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Original Article

Cecropia manauara (Urticaceae), a new species from the Brazilian Amazon

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ABSTRACT

A new species of *Cecropia* (Urticaceae) is described for Amazonas state, Brazil. Collecting and processing of the vouchers followed the usual procedures for botanical specimens. Parallel to the herbarium procedures, phylogenetic analyses were performed and photographs of the species in the field were obtained. The species shares morphological similarities with *Cecropia membranacea* and *C. concolor*, which are discussed in this paper. It appears as a sister group of *C. membranacea* in the phylogenetic analysis in a strongly supported clade. An identification key for all known *Cecropia* species from the Central Amazon is provided. The conservation status of the new species is Vulnerable since it was only collected in Manaus municipality, occurring in the edges and vicinity of secondary "terra firme" forests and anthropized urban areas. The species is the tenth described for the Central Amazon.

Keywords: Cecropieae, Manaus, Neotropical flora, secondary forest, taxonomy.

Introduction

Cecropia Loefl. comprises 61 species restricted to neotropical moist forests in South and Central America, from South Mexico to Northern Argentina (Berg & Rosselli, 2005). The genus is composed of dioecious trees, often with stilt or buttress roots; fistulous leafy twigs, that when cut release a white watery exudate, which turns black when exposed to the air; palmatilobed and peltate leaves born in spirals, stipules fully encircling the stem; cymose inflorescences usually in pairs, with the axillary bud between them, urceolate pistillate perianths, and fruits at maturation consisting of an achene enclosed by enlarged fleshy perianth parts with persistent stigma. Thichilium is also a typical structure, found in most of the species (Berg, 1978b; Berg & Rosselli, 2005).

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Cecropia has been classified into three different families: Cecropiaceae (Berg, 1978a; Cronquist, 1988; Thorne, 1992), Moraceae (Engler, 1889; Romaniuc-Neto, 1999), and more recently Urticaceae (APG III, 2009). The inclusion in this last family results from several phylogenetic studies (Sytsma *et al*., 2002; Datwyler & Weiblen, 2004; Hadiah *et al*., 2008; Wu *et al*., 2013; Treiber *et al*., 2016) indicating that the genera which were traditionally recognized within the ancient family Cecropiaceae (*Cecropia*, *Coussapoa* Aubl., *Musanga* R.Br., *Myrianthus* P. Beauv., and *Pourouma* Aubl.) are better placed in the tribe Cecropieae, within Urticaceae.

Most *Cecropia* are lowland species associated with non-flooded secondary forests, occurring at elevations up to 1000–1300 m a.s.l (above sea level). Some species are described as submontane, occurring at 700–2000 m; some are considered montane, found in cloud forests at 1600–2600 m (Berg & Rosselli, 2005). *Cecropia latiloba* Miq. and *C. membranacea* Trécul, on the other hand, are typical species from wetlands, commonly occurring along white-water river banks ("várzeas") of the Amazon Basin (Wittmann *et al*., 2010). *Cecropia concolor* Willd. is among the typical species of secondary forests, while others, such as *C. distachya* Huber, are found only in primary forest gaps and their edges (Berg, 1978b). *Cecropia* is important for the regeneration in seasonally dry forests in the Southern Brazilian Amazon after fire events, being a dominant species in the initial stages of succession, seven to eight years after fire or fallow (D'Oliveira *et al*., 2011).

In Brazil, nine of the 20 recognized species (Gaglioti & Aguiar, 2024) are found in the Central Amazon (Berg, 1978b; Berg & Rosselli, 2005), where secondary forests can be entirely dominated by *Cecropia* (Mesquita *et al*., 1998). Two of those species, *C. purpurascens* C.C. Berg and *C. ulei* Snethl., are typical of the city of Manaus in the Amazonas state (Berg, 1978b). Here, using morphological and molecular criteria, we formally describe the new species *Cecropia manauara*, from Manaus vicinity, Amazonas state, Brazil. Additionally, we present field ecological data, photographic plates, a phylogenetic tree with closely related species, an identification key for all known *Cecropia* species from the Central Amazon, and the conservation status of the species.

Material and methods

Taxonomic treatment

We studied approximately 5,750 specimens of *Cecropia*, including type materials from AAU, B, BG, BM, BOTU, CAY, COAH, COL, CUVC, EAFM, ESA, F, GUA, HAMAB, HEPH, HRCB, HUAM, HUT, IAC, IBGE, INPA, K, M, MBM, MEDEL, MIN, MIRR, MO, P, PMSP, QCA, R, RB, SP, SPF, SPSF, U, UEC, UFACPZ, UPCB, and VEN, together with voucher samples acquired from multiple field trips in Brazil. The specimens were collected and processed following the usual procedures for botanical specimens (Fidalgo & Bononi, 1989). From this analysis, it was possible to highlight seven vouchers, obtained in the city of Manaus from July 2018 to March 2021, which presented marked differences in relation to the species already known for the Central Amazon. The vouchers were deposited in the herbaria of Instituto Nacional de Pesquisas da Amazônia (INPA) and Instituto de Pesquisas Ambientais (SP) (acronyms according to Thiers, 2024). The description of dried material was complemented by collections from the INPA herbarium.

The photos and descriptions of the species in its habitat were carried out in the field. The main characters used for description and comparison with other species were: the number of leaf segments and type of apex of these segments, type of venation, presence and type of indumentum on leaves and petioles, color and type of indumentum of the terminal stipule, color and type of indumentum of the spathe, position and number of spikes of pistillate and staminate inflorescences, in addition to flowers, whose analysis was carried out with the aid of an electronic magnifier. All these structures are highlighted by Berg and Rosselli (2005) for the description of *Cecropia* species.

The preliminary conservation status of the new species was obtained based on the IUCN (2024) criteria, using Extent of Occurrence (EOO) and Area of Occupancy (AOO), which were calculated using GeoCAT software (Bachman *et al*., 2011), in addition to other information, such as occurrence in protected areas and threats.

Taxon Sampling, DNA extraction, sequencing, and editing

We included 43 accessions regarding 14 taxa, comprising all sympatric species and other associated taxa. Accessions from six of the seven samples considered to belong to the new species were used. *Pourouma guianensis* Aubl. was selected as an outgroup. The taxa sampled, voucher information and GenBank accession numbers can be found in the Supplementary File.

To obtain sequences we collected leaf samples in the field or from herbarium vouchers. Genomic DNA was extracted from 50 mg of dried leaf tissue using a modified CTAB method proposed by Sharma *et al*. (2008). DNA amplification by polymerase chain reaction (PCR) of the trnL-F region was amplified using the primers "c" and "f" (Taberlet *et al*., 1991). The ITS region was amplified using the primers ITS 5 and ITS 4 (White *et al*., 1990). The nrFA16180b region was amplified using the primers FA16180b and FA16180b (Yao *et al*., 2013).

The amplification reaction mixture contained 20µl of approximately 20 ng of genomic DNA, 1X PCR buffer, 3 mM $MgCl_2$, 10 µM each primer, 0.2 mM each dNTP, and 1 U of Taq DNA polymerase (Invitrogen S.A.). The reaction was adjusted with ultrapure water. Thermo cycling for *trn*L-F was performed using an initial denaturation step at 94°C for 4 min, followed by 35 cycles of 94°C for 1 min, 55°C for

1 min, and 72°C for 1 min; and a final extension step at 72°C for 10 min; for ITS 4-5, the thermal cycling was performed at 94°C for 2 min for initial denaturation, followed by 30 cycles of 95°C for 30 s, 50°C for 1 min, 72°C for 1 min and a final extension step at 72°C for 7 min. The *nrFA*16180b region was amplified using an initial denaturation step at 94°C for 5 min, followed by 35 cycles of 94°C for 50 s, 55°C for 50 s, and 72°C for 1 min, and a final extension step at 72°C for 10 min. The amplified fragment was cleaned with a GenEluteTM PCR Clean-Up kit (Sigma-Aldrich, Missouri, USA). The concentration and quality of the clean PCR products were checked on a 0.8% agarose gel using standard concentrations of λ phage DNA (50 and 100 ng).

Sequencing reactions were performed using the clean PCR products and BigDye Terminator sequencing reagents and instructions according to the manufacturer (Applied Biosystems, Foster City, California, USA). The sequence data were performed on an ABI 3730 automated sequencer (Applied Biosystems).

Sequence Alignment and Phylogenetic analyses

DNA sequences were assembled using Geneious® v.11.1.5 (Kearse *et al*., 2012). Multiple sequence alignment was performed using ClustalW 2.0. (Larkin *et al*., 2007). Preliminary phylogenetic analyses were conducted with each molecular marker (*trn*L-F, ITS 4-5, and *nrFA*16180b) to observe the formation of robust and congruent phylogenetic clades. Phylogenetic analyses were performed for each molecular matrix and combined them using parsimony (MP), maximum likelihood (ML), and Bayesian inference (BI). MP and ML analysis were performed with PAUP* v.4.a168 using *Pourouma guianensis* as an outgroup. Heuristic searches were performed with tree-bisection-reconnection (TBR) branch-swapping algorithm with "steepest descent" and "multrees" options off, with 10,000 replicates random-taxon addition replicates, and 10 trees held in each replicate. In MP, strict consensus was applied and in ML, the tree with the best likelihood score was selected. The most appropriate model of sequence evolution for each matrix was selected using the Akaike information criterion in jModelTest2 (Posada & Buckley, 2004; Darriba *et al*., 2012). We analyzed the chloroplast marker trnL-F and the nuclear markers ITS 4-5 and FA16180b, either separated or combined.

Clade support for both the MP and ML phylogenies was assessed with a bootstrap analysis (maximum parsimony bootstrap [PB] and maximum likelihood bootstrap [LB]) using 10,000 pseudoreplicates with 100 random additional sequence replicates and tree-bisection-reconnection (TBR) branch swapping as implemented in PAUP v.4.a168 (Swofford, 2002). We considered the branching support as follows (Erixon *et al*., 2003): high (PB / LB / PP ≥ 95% / 95% / 0.95), moderate (PB / LB / PP 90–80% / 90–80% / 0.9–0.8) or low (PB / LB / PP < 80% / 80% / 0.80), in which PP is the Bayesian posterior probability.

The BI was performed by MrBayes v.3.1.2 (Ronquist & Huelsenbeck, 2003) with four simultaneous Markov chain Monte Carlo simulations (each with 10 MB) and sampled every 1,000 generations for a total of 40 MB generations. Convergence, effective sample size (ESS), and the choice of appropriate 'burn-in' were evaluated in TRACER 1.6.0 (Rambaut *et al*., 2018). All ESS values were above 200 after burn-in (25%).

Results

Phylogenetic analyses

The number of accessions, number of characters and their variation, number of parsimony informative characters, length and number of MP trees, consistency and retention index, and evolutionary model selected are summarized in Table 1.

In all phylogenetic analyses, *Cecropia* is supported as a monophyletic group (PB = 100%, LB = 100%, and Bayesian posterior probability [PP] = 1.00) (however, see Treiber *et*

Table 1. Number of accessions sequenced for each marker and plastid (pt) + nuclear (nr) markers, character statistics, tree statistics for the maximum parsimony (MP) analyses, and model selected (AIC).

Parameters	Markers			Combined	
	trnL e-f	ITS 4-5	FA16180b	Nuclear	All combined
Number of accessions (ingroup/outgroup)	43 (42/1)	43 (42/1)	43 (42/1)	43 (42/1)	43 (42/1)
Number of characters (bp)	426	742	414	1156	1582
Variable characters (%)	39 (9.16)	167 (22.51)	21 (5.08)	188 (16.26)	227 (14.35)
Constants characters	387 (90.84)	575 (77.49)	393 (94.92)	968 (83.74)	1355 (85.65)
Number of parsimony informative characters (%)	35 (8.22)	159 (21.43)	19 (4.59)	178 (15.40)	411 (12.45)
Number of MP trees	797	1502	613	2115	2912
MP tree length	872	1638	717	2355	3227
Consistency index (CI)	0.5627	0.5122	0.4860	0.5333	0.5516
Retention index (RI)	0.7740	0.8234	0.7663	0.8006	0.8255
Model selected (AIC)	GTR+G	GTR+G	GTR+I+G		

al. (2016) for the discussion of *Cecropia* sensu lato). *Cecropia manauara* emerged as sister group of *C. membranacea* with high support (PB = 90%, LB = 91%, and PP = 0.95). These two species emerged as sister group of *C. distachya* and *C. latiloba* with high support (PB = 92%, LB = 92%, and PP = 0.98). Our phylogenetic data also show high support for the six *C. manauara* samples used in the analysis (PB = 100%, LB = 100%, and PP = 1.00) (Fig. 1).

The ILD test did not indicate incongruences between datasets (p = 0.065). The MP strict consensus and ML trees generated by combined data are identical in topology to the Bayesian 50% majority rule consensus phylogenetic tree. The BI topology for the combined molecular data (ITS 4-5, trnL-F, and FA16180b) is highly supported in most of the clades (Fig. 1).

Conservation status

Based on the GeoCAT software (Bachman *et al.*, 2011), *C. manauara* has an estimated Extent of Occurrence (EOO) of 47 km^2, an Area of Occupancy (AOO) of 28 km^2, and only seven nearby collection points (B2a) (Fig. 2). Although the species can benefit from secondary forest fragments, it was not found in high densities at any of the sites where it was collected. Recently, the disorderly urban growth of the city of Manaus has been destroying several forest remnants in urban and peri-urban areas where this species can occur. As a consequence, the trees of *C. manauara* were predominantly found in small and isolated fragments, suggesting the continued decline of its habitat, which has certainly impacted its population (A1c + B2bi, ii, iii). So, based on the IUCN (2024) criteria, the species is suggested to be classified as Vulnerable.

Discussion

As seen in the phylogenetic tree, *C. manauara* is a sister group of *C. membranacea*, corroborating the fact that the last species is the most morphologically similar to the new one, which is why *C. manauara* had been called "*Cecropia* aff. *membranacea*" in a previous scientific note published by Aguiar *et al*. (2024). The lamina shape of some specimens of *C. manauara*, especially of juvenile plants, can be confused with *C. membranacea*. The presence of setose trichomes on leafy twigs and petioles of most individuals and the secondary veins submarginally loop-connected are also characters that allude to that species. *Cecropia manauara* is distinguished from *C. membranacea* by the arachnoid indumentum on the petiole and by the stipules, which are never subglabrous like in *C. membranacea*. *Cecropia manauara*'s primary branches do not present the typical "V"-shaped dichotomization, which can be seen in *C. membranacea*, and the former species is never found at floodable sites (Tab. 2). Although C. *distachya* and *C. latiloba* emerged as a sister group of *C. manauara* and *C. membranacea*, no important morphological similarity can be highlighted between the two groups.

On the other hand, even though relatively distant from a phylogenetic viewpoint, medium trees of the new species can also be confused with *C. concolor* due to the lamina shape of some individuals and the arachnoid indumentum on the petiole. It is distinguished by the stipule, which is hirtellous to setulose in *C. manauara* and puberulous to sericeous in *C. concolor*. In addition, *C. concolor*'s secondary veins are marginally loop-connected (*vs*. submarginally in *C. manauara*) and the leafy twigs are never setose (Tab. 2).

An important difference regarding the two most similar species concerns the perianth length of the staminate flower. The structure of *C. manauara* is much smaller (0.2–0.4 mm long) than *C. membranacea*'s (0.8 mm) and *C. concolor*'s (0.8–1.5 mm) (Tab. 2).

The similarity with very well-known *Cecropia* species from Central Amazon (see the key below), the occurrence in low density, the fact that it is found predominantly in areas undergoing accelerated urban expansion, and the general difficulty to herborizing and obtaining *Cecropia* vouchers (due, respectively, to the large dimensions of leaves and petioles and the presence of aggressive ants) may have contributed to *C. manauara* remaining unknown until now. Another aspect to be considered is that the limited road access in the region may have contributed to the fact that *C. manauara* was not recorded in other locations. However, we believe that an increase in sampling effort could potentially reveal the presence of this species in other areas with similar habitat characteristics.

Although only two of the *C. manauara* collections were in protected areas (Área de Proteção Ambiental (APA) Floresta Manaós and APA Tarumã-Ponta Negra), other protected areas such as Parque Estadual Sumaúma, Parque Municipal do Mindu, and Reserva Florestal Adolpho Ducke may be important strongholds for the species in face of the urban growth and can ensure the protection of the species. The discovery of this new species, suggested here to be vulnerable, which occurs in areas heavily subject to anthropic disturbances, is a warning not only due to the need to preserve this species but also to the importance of conserving biodiversity in urban and peri-urban sites that occur outside of protected areas.

Taxonomic treatment

Cecropia manauara D. Aguiar, Demarchi & Gaglioti, sp. nov. (Figs. 3-4 Tab. 2)

Type: BRAZIL – **Amazonas • Manaus**, Tarumã, INFRAERO Operational Area; 3º1'44,13'' S, 60º2'57,77'' W; 86 m; 2 Jun. 2018; *Demarchi 1212*; holotype: INPA [INPA280583]; isotype: SP [SP499173].

Diagnosis: *Cecropia manauara* can be differentiated from *C. membranacea* by the arachnoid indumentum on the petiole (absent in *C. membranacea*), and from *C. concolor* by the

Figure 1. Bayesian 50% majority rule consensus phylogenetic tree for *Cecropia* based on combined molecular data (ITS 4-5, trnL-F and FA16180b). The numbers above the branches indicate support (maximum parsimony bootstrap, maximum likelihood bootstrap, and Bayesian posterior probability). The initials of the collector's name and number are next to each species' name.

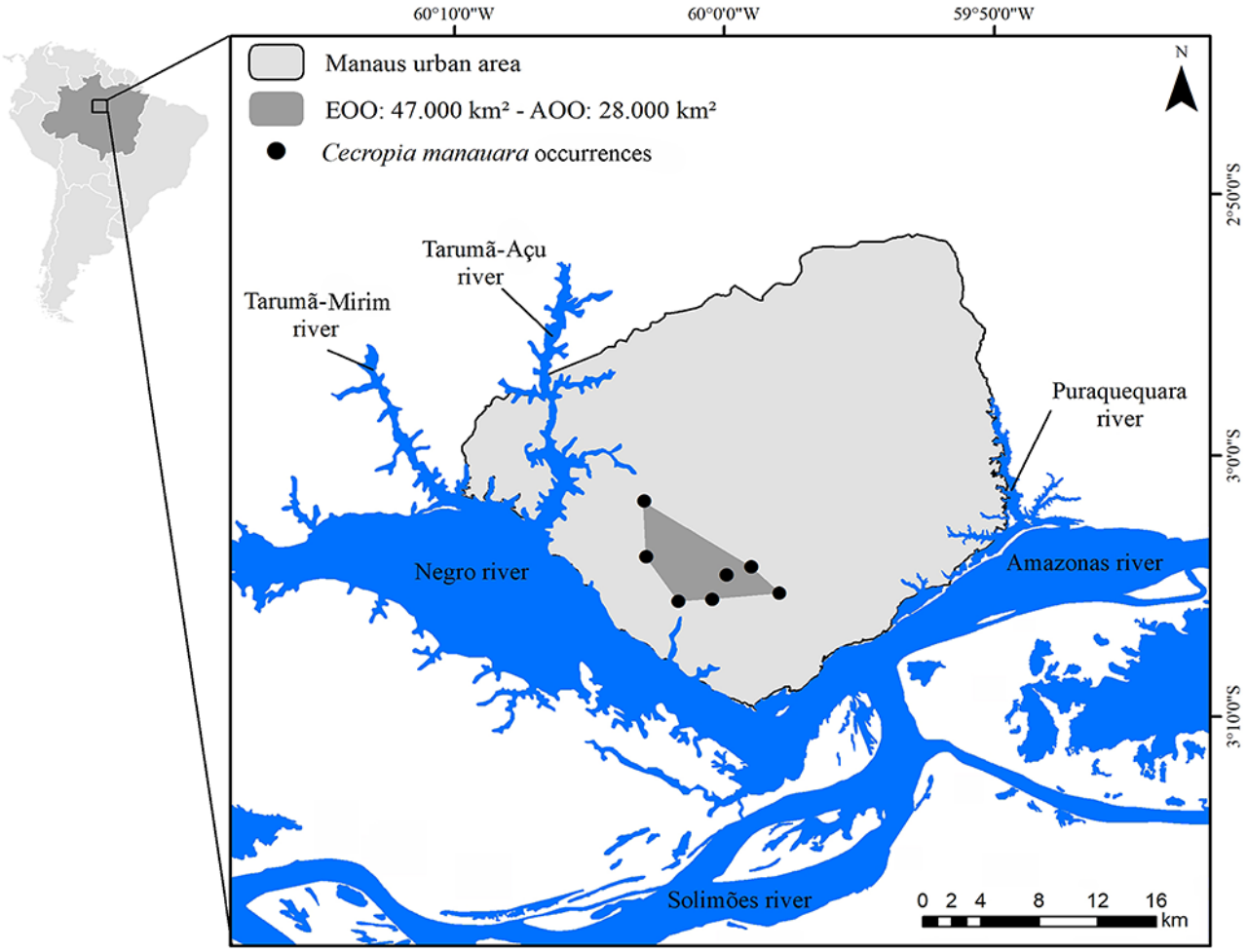

Figure 2. Geographic distribution of *Cecropia manauara* samples in the Brazilian Amazon (EOO: Extent of Occurrence; AOO: Area of Occupancy; source: GeoCAT). The inset map shows the sampling location in northern Brazil. Map created using ArcMap 10.6 (https://www.arcgis.com). © Esri and its licensors, all rights reserved.

Table 2. Main characters distinguishing *Cecropia manauara* from *C. membranacea* and *C. concolor*.

	C. manauara	*C. membranacea*	*C. concolor*
Stipule	hirtellous to setulose	(sub)glabrous	puberulous to sericeous
Secondary veins	submarginally loop-conected	submarginally loop-conected	marginally loop-conected
Petiole	sericeous to (sub)hispidulous to setose	glabrous to setose	sparsely puberulous to densely sericeous
Perianth of staminate flower	0.2–0.4 mm long	0.8 mm long	0.8–1.5 mm long
Anthers	appendiculate	not appendiculate	appendiculate
Habitat	non-inundated places	mainly inundated places	non-inundated places

hirtellous to setulose stipule (*vs.* puberulous to sericeous in *C. concolor*) and by the secondary veins submarginally loop-connected (*vs*. marginally in *C. concolor*). In addition, it can be differentiated by the length of the perianth of the staminate flower (0.2–0.4 mm in *C. manauara vs.* 0.8 mm in *C. membranacea* and 0.8–1.5 mm in *C. concolor*).

Description: Tree, 10–20 m tall. Leafy twigs 2–4 cm thick, green, hispidulous to setose. Lamina (sub)coriaceous, 35–55 × 35–55 cm, the segments 8–9, the free parts of the upper segments (sub)obovate to elliptic to oblong, the incisions down to 4.3–9.5 cm from the petiole; apices acuminate; upper surface smooth, sparsely hispidulous

Figure 3. Holotype of *Cecropia manauara*. Photograph by Layon Demarchi.

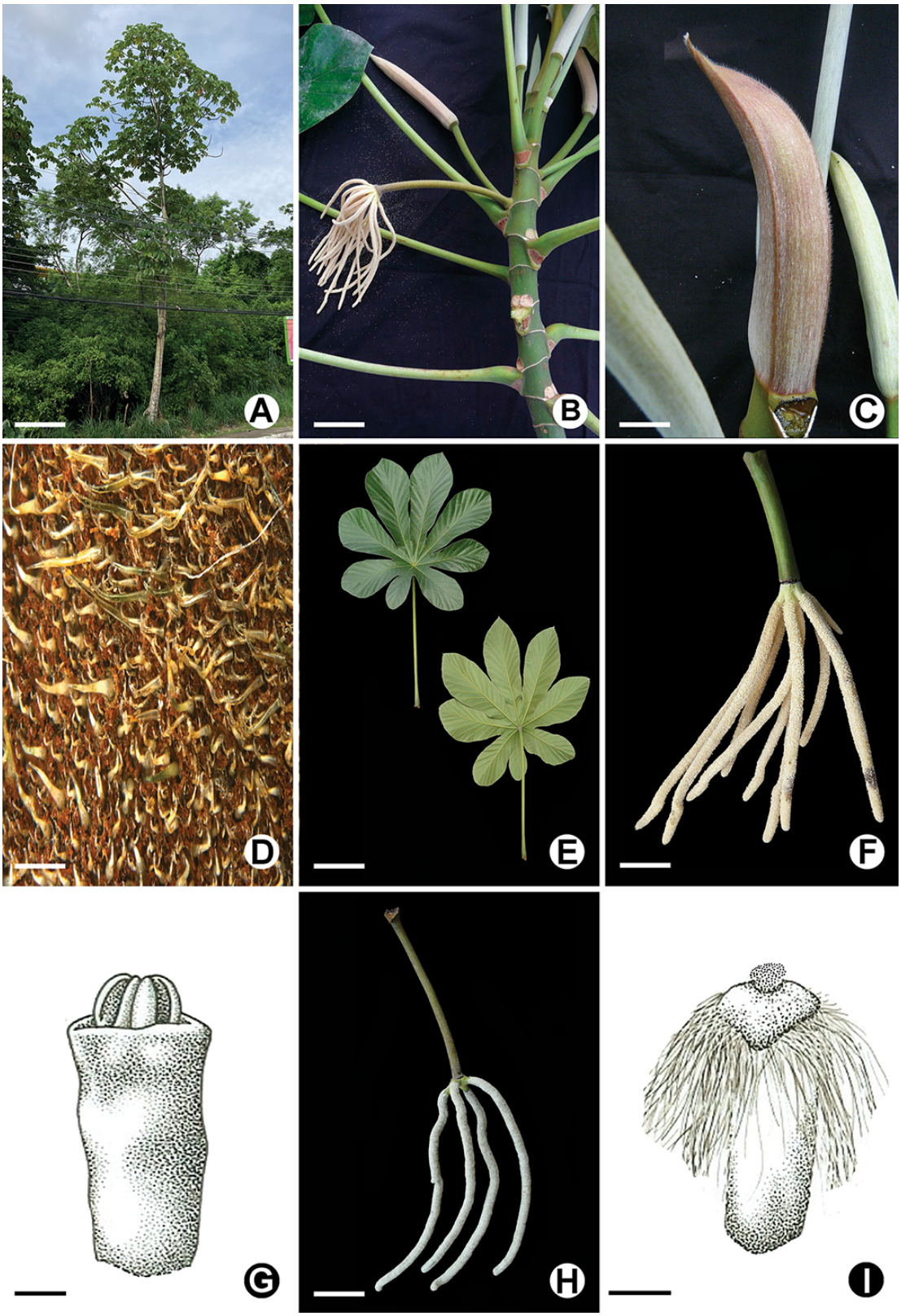

Figure 4. Morphological characteristics of *Cecropia manauara*. **A**. Adult tree. **B**. Detail for a leafy twig of a staminate individual. **C**. Detail for stipule and spathe. **D**. Leaf twig trichomes. **E**. Upper and lower lamina surface. **F**. Staminate inflorescence. **G**. Staminate flower. **H**. Pistillate inflorescence **I**. Pistillate flower. Scale: **A**. 2.5 m; **B**. 7.5 cm; **C**. 2 cm; **D**. 1 mm; **E**. 10 cm; **F**. 2 cm; **G**. 0.05 mm; **H**. 5 cm; **I**. 0.15 mm. A and B from *Demarchi 1763*; C and H from *Demarchi 1212*; D from *Demarchi 1229*; E and F from *Demarchi 1387*. Photographs were taken at the type locality from 2018 to 2021 by Daniel Aguiar (A, B, C, E, F, H), and in the laboratory by Layon Demarchi (D); illustrations by André Gaglioti (G, I).

to sparsely setulose and with sparse to dense arachnoid indumentum; lower surface puberulous to (sub)hispidulous on the areoles, sometimes with sparse to dense arachnoid indumentum and sparse longer uncinate hairs; puberulous to hispidulous and sometimes subsetulose and/or with arachnoid indumentum on the main veins; lateral veins in the free part of the midsegment 12–16 pairs, submarginally loop-connected, several of them branched; petiole 27–56 cm long, sericeous to (sub)hispidulous, sparse to dense arachnoid indumentum, sometimes setose at the base; trichilia fused, the brown indumentum intermixed with short and/or rather long whitish hairs; stipules 9–14.5 cm long, grayish, orange or reddish, hirtellous to setulose indument, sometimes sparsely sericeous outside, glabrous inside. Staminate inflorescences in pairs, the peduncle erect to deflexed and the spikes pendulous; peduncle 5.4–14 cm long, sericeous to hispidulous, sometimes also setulose; spathe 8–18 cm long, whitish to pale yellowish, indument due sericeous to hirtellous outside, glabrous inside; spikes 7–25, 8–17.5 × 0.4–0.8 cm, with stipes 0.5–1.1 cm long, with indumentum whitish, hirtellous and strigose; rachis hairy. Staminate flowers: perianth tubular, 0.2–0.4 mm long, indumentum whitish, strigulose in the apex and hirsute below the margin, the apex plane to slightly convex, muriculate, the aperture often surrounded by a rim; filaments slightly swollen; anthers 0.2–0.4 mm long, appendiculate, detached at anthesis, reattached to the margins of the aperture by the appendages. Pistillate inflorescences in pairs, the peduncle deflexed to pendulous and the spikes pendulous; peduncle 9.3–16.8 cm long, sericeous to hispidulous, sometimes also setulose; spathe 11.7–15 cm long, the color and indumentum as in the staminate inflorescence; spikes 4, 9.8–10.9 × 0.6–0.7 cm, to 19.4–23.2 in flower × 0.6–1.0 cm in fruit, with stipes 0.4–0.7 cm long, with indumentum hirtellous and strigose, whitish; rachis hairy. Pistillate flowers: perianth tubular, 0.5–1 mm long, with arachnoid indumentum below the apex outside and below the style channel inside, the apex convex, minutely muriculate; style rather long, straight; stigma comose. Fruit oblongoid to ellipsoid, 1–1.5 mm long, muriculate.

Distribution: Central Amazon, only known from the city of Manaus, Amazonas state, Brazil (Fig. 2).

Habitat and ecology: Occurs in low density in the edges and vicinity of secondary "terra firme" forests and altered areas in the urban zone, at an elevation of 35 to 90 m a.s.l.

Vernacular name: It is known as 'imbaúba' in the city of Manaus.

Etymology: The epithet refers to a popular adjective used for people and things which are native to Manaus.

Phenology: *Cecropia manauara* was observed with flowers in June and July and from October to December and with fruits in June and July.

Additional material examined: BRAZIL – **Amazonas** • Manaus, Parque 10 de Novembro neighborhood, Arthur Reis housing complex; 3º4'34,5'' S, 59º59'53,91'' W; 39 m; 15 Jun. 2018; fl. ♀; *Demarchi 1229*; INPA [INPA280591], SP [SP499145] • Manaus, UFAM campus, next to the Technology College's parking lot; 3º5'15,59'' S, 59º57'56,82'' W; 78 m; 26 Oct. 2018; fl. ♂; *Demarchi 1387*; INPA [INPA282379], SP [SP525812] • Manaus, Aleixo neighborhood, Colônia Japonesa, next to Waldemar Maués street; 3°39'55'' S, 59°58'78'' W; 45 m; 21 Dez. 2019; fl. ♂; *Demarchi 1638*; INPA [INPA289921], SP [SP525791] • Manaus, Chapada neighborhood, Theomario Pinto avenue, next to the viaduct; 3°5'34'' S, 60°1'42'' W; 26 m; 25 Sep. 2021; fl. ♂; *Demarchi 1763*; INPA [INPA289965], SP [SP525800] • Manaus, Planalto neighborhood, Campos Elíseos housing complex, Estocolmo street; 3°3'52,33'' S, 60°2' 52,63'' W; 81 m; 25 Sep. 2021; fl. ♂; *Demarchi 1767*; INPA [INPA289969], SP [SP525802] • Manaus, Adrianópolis neighborhood, Parque Adrianópolis housing complex; 3º5'29,5'' S, 60º0'25,47'' W; 35 m; 18 Jul. 2019; fl. ♀, fr.; *Aguiar 4*; INPA [INPA 289900].

Key to *Cecropia* species from Central Amazon

1. Trichilia absent ..... ***C. sciadophylla***

1'. Trichilia present **2**

2. Lamina with 12-15 segments ..... ***C. ulei***

2'. Lamina with up to 10(-12) segments **3**

3. Lamina incised down to the petiole or to 1.5(-2.5) cm from the petiole ..... ***C. concolor***

3'. Lamina incised down to at most 4 cm from the petiole **4**

4. Lateral veins of the free part of the midsegment marginally loop-connected **5**

4'. Lateral veins of the free part of the midsegment submarginally loop-connected **7**

5. Lamina attached to the petiole at ca. 1/4 of the total length from its base; mostly found at flooded places ... ***C. latiloba***

5'. Lamina attached to the petiole clearly > 1/4 of its total length from its base; found at non-flooded places **6**

6. Inflorescences erect (at least at anthesis); spathes red ..... ***C. distachya***

6'. Inflorescences pendulous at anthesis; spathes white ..... ***C. palmata***

7. Leaf apices obtuse ..... ***C. purpurascens***

7'. Leaf apices acuminate **8**

8. Lamina chartaceous ..... ***C. ficifolia***

8'. Lamina subcoriaceous to coriaceous **9**

9. Petiole with arachnoid indumentum ..... ***C. manauara***

9'. Petiole without arachnoid indumentum ..... ***C. membranacea***

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Authors' Contribution

DPPA: Conceptualization, Methodology, Investigation, Writing – original draft; LOD: Methodology, Investigation, Writing – original draft; MTFP: Formal Analysis, Funding acquisition, Supervision, Writing – review & editing; RGC: Formal Analysis, Methodology, Writing – review & editing; PRS: Formal Analysis, Methodology, Writing – review & editing; HBZS: Formal Analysis, Methodology, Writing – review & editing; ALG: Conceptualization, Data curation, Methodology, Investigation, Software, Validation, Writing – original draft

Conflicts of Interest

The authors declare no conflict of interest.

References

Aguiar DPP, Somavilla A, Fernandes IO, Demarchi LO. 2024. Social wasps (Vespidae: Polistinae) harvesting food bodies of *Cecropia* Loefl. (Urticaceae) in Central Amazon. Entomological Communications 6: ec06002.

APG III. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. Botanical Journal of the Linnean Society 161: 105-121.

Bachman S, Moat J, Hill AW, Torre J, Scott B. 2011. Supporting Red List threat assessments with GeoCAT: Geospatial conservation assessment tool. ZooKeys 150: 117-126.

Berg CC. 1978a. Cecropiaceae, a new family of the Urticales. Journal of the International Association of Plant Taxonomy 27: 39-44.

Berg CC. 1978b. Espécies de *Cecropia* da Amazônia Brasileira. Acta Amazonica 8: 149-182.

Berg CC, Rosselli PF. 2005. *Cecropia*. Flora Neotropica. Monograph 94. New York, The New York Botanical Garden.

Cronquist A. 1988. The evolution and classification of flowering plants. 2nd ed. New York, The New York Botanical Garden.

Darriba D, Taboada GL, Doallo R, Posada D. 2012. jModelTest 2: More models, new heuristics and parallel computing. Nature Methods 9: 772.

Datwyler SL, Weiblen GD. 2004. On the origin of the fig: Phylogenetic relationships of Moraceae from ndhF sequences. American Journal of Botany 91: 767-777.

D'Oliveira MVN, Alvarado EC, Santos JC, Carvalho Jr JA. 2011. Forest natural regeneration and biomass production after slash and burn in a seasonally dry forest in the Southern Brazilian Amazon. Forest Ecology and Management 261: 1490-1498.

Engler HGA. 1889. Ulmaceae, Moraceae, Urticaceae. In: Engler HGA, Prantl KAE. (eds.). Die Natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten, insbesondere den Nutzflanzen, unter Mitwirkung zahlreicher hervorragender Fachgelehrten begründet. Leipzig, Verling von Wilhelm Engelmann. vol. III, p. 59-118.

Erixon P, Svennblad B, Britton T, Oxelman B. 2003. Reliability of Bayesian Posterior Probabilities and Bootstrap Frequencies in Phylogenetics. Systematic Biology 52: 665-673.

Fidalgo O, Bononi VLR. 1989. Técnica de coleta, preservação e herborização de material botânico. São Paulo, Instituto de Botânica.

Gaglioti AL, Aguiar DPP. *Cecropia in* Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB15038. 30 Jul. 2024.

Hadiah JT, Conn BJ, Quinn CJ. 2008. Infra-familial phylogeny of Urticaceae, using chloroplast sequence data. Australian Systematic Botany 21: 375-385.

IUCN. 2024. Guidelines for using the IUCN Red List Categories and Criteria. Version 16. Prepared by the Standards and Petitions Committee. https://www.iucnredlist.org/documents/RedListGuidelines.pdf. 19 Jul. 2024.

Kearse M, Moir R, Wilson A *et al*. 2012. Geneious Basic: An integrated and extendable desktop software platform for the organization and analysis of sequence data. Bioinformatics 28: 1647-1649.

Larkin MA, Blackshields G, Brown NP *et al*. 2007. Clustal W and Clustal X version 2.0. Bioinformatics 23: 2947-2948.

Mesquita RCG, Workman SW, Neely CL. 1998. Slow litter decomposition in a *Cecropia*-dominated secondary forest of central Amazonia. Soil Biology and Biochemistry 30: 167-175.

Posada D, Buckley TR. 2004. Model Selection and Model Averaging in Phylogenetics: Advantages of Akaike Information Criterion and Bayesian Approaches Over Likelihood Ratio Tests. Systematic Biology 53: 793-808.

Rambaut A, Suchard MA, Xie W, Drummond AJ. 2018. Tracer version 1.7.1. https://tree.bio.ed.ac.uk/software/tracer/. 20 Jul. 2024.

Romaniuc-Neto S. 1999. Cecropioideae (C.C.Berg) Romaniuc Neto stat. nov. (Moraceae-Urticales). Albertoa 4: 13-16.

Ronquist F, Huelsenbeck JP. 2003. MrBayes 3: Bayesian phylogenetic inference under mixed models. Bioinformatics 19: 1572-1574.

Sharma K, Mishra AK, Misra RS. 2008. A simple and efficient method for extraction of genomic DNA from tropical tuber crops. African Journal of Biotechnology 7: 1018-1022.

Swofford DL. 2002. PAUP*: Phylogenetic analysis using parsimony (*and other methods), version 4.0b10. Sunderland, Sinauer Associates, Inc.

Sytsma KJ, Morawetz J, Pires JC *et al*. 2002. Urticalean rosids: Circumscription, rosid ancestry, and phylogenetics based on rbcL, *trn*L-F, and ndhF sequences. American Journal of Botany 89: 1531-1546.

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.

Thiers B. 2024. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. https://sweetgum.nybg.org/science/ih/. 21 Jul. 2024.

Thorne RF. 1992. Classification and geography of the flowering plants. Botanical Review 58: 225-348.

Treiber EL, Gaglioti AL, Romaniuc-Neto S, Madriñan S, Weiblen GD. 2016. Phylogeny of the Cecropieae (Urticaceae) and the Evolution of an Ant-Plant Mutualism. Systematic Botany 41: 56-66.

White TJ, Bruns T, Lee S, Taylor J. 1990. Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In: Innis MA, Gelfand DH, Sninsky JJ, White TJ (eds.). PCR protocols: A guide to methods and applications. San Diego, Academic Press. p. 315-322.

Wittmann F, Schöngart J, Brito JM *et al*. 2010. Manual de árvores de várzea da Amazônia Central-Taxonomia, ecologia e uso. Manaus, Editora INPA.

Wu ZY, Monro AK, Milne RI *et al*. 2013. Molecular phylogeny of the nettle family (Urticaceae) inferred from multiple loci of three genomes and extensive generic sampling. Molecular Phylogenetics and Evolution 69: 814-827.

Yao X, Li C, Dick, CW. 2013. Exon-primed intron-crossing (EPIC) markers for evolutionary studies of *Ficus* and other taxa in the fig family (Moraceae). Applications in Plant Sciences 1: 1-4.

Supplementary Material

The following online material is available for this article:

Supplementary File. Taxon, country, collector, collection number (Herbarium acronym). GenBank accession numbers are described in the order: ITS 4-5, trnL-F, and FA16180b. Sequences newly generated for this study are marked with an asterisk.