

# A checklist of Lecythidaceae in the upper Madeira River, Rondônia, Brazil with comments on diversity and conservation

FERNANDA SILVEIRA CATENACCI<sup>1</sup> AND MARCELO FRAGOMENI SIMON<sup>2</sup>

<sup>1</sup> Programa de Pós-Graduação em Botânica, Departamento de Botânica, Instituto de Ciências Biológicas, Campus Universitário Darcy Ribeiro, Universidade de Brasília, Caixa Postal 4457, Brasília-DF, CEP: 70919-970, Brazil; e-mail: fer\_catenacci@hotmail.com

<sup>2</sup> Embrapa Recursos Genéticos e Biotecnologia, Parque Estação Biológica (PqEB), Av. W5 Norte (final), Asa Norte, Caixa Postal 2372, Brasília-DF, CEP: 70770-917, Brazil; e-mail: marcelo.simon@embrapa.br

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**Abstract.** The Lecythidaceae or Brazil Nut family are ubiquitous in non-flooded lowland forests of the Amazon, where they are indicative of well-preserved or little-disturbed habitats. A recent checklist of the Brazilian flora reported 10 genera and 119 species for that country, of which 104 are found in the Amazon region. However, the botanical knowledge in many regions of the country remains far from complete. This study aimed to analyze the diversity of Lecythidaceae in the upper Madeira River region in Rondônia, an area where botanical data is scarce. Lecythidaceae collections deposited in the CEN, INPA and RON herbaria were examined, and four field expeditions in the study area were carried out. For that region, we recorded 37 species of Lecythidaceae belonging to 7 genera: *Eschweilera* (21 species), *Couratari* (6), *Cariniana* (3), *Gustavia* (3), *Allantoma* (2), *Bertholletia* (1) and *Lecythis* (1). Among these species, five are listed as threatened in the IUCN Red List. The total number of species found in the upper Madeira River of Rondônia alone is higher than the 28 species reported to date for the entire state of Rondônia in the Brazilian Flora Checklist (Smith et al., 2015), and adds 13 new records of Lecythidaceae for the state. Considering that this study is restricted to the northern part of the state, our results suggest that the number of Lecythidaceae species in Rondônia is severely underestimated. Our findings highlight the need for more intensive floristic studies in the Amazon region, which should target areas that are botanically unexplored but have high biodiversity potential. Such studies will provide valuable information to support both taxonomic studies and species conservation assessments.

**Keywords:** Amazonia, conservation, field survey, flora, herbarium, Neotropics, new records.

**Resumo.** As Lecythidaceae, família da castanha-do-brasil, são ubíquas em florestas de terras baixas não inundáveis da Amazônia, onde são indicadoras de ambientes bem preservados ou pouco perturbados. Uma lista recente das espécies da flora do Brasil registrou 10 gêneros e 119 espécies para o país, das quais 104 são encontradas na região Amazônica. Porém, o conhecimento botânico em várias regiões do país permanece incompleto. Esse estudo tem como objetivo analisar a diversidade de Lecythidaceae na região do alto rio Madeira em Rondônia, uma área onde o conhecimento botânico é escasso. Coletas de Lecythidaceae depositadas nos herbários CEN, INPA e RON foram examinadas, e foram realizadas quatro expedições na área de estudo. Foram registradas para a região 37 espécies de Lecythidaceae pertencentes a 7 gêneros: *Eschweilera* (21 espécies), *Couratari* (6), *Cariniana* (3), *Gustavia* (3), *Allantoma* (2), *Bertholletia* (1) e *Lecythis* (1). Dentre essas espécies, cinco são listadas como ameaçadas na Lista Vermelha da IUCN. O número total de espécies encontradas apenas no alto rio Madeira em Rondônia é maior do que as 28 espécies registradas para todo o estado de Rondônia na Lista de Espécies da Flora do Brasil (Smith et al., 2015), e acrescenta 13 novos

registros de Lecythidaceae para o estado. Considerando que esse estudo se restringe à parte norte do estado, nossos resultados sugerem que o número de espécies de Lecythidaceae para Rondônia encontra-se extremamente subestimado. Nossos resultados ressaltam a necessidade de realização de estudos florísticos intensivos na região Amazônica, os quais devem focar em áreas pouco exploradas botanicamente, mas com alto potencial para biodiversidade. Esses estudos poderão gerar informações relevantes para subsidiar tanto estudos taxonômicos quanto avaliação do estado de conservação de espécies.

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The Lecythidaceae s.l., including Napoleonaceae and Scytopetalaceae, comprise a pantropical family of shrubs to large trees with about 350 species in 23 genera (Mori et al., 2007; Mori et al., 2010; Prance & Kartawinata, 2013; Prance & Jongkind, 2015). It is known worldwide as the Brazil Nut family because of the global trade of the seeds of *Bertholletia excelsa* Bonpl. The family is distributed in tropical regions of Africa, Madagascar, Mauritius, Asia, Australia, in the Pacific Islands and the Neotropics (Prance & Mori, 1979; Mori et al., 2007).

The circumscription of the family is not well resolved, with a lack of consensus about the inter- and intrafamilial relations of the group. Lecythidaceae s.s. as recently circumscribed (Mori et al., 2007; Mori et al., 2015; Huang et al., 2015) comprise three subfamilies: Barringtonioideae (erroneously referred as Planchonioideae in some publications), Foetidoideae and Lecythidoideae. Other studies include Napoleonaceae and Scytopetalaceae subfamilies in Lecythidaceae s.s. (APG II, 2003), but this broader circumscription would lead to taxonomic and nomenclatural inconsistencies (Mori et al., 2015). The relationships at lower taxonomic levels are also not completely resolved. Recent phylogenetic studies focused on Lecythidoideae, which includes the neotropical Lecythidaceae, support the monophyly of most genera (sensu Prance & Mori, 1979; Mori & Prance, 1990), but suggest that *Eschweilera* Mart. ex DC. and *Lecythis* Loefl. are not monophyletic and may be split into new genera (Huang et al., 2015; Mori et al., 2015).

Lecythidoideae, the subfamily with the largest number of species, is found from Mexico to Paraguay, occupying various types of habitats, but it is more diverse in the Guianas-Amazon floristic province,

particularly in non-flooded lowland forests (Prance & Mori, 1979). To date, Brazil has 10 genera and a total of 119 species of Lecythidaceae, of which 104 are found in the Amazon and 40 species are endemic to the country (Smith et al., 2015). Some species are very important economically in the Amazon: the edible seeds of *Bertholletia excelsa* are one of the principal products harvested in the biome, and several species of *Allantoma* Miers, *Cariniana* Casar. and *Couratari* Aubl., regionally referred as “tauari,” are intensively exploited by the timber industry (Procópio et al., 2010). In the Amazon, the family can often be identified by a combination of vegetative characters: mostly arboreal habit, fibrous inner bark (locally called “envira”), a characteristic smell of linseed released when the bark is slashed, and simple and alternate leaves (Hopkins & Mori, 1999). Neotropical Lecythidaceae are indicative of preserved or slightly disturbed lowland forests (Prance & Mori, 1979) and comprise one of the most abundant families of the Amazon forests (ter Steege et al., 2013).

The aim of this study is to analyze the diversity of Lecythidaceae in the region of the upper Madeira River in the municipality of Porto Velho, Rondônia, Brazil. This region has suffered major environmental impacts over the last four decades due to agricultural expansion and infrastructure development. In the second volume of the Lecythidaceae monograph published in *Flora Neotropica*, Mori and Prance (1990) had already warned of the rapid process of deforestation in Rondônia and the existence of highly endangered species at that time. The construction of the BR-364 highway in the 1980's expanded the state's agricultural frontier and led to the conversion of more than 75% of its forests into pastures (Ferraz et al., 2005). More recently, hydroelectric dams

have been built in the Madeira River basin (Moser et al., 2014), representing another threat to natural habitats. Although the municipality of Porto Velho accounts for 60% of total Lecythidaceae records in Rondônia (according to the *species-Link* network, [www.splink.org.br](http://www.splink.org.br)), the area remains poorly explored botanically compared to relatively well-collected areas such as Manaus and Belém (Hopkins, 2007).

Considering this scenario of rampant deforestation and rapid habitat loss, it is crucial to increase the knowledge of the composition and distribution of biological diversity in Rondônia, as a source of information to establish better strategies for conservation and landscape management. In this study we present a checklist of Lecythidaceae in the region of the upper Madeira River and contribute improved information on species diversity of this important group of Amazonian plants, aiming at filling gaps in the floristic knowledge of Rondônia and the southern Amazon.

### Materials and methods

The study area is located in the upper Madeira River region, in the municipality of Porto Velho, in southwestern Amazonia. The climate according to the Köppen classification is tropical humid (*Aw* type) with a relatively short dry season from June to August. The annual average temperature is 25.6°C and annual rainfall is between 1700 and 2000 mm (INMET, 2014). The landscape in the study area is physiognomically heterogeneous, forming different vegetation types such as dense and open upland forests, flooded forests, campinaranas (open woodland), savannas, and transitional vegetation, with different levels of human disturbance (RADAMBRASIL, 1978; Perígolo et al., 2016).

We examined about 370 Lecythidaceae specimens deposited in CEN, INPA and RON, (abbreviations following Thiers, 2015, continuously updated), the herbaria with the most comprehensive holdings from the upper Madeira River. Moreover, an extensive floristic survey carried out from 2008–2013 in the study region by the field team of the Embrapa Genetic Resources and Biotechnology herbarium (CEN) resulted in a large number of botanical collections from the area affected by the Jirau hydroelectric dam. Finally, we also carried out four field

expeditions between February 2014 and March 2015 that specifically targeted Lecythidaceae, totalling a sampling effort of 42 days and 33 specimens collected in the study area. The collected material was deposited in CEN, with duplicates sent to IAN, INPA, NY, RON, RB, UB and UFAC. Identification of the material was based on dichotomous keys and species descriptions available for the family (Prance & Mori, 1979; Mori & Prance, 1990; Mori & Lepsch-Cunha, 1995; Hopkins & Mori, 1999; Mori et al., 2010). The material examined was also compared with specimens identified by Scott Mori (specialist in the Lecythidaceae) available online at the NY Virtual Herbarium (<http://sciweb.nybg.org/science2/VirtualHerbarium.asp>). The names and authors were checked in the International Plant Name Index (<http://www.ipni.org>). Information on geographical distribution of species was collated from The Lecythidaceae Pages (Mori et al., 2010), which contains a virtual monograph of the family, also from the Brazilian Flora Checklist (Smith et al., 2015). A vetted collection was selected as the voucher for each species found in the study area.

### Results

We found 37 species of Lecythidaceae in the Upper Rio Madeira region (Table 1; Figs. 1, 2), belonging to seven genera: *Eschweilera* (21 species), *Couratari* (6), *Cariniana* (3), *Gustavia* L. (3), *Allantoma* (2), *Bertholletia* (1) and *Lecythis* (1). Data on stratum, habitat in the study area and geographical distribution and selected voucher specimens are provided in Table 1. Habit ranged from understory shrubs and treelets in *Gustavia* to emergent trees such as *Bertholletia excelsa* and *Cariniana micrantha* (Fig. 1I). The family grows in a wide range of habitats (Table 1), but most taxa were recorded in non-flooded forests (*terra firme*), while only four species were restricted to flooded forests (*Couratari tenuicarpa*, *Eschweilera albiflora*, *E. ovalifolia* and *Gustavia augusta*). Among the species recorded, nine are endemic to Brazil (*Cariniana rubra*, *C. penduliflora*, *Couratari tauari*, *Eschweilera amazonica*, *E. atropetiolata*, *E. cyathiformis*, *E. pseudodecolorans*, *E. truncata* and *Lecythis serrata*), while 13 species are new records of Lecythidaceae for Rondônia and one represents a possible new species (Table 1).

TABLE 1. Species of Lecythydaceae found in the upper Madeira River in Rondônia<sup>a</sup>

Species	Stratum	Habitat	Global distribution / Brazilian States	Voucher
<i>Allantoma decandra</i> (Ducke) S.A.Mori, Ya Y.Huang & Prance	em	tf	Bra, Col, Per / AC, AM, RO	<i>Catenacci 70</i> (CEN, INPA, NY, RON, UB); <i>Pereira-Silva 1515610610</i> (CEN, INPA, NY, RON)
<i>Allantoma pluriflora</i> S.A.Mori, Ya Y.Huang & Prance	cp	tf	Bol, Bra, Col, Per, Ven / AM, RO	<i>Catenacci 74</i> (CEN, INPA, NY, RON, UB); <i>Catenacci 75</i> (CEN, INPA, NY, RON, UB)
<i>Bertholletia excelsa</i> Bonpl.	cp, em	tf, tfd	Bol, Bra, Col, GFr, Guy, Per, Sur, Ven, TTb / AC, AM, AP, MT, PA, RO, RR	<i>Catenacci 58</i> (CEN, INPA, NY, RON); <i>Pereira-Silva 15638</i> (CEN, INPA, NY, RON)
<i>Cariniana micrantha</i> Ducke	em	tf	Bol, Bra, Per / AC, AM, RO	<i>Catenacci 57</i> (CEN, INPA, NY, RON, UB); <i>Pereira-Silva 16133</i> (CEN, INPA, NY, RON)
<i>Cariniana penduliflora</i> Prance	ud	tf	Bra / RO	<i>Prance 8811</i> (INPA)
<i>Cariniana rubra</i> Miers	ud	gal, sw	Bra / GO, MT, PA, RO, TO	<i>Catenacci 48</i> (CEN, INPA, NY, RON); <i>Catenacci 71</i> (CEN, INPA, NY, UB, RON)
<i>Couratari atrovinosa</i> Prance	cp	tf	Bra, Per / AM, RO	<i>Cid Ferreira 8816</i> (INPA); <i>Nee 34842</i> (INPA)
<i>Couratari guianensis</i> Aubl.	cp	tf	Bra, Col, Cos, Ecu, GFr, Guy, Pan, Sur, Ven / AC, AM, AP, MA, PA, RO	<i>Catenacci 40</i> (CEN, INPA, NY, RON); <i>Nelson P21262</i> (INPA)
<i>Couratari macrosperma</i> A.C.Sm.	cp, em	tf, tfd	Bol, Bra, Col, Per / AC, AM, BA, ES, MT, PA, RJ, RO	<i>Catenacci 52</i> (CEN); <i>Pereira-Silva 16340</i> (CEN, INPA, NY, RON)
<i>Couratari multiflora</i> (Sm.) Eyma	ud	tf	GFr, Guy, Sur, Ven / AM, AP, MA, MT, PA, RO, RR	<i>Cid Ferreira 8845</i> (INPA); <i>Lima 69</i> (RON)
<i>Couratari tauari</i> O.Berg	cp	tf	Bra / AM, PA, RO	<i>Catenacci 64</i> (CEN); <i>Melo 663</i> (CEN, INPA)
<i>Couratari tenuicarpa</i> A.C.Sm.	cp, em	ig, cam, va	Bra, Sur, Ven / AM, PA, RO	<i>Simon 1494</i> (CEN, INPA, NY, RON); <i>Simon 2620</i> (CEN, INPA, NY, RON)
<i>Eschweilera albiflora</i> Miers	cp, ud	ig	Bol, Bra, Col, Per / AC, AM, MT, PA, RO	<i>Pereira 186</i> (RON); <i>Pereira-Silva 15663</i> (CEN, INPA, NY, RON)
<i>Eschweilera amazonica</i> R.Knuth	cp, ud	tf, tfd	Bra / AM, AP, PA, RO, RR	<i>Thomas 5019</i> (INPA); <i>Thomas 5057</i> (INPA)
<i>Eschweilera atropetiolata</i> S.A.Mori	cp	tf, tfd	Bra / AM, RO	<i>Catenacci 73</i> (CEN, INPA, NY, RON, UB); <i>Thomas 5109</i> (INPA)
<i>Eschweilera bracteosa</i> Miers	ud	tf	Bra, Col, Ecu, Per, Ven / AM, RO	<i>Mota 99</i> (INPA); <i>Silveira 111</i> (RON)
<i>Eschweilera chartaceifolia</i> S.A.Mori	cp, ud	ig, tf, tfd	Bra, Col, GFr, Guy, Per / AM, RO	<i>Nee 34844</i> (INPA); <i>Simon 1431</i> (CEN, INPA, NY, RON)
<i>Eschweilera coriacea</i> (DC.) S.A.Mori	cp, ud	tf, va	Bol, Bra, Col, Ecu, GFr, Guy, Hon, Pan, Per, Sur, Ven / AC, AM, AP, MA, MT, PA, RO, RR	<i>Pereira-Silva 15708</i> (CEN); <i>Simon 1675</i> (CEN, INPA, NY, RON)
<i>Eschweilera cyathiformis</i> S.A.Mori	cp	tf	Bra / AM	<i>Catenacci 46</i> (CEN, INPA, NY, RON)
<i>Eschweilera decolorans</i> Sandwith	cp, em	tf	Bra, Ecu, Guy, GFr, Per, Sur, Ven / AM, RO, RR	<i>Simon 1226</i> (CEN, INPA, NY, RON); <i>Amaral-Santos 3599</i> (CEN, INPA, NY, RON)
<i>Eschweilera laevicarpa</i> S.A.Mori	cp, ud	ig, tf	Bra, Col, Ecu, GFr, Per, Ven / AM, MT, RO, RR	<i>Catenacci 55</i> (CEN); <i>Pereira-Silva 15462</i> (CEN, INPA, NY, RON)
<i>Eschweilera micrantha</i> Miers	ud	tf	Bra, GFr, Guy, Per, Sur, Ven / AM, AP, MA, PA, RO	<i>Matos 68</i> (INPA)

TABLE 1. Continued

Species	Stratum	Habitat	Global distribution / Brazilian States	Voucher
<b><i>Eschweilera ovalifolia</i> Nied.</b>	cp, ud	va	Bol, Bra, Col, Ecu, Per / AC, AM, RO, RR	<i>Catenacci 59</i> (CEN); <i>Goulding 6</i> (INPA)
<b><i>Eschweilera parviflora</i> Miers</b>	ud	tf	Bol, Bra, GFr, Guy, Per, Ven / AM, AP, RO	<i>Vieira 259</i> (INPA)
<i>Eschweilera parvifolia</i> Mart. ex DC.	cp, ud	tf, va	Bol, Bra, Col, Ecu, Guy, Per, Sur, Ven / AC, AM, MT, RO, RR	<i>Pereira-Silva 16232</i> (CEN, INPA, NY, RON); <i>Pereira-Silva 16316</i> (CEN, INPA, NY, RON)
<i>Eschweilera pedicellata</i> (Rich.) S.A.Mori	cp, ud	ig, tf, tfd	Bra, GFr, Guy, Sur, Ven / AC, AM, AP, PA, RO, RR	<i>Perigolo 277</i> (CEN, INPA, NY, RON); <i>Simon 1826</i> (CEN, INPA, NY, RON)
<b><i>Eschweilera pseudodecolorans</i> S.A.Mori</b>	cp, em	tf	Bra / AM, RO	<i>Catenacci 56</i> (CEN, INPA, NY, RON); <i>Pereira 369</i> (RON)
<b><i>Eschweilera subglandulosa</i> Miers</b>	cp	tf	Bra, Guy, GFr, Per, Sur, Ven, TTb / AM, RO	<i>Amaral 2053</i> (CEN, INPA, NY, RON)
<i>Eschweilera tessmannii</i> R.Knuth	ud	tf	Bra, Col, Ecu, Per / AC, AM, RO	<i>Catenacci 61</i> (CEN, INPA, NY, RON); <i>Pereira-Silva 15599</i> (CEN, INPA, NY, RON)
<i>Eschweilera truncata</i> A.C.Sm.	cp	tf	Bra / AC, AM, RO	<i>Catenacci 50</i> (CEN); <i>Simon 1074</i> (CEN, INPA, NY, RON)
<b><i>Eschweilera wachenheimii</i> (Benoist) Sandwith</b>	ud	tf	Bra, Guy, GFr, Per, Sur / AM, RO	<i>Pereira-Silva 15689</i> (CEN, INPA, NY, RON); <i>Simon 1025</i> (CEN, INPA, NY, RON)
<i>Eschweilera</i> aff. <i>romeu-cardosoi</i> S.A.Mori	cp	tf	-	<i>Catenacci 63</i> (CEN, INPA, NY, RON, UB)
<i>Eschweilera</i> sp. nov.	cp	tf	-	<i>Pereira-Silva 15647</i> (CEN, INPA, NY, RON)
<i>Gustavia augusta</i> L.	ud	va	Bol, Bra, Col, GFr, Guy, Per, Sur, Ven / AC, AM, AP, BA, CE, GO, MA, MT, PA, PB, PE, RO, RR	<i>Pereira-Silva 15175</i> (CEN, INPA, NY, RON); <i>Pereira 238</i> (RON)
<i>Gustavia hexapetala</i> Sm.	cp, ud	tf, tfd, va	Bol, Bra, Col, Ecu, GFr, Guy, Per, Sur, Ven / AC, AM, AP, MT, PA, RO, RR	<i>Catenacci 41</i> (CEN, INPA, NY, RON); <i>Simon 1860</i> (CEN, INPA, NY, RON)
<i>Gustavia poeppigiana</i> O.Berg	ud	tf	Bol, Bra, Col, Guy, Per, Ven / AC, AM, PA, RO	<i>Catenacci 54</i> (CEN, INPA, NY, RON); <i>Perigolo 195</i> (CEN, INPA, NY, RON)
<i>Lecythis serrata</i> S.A.Mori	ud	tf	Bra / PA, RO	<i>Equipe resgate 482</i> (RON)

<sup>a</sup>Species in bold are new records for Rondônia. Stratum: cp = canopy, em = emergent, ud = understory. Habitat: cam = campinarana, gal = gallery forest, ig = igapó forest, tf = terra firme forest, tfd = disturbed terra firme forest, va = várzea forest, sw = swamp (vereda). Countries: Bol = Bolivia, Bra = Brazil, Col = Colombia, Cos = Costa Rica, Ecu = Ecuador, GFr = French Guiana, Guy = Guyana, Hon = Honduras, Pan = Panama, Per = Peru, Sur = Suriname, Ven = Venezuela, TTb = Trinidad and Tobago. Brazilian states: AC = Acre, AM = Amazonas, AP = Amapá, BA = Bahia, CE = Ceará, ES = Espírito Santo, GO = Goiás, MA = Maranhão, MT = Mato Grosso, PA = Pará, PB = Paraíba, PE = Pernambuco, RJ = Rio de Janeiro, RO = Rondônia, RR = Roraima, TO = Tocantins.

## Discussion

According to the Brazilian Flora Checklist, Rondônia is the state with the third-richest Lecythidaceae flora (28 species, or 41 including the 13 new records reported here), behind Amazonas and Pará, with 79 and 43 species respectively (Smith et al., 2015). The current study represents a 46% increase in the known species richness of the family in Rondônia. Considering

that this survey was restricted to the northern part of the state, our results suggest that the number of species of Lecythidaceae in Rondônia should increase as other regions and vegetation types are adequately surveyed. Botanical knowledge is lacking for most regions in the Brazilian Amazon, since collection effort is concentrated around major cities, rivers and highways. Not surprisingly, Brazil is the country with the largest collection gaps within Amazonia (Schulman et al., 2007).



**FIG. 1.** Diversity of Lecythidaceae in the upper Madeira river, Rondônia. **A–B.** *Allantoma decandra* (Pereira-Silva 15610, Catenacci 70, respectively). **C–D.** *Allantoma pluriflora* (Catenacci 75, Catenacci 67). **E–G.** *Eschweilera tessmannii* (Pereira-Silva 15730, Catenacci 61, Pereira-Silva 15599). **H.** *Cariniana rubra* (Catenacci 71). **I.** *Cariniana micrantha* (Pereira-Silva 16133). **J–K.** *Couratari tauari* (Catenacci 64, Melo 663). **L.** *Couratari atrovinosa* (Nee 34842). **M.** *Couratari macrosperma* (Pereira-Silva 16340). **N–O.** *Couratari tenuicarpa* (Simon 2620, Pereira-Silva 16223). The species group depicted in A–G is easily recognized in the field by orange inner bark. (Photos: A, E, G, I, M and O by G. Pereira-Silva; B–D, F, H, J–L by F. Catenacci; N by M. F. Simon).



**Fig. 2.** Diversity of Lecythidaceae in the upper Madeira river, Rondônia. **A.** *Eschweilera albiflora* (Catenacci 73). **B.** *Eschweilera chartaceifolia* (Simon 1431). **C.** *Eschweilera coriacea* (Pereira-Silva 15708). **D.** *Eschweilera cyathiformis* (Catenacci 46). **E-F.** *Eschweilera laeviscarpa* (Catenacci 55), showing bluish-green coloration of fruits when bruised. **G.** *Eschweilera ovalifolia* (Catenacci 59). **H-I.** *Eschweilera parvifolia* (Pereira-Silva 16232, 16316). **J.** *Eschweilera pedicellata* (Perigolo 277). **K.** *Eschweilera pseudodecolorans* (Catenacci 42). **L.** *Gustavia hexapetala* (Catenacci 41). **M.** *Gustavia poeppigiana* (Perigolo 195). **N.** *Lecythis serrata* (Equipe resgate 482). (Photos: A, D-G, K-L and N by F. Catenacci; B by M. F. Simon; C, H-I by G. Pereira-Silva; J and M by N. Perigolo).

Several species found in the Upper Rio Madeira region are widely distributed in the Amazon region and adequately represented in herbaria (e.g., *Bertholletia excelsa*, *Couratari guianensis*, *C. macrosperma*, *C. multiflora*, *Eschweilera albiflora*, *E. coriacea*, *E. micrantha*, *E. parvifolia*, *E. pedicellata*, *Gustavia augusta*, *G. hexapetala* and *G. poeppigiana*), while others are endemic to Brazil but are also well-collected (*Cariniana rubra*, *Eschweilera amazonica*, *E. atropetiolata*, *E. pseudodecolorans*, *E. truncata*). However, four little-known species have drawn attention by the scarcity of records in herbaria (*Cariniana penduliflora*, *Couratari atrovinosa*, *C. tauari* and *Lecythis serrata*; Figs. 1 and 2), all with under 15 collections recorded in Brazil (*speciesLink*; [www.splink.org.br](http://www.splink.org.br)). *Cariniana penduliflora* is known only from the type specimen collected in 1968 on the outskirts of Mutum-Paraná in Rondônia, a village flooded by the Jirau hydroelectric dam, while the other three species are known from few widely separated collections across the Amazon. Such scarcity of records suggests that these species may be globally rare, although this may also be an artifact of incomplete botanical knowledge in the region (Hopkins, 2007). Other poorly documented species are *Allantoma pluriflora* (Fig. 1C-D), which is relatively well collected in western Amazonia (Bolivia, Peru and Colombia) but has only a few collections in Brazil (western Amazonas state), and *Eschweilera cyathiformis* (Fig. 2D), which was previously known only from the Manaus region. The new records of these species for Rondônia could represent the extremes of their ranges but with gaps in between that could be filled by further collections.

Two taxa (*Eschweilera* sp. nov. and *E. aff. romeo-cardosoi*) could not be confidently assigned to any known species, but they are certainly distinct from other Lecythidaceae in the study area. One was identified as a possible new species by Lecythidaceae specialist S. Mori and requires additional plant material to permit a thorough description, since the flowers of this taxon are still not known. The other taxon has affinity with *Eschweilera romeo-cardosoi*, but its flowers and pedicels are much larger than those recorded for that species. This other possibly new taxon is morphologically intermediate between *E. romeo-cardosoi* and *E. collina* Eyma, with leaves and bark similar to the first and flowers and fruits similar to the latter. Although *E. aff. romeo-cardosoi* is a common species in some locations

of the study area, more collections are needed to establish its identity.

Among the species found in the study area, five species are listed as threatened on the IUCN Red List ([www.iucnredlist.org](http://www.iucnredlist.org)): *Cariniana penduliflora* (critically endangered), *Couratari atrovinosa* (endangered), *Bertholletia excelsa*, *Couratari guianensis*, and *C. tauari* (vulnerable). However, conservation assessments of these species must be reviewed considering recent occurrence data. According to the Red Book of Brazil's Flora (Martinelli & Moraes, 2013), where *B. excelsa* is listed as vulnerable, Lecythidaceae is considered to be one of the ten botanical families of greatest interest for conservation and research because of restricted distributions or insufficient data for most species of the family. At a local scale, species of Lecythidaceae are threatened by both deforestation and infrastructure projects. Species restricted to the lowlands along the margins of the Madeira River are particularly affected by the construction of hydroelectric projects on the river, since most species of Lecythidaceae in the study are sensitive to flooding caused by dams.

Both herbarium and field work contributed to improved knowledge of the Lecythidaceae in the study area. Although recent field surveys added a substantial amount of botanical information, many of the new records presented here derived from specimens collected many years ago that had remained unidentified or misidentified in herbaria. For example, a search in the Brazilian network of herbaria (*speciesLink*) showed that 22% of the herbarium specimens of Lecythidaceae collected in Rondônia are determined only to genus, while about 30% of *Eschweilera* are unidentified to species. In addition, many Lecythidaceae collections are incomplete due to the difficulty of collecting large trees or are inappropriately dried or pressed, which causes the loss of floral features important for their identification. This situation, coupled with the great vegetative similarity between many of the species, makes identification of species of this family in the herbarium difficult (Mori & Prance, 1987).

Lack of taxonomic expertise and unreliable identifications of herbarium specimens, together with geographically imbalanced collection effort, are major barriers to the improvement of our knowledge of the Amazon flora, making it difficult to accurately map species distributions and identify regions of endemism, key aspects of conservation planning (Hopkins, 2007).



This situation is critical in the case of Rondônia, given the scenario of continued deforestation and habitat loss (Ferraz et al., 2005), including deforestation in protected areas (Verissimo et al., 2011) and the impacts of large hydroelectric projects (Fearnside, 2013). Rondônia should therefore be a priority area for floristic studies in the Amazon; it comprises a rich mosaic of landscapes in the transition between Cerrado and Amazonia, and it represents a probable center of plant endemism that is largely under-collected and has been facing high rates of deforestation for decades (Prance & Campbell, 1988; Prance, 2001). Therefore, additional efforts are needed to inventory the state flora as a whole as well as in the protected areas, in order to evaluate the latter's effectiveness in conserving the landscape and floristic diversity of the state. Our results highlight a need for expanding floristic studies to areas in the Amazon that still lack adequate botanical information. Moreover, it is important to expedite the identification, mapping, and habitat analysis of the specimens generated by these studies. This would permit more robust conservation assessments and strategies for the Amazon flora.

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