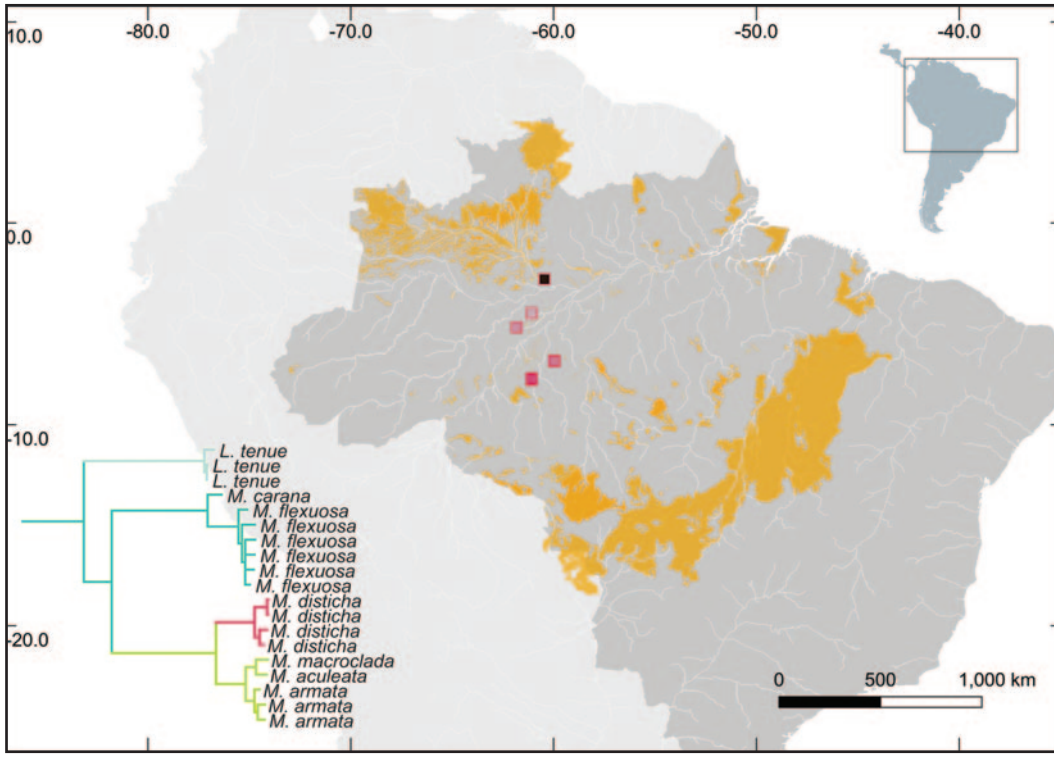


8. Map of the geographic distribution of *Mauritiella disticha* populations (red squares); one individual from each population was used for the genetic analyses (Torres Jiménez et al. 2021), except for the population more recently found by Pierre-Olivier Albano and Jean-Michel Chaillet, represented by the red square filled with black. The orange shades mark the distribution of white sand habitats (where *M. disticha* is found) and other open areas (Adeney et al. 2016; downloaded on November 26th, 2020 from http://www.botanicaamazonica.wiki.br/labotam/doku.php?id=projetos:campinas:mapas:inicio). The phylogenetic tree in the bottom left shows the evolutionary relationships between *M. disticha* (red), other *Mauritiella* species (light green), *Mauritia* species (teal), and *Lepidocaryum* species (light teal), all species within Mauritiinae.

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