

CHEMICAL PROFILE OF EXTRACTIVES OF LECYTHIDACEAE FROM THE BRAZILIAN AMAZON

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The Lecythidaceae family in the Amazon rain forest offers notable technological potential, but its chemical compositions, particularly extractives, are poorly studied. These compounds serve ecological functions, including pollinator attraction and environmental defense, though certain extractives, namely phenols and alkaloids, may be toxic to humans. This study attempted to identify the chemical classes present in the extractives of Lecythidaceae species from the Brazilian Amazon. Samples were collected from secondary forests in Amazonas, Amapá, and Pará (Brazil). We obtained the extracts using water and ethanol and they were later analysed for chemical classes via phytochemical and physicochemical tests. The results showed the wood extractives of *Eschweilera odora* were the richest in chemical classes, including tannins, saponins, steroids, triterpenes, flavonoids, alkaloids, and coumarins, while *Couratari stellata* and *Corythophora rimosa* had lower concentrations. These chemical compounds influence the wood's properties, such as density, durability, and resistance to fungi and termites. We also discovered potential toxicological risks posed by certain extractives, which could be harmful to humans. Understanding the chemical composition of Lecythidaceae species, therefore, provides valuable insights into their potential uses in the pharmaceutical, botanical, and chemical industries, while aiding in classification and sustainable utilisation of these Amazonian woods.

Keywords: Extractives, chemotaxonomy, Amazonian woods, *Eschweilera*, toxic wood

INTRODUCTION

The biological potential of the Amazon is immense, featuring a diverse array of species with significant technological potential that has garnered global attention. In the Neotropical region, the Lecythidaceae family comprises 10 genera and approximately 300 tree species, among which *Bertholletia*, *Couratari*, *Eschweilera*, and *Lecythis* are particularly diverse in the Amazon and are recognised as the third most abundant family in the region (ter Steege et al. 2020, Ferreira et al 2021).

Despite the considerable variability within this family, little is known about the chemical nature of its extractives. The classification of plant species based on their chemical composition is based on a technique known as chemotaxonomy. This approach is grounded in the observation

that certain secondary metabolites of species within the same genus tend to exhibit similarities. Consequently, the presence of specific chemical classes in the extractives can facilitate botanical identification by serving as taxonomic markers (Nascimento et al. 2019).

The metabolites found in the extractives play an ecological role by attracting pollinators, representing chemical adaptations to environmental stress, and providing chemical defence against UV radiation, microorganisms, and herbivory, among others (Taiz et al. 2017). It is important to emphasise both the beneficial and harmful effects of these extractives. Although they can be toxic to humans, understanding which substances pose health risks is essential. Several classes of compounds, including phenols,

tannins, alkaloids, and cyanogenic heterosides, exhibit a high degree of toxicity (Varejão et al. 2009). Furthermore, the acoustic, physical-mechanical, and biological properties of wood, such as sound quality, modulus of elasticity, wood density, moisture content, colour, odour, and natural durability, are influenced by these compounds (Ahmad et al. 2013, Farvardin et al. 2015, Nascimento et al. 2021).

A comprehensive understanding of the chemical composition of Amazonian wood and its extractives contributes to the improved utilisation of this raw material in the region. This knowledge enables the correct classification of their uses across various fields, including pharmacology, botany, and the chemical industry. Additionally, this enhances product quality and aligns technological advancements with societal needs and economic development, particularly through the introduction of new species into the market (Araújo et al. 2019, Silva et al. 2020, Nascimento et al. 2024). In this context, the objective of this study was to identify the chemical classes present in the extractives of tree species from the Lecythidaceae family in the Brazilian Amazon. The aim is to achieve a comprehensive technological characterisation and to develop a database of extractives from forest species to explore their future applications.

MATERIALS AND METHODS

Samples were collected from several areas of non-flooded secondary forests (Amazonas, Amapá, and Pará/Brazil). Two to three individuals of each species were collected totalling 27 trees. They were selected based on their frequency, number of repetitions, and wide distribution in the Brazilian Amazon. At the diameter at breast height (DBH), 10 cm thick discs were removed, and only the wood (heartwood and sapwood) was used. The material was air-dried for 48 hours, fractionated, and sent to the Botanical Collection Xiloteca/INPA for taxonomic identification (Table 1). The remaining material was shredded and ground to obtain 60 mesh sawdust.

Obtaining wood extracts

The extracts were obtained from wood sawdust (40 mesh) with water and ethanol (95%) in an ultrasonic washer (Ultrasonic washer/UNIQUE) at 50 °C until exhaustion. The extractive solution

was then filtered and concentrated at low pressure and temperature in a rotary evaporator and stored in a dark glass bottle for later tests to detect chemical classes.

Phytochemical tests

The methodologies used in the study were based on the principles described by (Barbosa et al. 2006, Simões et al. 2017) which focused on three classes of metabolites: terpenoids (steroids, triterpenes and saponins), nitrogen compounds (alkaloids and cyanogenic heterosides), and phenolic compounds (phenols and tannins, flavonoids, anthraquinones and anthranols, and coumarins).

Chemical Class Index (CCI) was used after the detection tests to determine the extractives of each species using Equation 1. The CCI provides a quantitative measure of the phytochemical richness of the extracts, representing the proportion of chemical classes detected relative to the total number of classes being tested. An index closer to 1.0 indicates a richer and more diverse chemical profile

$$CCI = \frac{nDC}{nTIC} \quad (1)$$

where nDC = No. detected class and nTIC = No. total investigated classes.

Physicochemical tests

Additionally, for a complete evaluation of the species, a quantitative analysis of the physicochemical traces of moisture, extractives, and total polyphenols was carried out, as well as the ash content (Barbosa et al. 2006, ASTM 2021).

Determination of moisture content

A fraction of 1.00 g of wood sawdust (60 mesh) was weighed in a filter-weigher and dried in an oven at 100 ± 3 °C for 4 hours. The material was later weighed to ensure a constant weight, and its moisture content calculated using equation 2

$$MC\% = \frac{Pu - Ps}{Ps} \times 100 \quad (2)$$

where Pu = Wet weight, g, and Ps = Dry weight, g.

Table 1 Forest species selected for the study

Scientific name/(common name)	No. samples	Collection site/Brazil
<i>Cariniana integrifolia</i> Ducke (Cerú)	2	Balbina/Amazonas: 1°58'46"S 59° 20'41"W; 1°59'29"S 59°20'55"W
<i>Corythophora rimosa</i> W. Rodr. (Castanha-jacaré)	2	Balbina/Amazonas: 1°59'37"S 59° 19'30"W; 1°59'33"S 59°19' 05"W
<i>Couratari guianensis</i> Aubl (Tauari)	2	Flona Amapá/Amapá; 1°04'59"N 51°31'27"W; 1°04'57"N 51°30' 26"W
<i>Couratari oblongifolia</i> Ducke & Knuth (Tauari-amarelo)	2	Curuá-Uma/Pará: 3°57'14"S 59°07'01"W; 3°57'13"S 59°07'05"W
<i>Couratari stellata</i> A.C.Smith (Tauari-branco)	3	Flona Tapajós/Pará: 4°03'20"S 54°57'20"W; 4°04'00"S 54°57'10"W; 4°03'10"S 54°58'00"W
<i>Eschweilera coriacea</i> S.A.Mori (Matá-matá-amarelo)	3	Manaus/Amazonas: 2°30'32"S 60°10'02"W; 2°31'37"S 60°09'45"W; 2°29'20"S 60°10'29"W
<i>Eschweilera odora</i> (Poepp) Miers (Ripeiro-preto)	3	Cristo Rei/Amazonas; 2°59'30"S 58°29'42"W; 2°59'20"S 58°29'29"W; 2°59'32"S 58°30'02"W
<i>Eschweilera truncata</i> A.C.Sm. (Matá-matá-preto)	2	Manaus/Amazonas: 2°30'37"S 60°10'45"W; 2°29'20"S 60°10'29"W
<i>Holopyxidium latifolium</i> Ducke (Jarana)	2	Itacoatiara/Amazonas: 3°03'15S 58°31'29"W; 3°03'42"S 58°31'31"W
<i>Lecythis paraensis</i> Hub (Sapucai)	3	Curuá-Uma/Pará: 3°55' 20"S 58°10'51"W; 3°55'23"S 59°16'40"W; 3°55'20"S 59°18'35"W.
<i>Lecythis usitata</i> S.A. Mori&Prance (Castanha-Sapucai)	3	Curuá-Uma/Pará: 3°58'24"S 59°17'51"W; 3°58'23"S 59°17' 45"W; 3°59'20"S 59°18'05"W.

Ash content determination

In a porcelain crucible, 1.00 g of sawdust was added, and the crucible was placed in an oven (100 ± 3 °C) for an hour to remove moisture. The container was later transferred to a muffle furnace for incineration, starting with gradual heating to 580–600 °C. After incineration, the crucible was weighed to a constant weight. The ash content was determined using equation 3.

$$\text{Ash\%} = \frac{P_{\text{ash}}}{P_s} \times 100 \quad (3)$$

where P_{ash} = ash mass, g, and P_s = Dry weight, g.

Determination of extractive content

Two extractions with solvents of different polarities were conducted on sawdust. In the first extraction (FE), 5.00 g of sawdust was placed in a Soxhlet extractor with an ethanol-toluene solution. After 8 hours of reflux, the sawdust was dried and stored. The extract was concentrated, dried, and weighed to determine using equation 4:

$$\text{FE\%} = \frac{P_{\text{extractives}}}{P_s} \times 100 \quad (4)$$

where $P_{\text{extractives}}$ = extractives mass, g, and P_s = Dry weight, g.

In the second extraction (SE), the same procedure was repeated using ethanol. The SE% was calculated using equation 5:

$$\text{SE\%} = \frac{P_{\text{extractives}}}{P_s} \times 100 \quad (5)$$

where $P_{\text{extractives}}$ = extractives mass, g, and P_s = Dry weight, g.

The total extractive content (TEx) was obtained by adding the indices of both extractions (FE+SE).

Determination of total polyphenol content

A 2.00 g sawdust sample (60 mesh) from each species was refluxed with 100 mL of water at 90 °C for 60 minutes. The extract was filtered, and the wood residues were extracted again. The

combined extracts were later diluted with 500 mL and subsequently, 100 mL was mixed with 10 mL of 40% formaldehyde and 5 mL of concentrated HCl and refluxed for 30 minutes using Stiasny method. The precipitate was filtered, dried, and weighed. Finally, the tannin content was calculated using equation 6.

$$\text{Tan \%} = \frac{\text{TTM}}{\text{Ps}} \times 100 \quad (6)$$

where TTM= tannins mass, g, and Ps = Dry weight, g.

Statistical Analyses

Previous statistical tests of physical and mechanical properties ensured normality, homogeneity, and independence. ANOVA was applied when $p \leq 0.05$ indicated a significant difference, followed by Tukey's test. A Pearson correlation matrix was estimated, and multivariate statistics were used for cluster analysis, considering the chemical classes index and physical-chemical traits of the woods. In this type of analysis, it is possible to determine a rational structure (groups) for a set of information, classifying and allowing the study of similarities between each group (Silveira et al. 2013). PAST v.4.108 and Minitab®21.1 were used for analysis and graphing.

RESULTS AND DISCUSSION

Physicochemical properties of Lecythidaceae
The chemical composition of wood plays a fundamental role in determining its suitability for various industrial applications. An analysis of Lecythidaceae wood sourced from the Brazilian Amazon region (Table 2) revealed that *Holopyxidium latifolium* and *Cariniana integrifolia* present low moisture contents of 10.10% and 10.70% respectively. In contrast, *Eschweilera odora* and *Couratari guianensis* were characterized by elevated extractive levels, measuring 7.10% and 6.65% respectively, alongside notable total polyphenol contents of 2.64% and 2.79% respectively. Additionally, *Corythophora rimosa* and *H. latifolium* were found to have ash contents of $\leq 0.24\%$. Importantly, the values obtained in this study align with the typical ranges observed for tropical wood, thereby emphasizing the inherent variability in wood properties and their implications

for industrial applications (Fengel & Wegener 2003, Mohd-Jamil et al. 2018, Santos et al. 2019).

The Lecythidaceae family is not only prevalent but also presents significant diversity in the Amazon rainforest; however, their chemical metabolites remain insufficiently explored. The influence of wood extractives on critical properties, such as density, moisture retention, mechanical strength, and durability, can serve as valuable taxonomic markers (Barbosa et al. 2006, Nascimento et al. 2019). Species, such as *E. odora* and *H. latifolium*, which possess high concentrations of extractives, are particularly noteworthy for their enhanced durability and wood density. According to International Tropical Timber Organization (ITTO 2021), the wood from these species demonstrates considerable resistance to fungal decay and termite infestation, with densities exceeding 0.80 g/cm³. Furthermore, the mineral residue content (ash) in wood serves as a predictive variable for assessing its suitability for energy applications, as does the wear rate of cutting tools during processing in sawmills (Fengel & Wegener 2003). It is important to note that Lecythis wood, characterised by its high ash content, may present challenges when utilised in boiler systems for energy production.

Wood utilisation preference is intrinsically linked to technological properties, such as low energy input for production, renewability, aesthetic appeal, and diverse colors and textures. A comprehensive understanding of the mechanisms underlying the action of chemical constituents in wood is of paramount interest. Advancing research in wood technology serves as an effective means of identifying appropriate applications within the forest industry (Varejão et al. 2009, Acda & Devera 2014, Araújo et al. 2019).

The findings of this study not only contribute to the existing body of knowledge regarding the chemical composition of Lecythidaceae wood but also underscore the necessity for further research into its ecological and industrial implications. In elucidating the relationships between chemical constituents and wood properties, the current study attempts to enhance the sustainable utilisation of these valuable resources in various industrial sectors.

Means followed by the same letter in the column do not differ statistically from each other. Tukey's test was applied at the 5% probability level. The value between parents = the standard deviation. * = %.

Table 2 Results of quantitative assays of Lecythidaceae woods

Species	Moisture*	Total polyphenols*	Total extractives*	Ash*
<i>Cariniana integrifolia</i>	10.70c	2.47a	5.40b	0.72b
<i>Corythophora rimosa</i>	12.61a	0.80c	3.11c	0.23c
<i>Couratari guianensis</i>	10.96b	2.79a	6.65a	0.50b
<i>Couratari oblongifolia</i>	12.07a	1.07c	4.15b	0.44b
<i>Couratari stellata</i>	12.85a	0.33d	2.58c	0.52b
<i>Eschweilera coriacea</i>	12.55a	0.77c	3.17c	0.51b
<i>Eschweilera odora</i>	12.84a	2.64a	7.10a	0.70b
<i>Eschweilera truncata</i>	12.81a	0.90c	2.48c	0.48b
<i>Holopyxidium latifolium</i>	10.10c	2.66a	4.40b	0.24c
<i>Lecythis paraensis</i>	11.79b	1.40b	3.10c	1.63a
<i>Lecythis usitata</i>	11.17b	0.89c	1.93d	1.60a
Mean	11.86 (0.94)	1.52 (0.58)	4,01 (1,04)	0.69 (0.26)

Phytochemical profile of extractives from Lecythidaceae

The Brazilian flora is recognised as one of the most diverse in the world, particularly its array of plant compounds, which include medicinal, aromatic, insecticidal, and colouring substances. The identification of novel compounds is fundamental for advancing our understanding of the chemical properties of plants and their potential benefits to both humanity and the environment (Gottlieb 1981, Simões et al. 2017). The species within the Lecythidaceae family examined in this study predominantly contain tannins, saponins, steroids, and flavonoids (Figure 1). Notably, extracts from *Eschweilera odora* are particularly rich in various chemical classes, achieving a Chemical Class Index (CCI) of 0.78, which include tannins, saponins, steroids, triterpenes, flavonoids, alkaloids, anthraquinones, and coumarins. In contrast, *Couratari stellata*, *C. guianensis*, and *Corythophora rimosa* presented a lower CCI of 0.33. Among the extractives of this family, tannins (100%) and saponins (90.10%) were the most prevalent, while triterpenes (9.09%) and cyanogenic heterosides (18.18%) were found in lesser occurrence (Figure 2).

Terpenoids constitute a significant class of natural products known for their cytotoxic, antibacterial, antifungal, antiviral, antitumor, and anti-inflammatory properties, rendering them valuable in traditional medicine. These compounds, derived from isoprene units, include essential oils, resins, and fatty acids, with subclasses such as steroids, triterpenes, and saponins (Figure 3: I-IV); for instance, β -sitosterol, a common steroid found in xylem tissue, plays a role in regulating energy flow within plants, while hemolytic saponins provide a defense mechanism against xylophagous organisms (Simões et al. 2017, Ferreira et al. 2021).

Costa & Carvalho (2003) studied the chemical profile of *Eschweilera* and identified the presence of pentacyclic triterpenes, steroids, and saponins. Lima Neto et al. (2015) reported the detection of saponins in ethanolic extracts of *Cariniana* sp., corroborating the current study's findings, which confirmed the presence of terpenoids in extracts from *Eschweilera* species, with triterpenes observed exclusively in *E. odora* and saponins in *C. integrifolia*. These results are crucial for promoting the sustainable use of these species and for identifying their potential taxonomic markers.

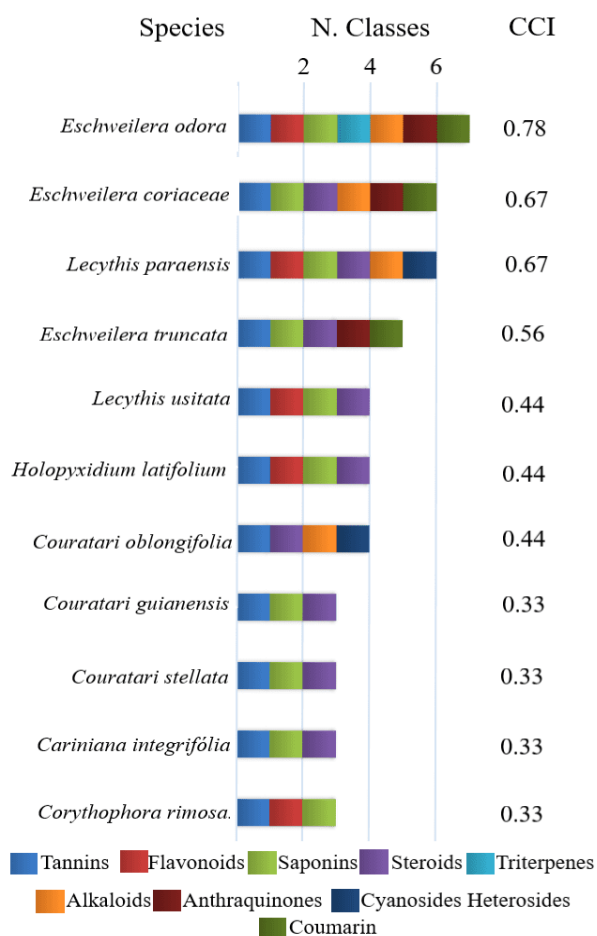


Figure 1 Chemical classes present in Lecythidaceae extracts. CCI = chemical class index

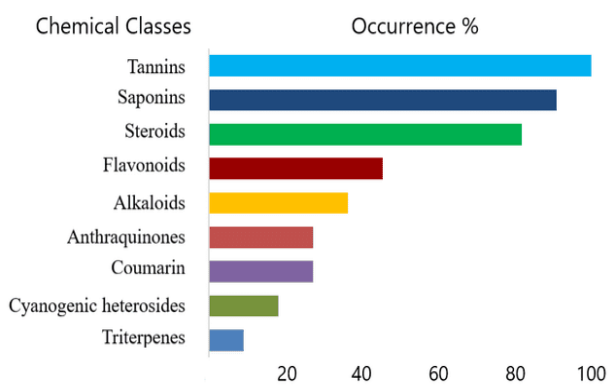


Figure 2 Occurrence of classes in Lecythidaceae extracts

Nitrogen-containing compounds in plants, such as alkaloids, cyanogenic heterosides, non-protein amino acids, and glucosinolates (Figure 3: V-VI), serve important biological functions, primarily in plant defense. The

concentration of cyanogenic compounds, which can be found in various plant parts, varies according to species, climatic conditions, and growth factors, with faster growth rates often correlating with higher concentrations (Evans 2017, Simões et al. 2017). Alkaloids were identified in *E. coriacea* and *E. odora*, while cyanogenic heterosides and alkaloids were detected in the extractives of *C. oblongifolia* and *Lecythis paraensis*. It is important to note that plants containing cyanogenic heterosides can pose toxicity risks to humans, as these compounds can be enzymatically converted into glucose, cyanide, and acetone. The released cyanide inhibits cytochrome oxidase, a vital enzyme involved in cellular respiration (Santos et al. 2019).

The third major class examined in this study comprised phenolic compounds, which are derived from plant metabolism, and they can be found in plant cell wall tissues, serving as substrates for peroxidases and polyphenol oxidases. These compounds can be categorized as phenolic acids, flavonoids, tannins, coumarins, lignans, and quinones (Figure 4). Phenolic compounds contribute significantly to the biological resistance of wood and its antioxidant properties, potentially enabling certain species to adapt to varying climatic conditions (Barbosa et al. 2006, Taiz et al. 2017).

Tannins were detected in the extractives of all species, with hydrolysable tannins confirmed in *E. odora*, *E. truncata*, and *C. rimosa*, while the remaining species contained condensed tannins. Phenolics, anthraquinones, and coumarins were found exclusively within the genus *Eschweilera*. Coumarins significantly influence plant physiology by affecting photosynthesis and photophosphorylation, reducing glucose synthesis, and inhibiting the early stages of chlorophyll biosynthesis. Physiological effects include alterations in normal plant growth and seed germination. Anthraquinones, which include compounds, such as lapachol and dihydrolapachol, present high toxicity to

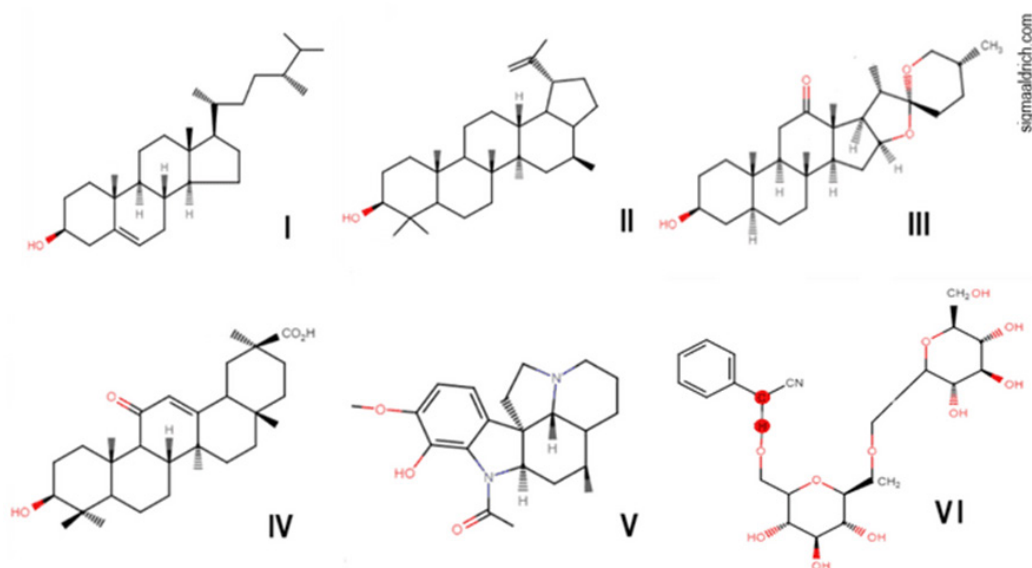


Figure 3 Chemical structures of terpenoids and nitrogen compounds: I – steroid (β -sitosterol); II – triterpene (lupeol); III – steroidal saponin (echogenic); IV – triterpene saponin (glycyrrhizic acid); V – alkaloid (aspidocarpine); and VI – cyanogenic heteroside (amygdalin)

the wood of *Tectona grandis* and certain species of *Handroanthus*, as well as dalbergiones in *Dalbergia* sp., acameline, and benzoquinone in *Acacia melanoxylon* (Santos et al. 2019, Vyas et al. 2019).

Human health can be adversely affected by these species through chemical or mechanical means, such as exposure to wood chips, sawdust, or wood dust. Airborne dermatitis, including contact dermatitis, has been widely documented in medical literature (Santos et al. 2018, Krenitsky et al. 2019). In terms of the utilization and recommendation of the studied woods, species such as *C. oblongifolia*, *L. paraensis*, *E. coriacea*, and *E. odora* present profiles containing alkaloids, anthraquinones, cyanogenic heterosides, and tannins, which should be avoided in the manufacture of educational toys and bio jewelry. This is due to their chemical similarities with woods from the genera *Cordia*, *Dalbergia*, and *Handroanthus* which are recognized as toxic (Varejão et al. 2009, Vyas et al. 2019).

Table 3 presents the Pearson correlation of the analyzed variables that demonstrated statistical significance. A strong correlation was observed only for interactions between the chemical classes index/total polyphenols

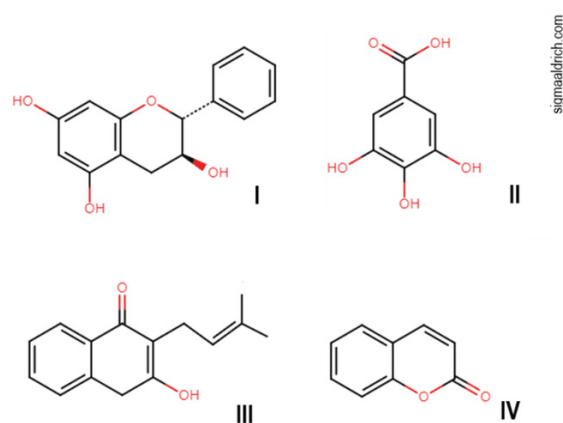


Figure 4 Chemical structures of phenolic compounds: I – catechin; II – gallic acid; III – quinone (lapachol) and IV – coumarin (1,2-benzopyrone)

($r = 0.8884$, $p = 0.0091$), chemical classes index/total extractives ($r = 0.7701$, $p = 0.0322$), and total polyphenols/ash ($r = 0.7484$, $p = 0.0051$). Correlation measures the direction and degree of the linear relationship between quantitative variables, indicating that two variables are associated when they exhibit similarities in the distribution of their scores. More specifically, they can be associated with frequency distribution through variance sharing (Miot 2018). Silva et al. (2020)

found correlations in recent studies involving Amazonian woods, such as extractives/wood density ($r = 0.56$) and extractives/ash ($r = 0.55$), with a particularly strong relationship for extractives/moisture ($r = 0.95$). The correlation between CCI and polyphenols was greater than that between the CCI and extractives and this difference may initially be attributed to the higher occurrence of phenolic compounds (anthraquinones, coumarins, flavonoids, and tannins) in the studied species.

Exploratory data analysis, specifically principal component analysis (PCA), was employed to identify potential relationships between botanical genera and chemical classes (5). The PCA of the chemical classes studied revealed three components that accounted for 76% of the variability. Upon analyzing the variables, distinct clusters were observed for two factors (PC1 vs. PC2), which included the *Eschweilera* group (*E. coriacea*, *E. odora*, and *E. truncata*), the *Couratari* group (*C. guianensis*, *C. oblongifolia*, and *C. stellata*), the *Lecythis* group (*L. paraensis* and *L. usitata*), and a fourth group (*C. integrifolia*, *C. rimosa*, and *H. latifolium*). Principal component analysis (PCA) is widely utilized in the analysis of complex datasets, aiming to preserve as much information (variance) as possible (Nascimento et al. 2021).

The analysis scores that dictate the clusters are likely influenced by detection scores of the chemical class groups. The *Eschweilera* group was distinctly separated from the others, likely due to the exclusive presence of anthraquinones and coumarins. The *Couratari* group predominantly comprises steroids and saponins. The classification of chemical compounds at the species, genus, and botanical family levels forms the foundation of chemotaxonomic studies (chemosystematics), and their aim is to classify and identify plant organisms based on similarities (chemotaxonomic markers) or differences in chemical composition (molecular structure) present in the extractives (Simões et al. 2017).

The findings of this study therefore, emphasise the importance of chemically profiling extractives in order to differentiate the different chemical profiles of the genera within the Lecythidaceae family. Further, this contributes to a better understanding of the defensive strategies employed by these compounds against xylophagous organisms (natural durability), facilitate the classification of toxic species, reinforce chemotaxonomy, and provide a scientific basis for the sustainable development of new products derived from natural sources.

Table 3 Results of Pearson's correlation between the variables studied from the relationships between physicochemical variables (moisture, total polyphenols, and total extractives) and chemical class index (CCI)

Variable 1	Variable 2	Pearson r	p value	Classes
Chemical classes index	Total polyphenols	0.8884	0.0091	Strong
	Total extractives	0.7701	0.0322	Strong
	Moisture	0.2328	0.4588	Low
	Ash	0.3578	0.2801	Low
Total polyphenols	Total extractives	0.0005	0.8569	Low
	Moisture	0.0423	0.7458	Low
	Ash	0.7484	0.0510	Strong
Total extractives	Moisture	0.4574	0.5512	Low
	Ash	0.4192	0.6921	Low

The classification (classes) correlation strength was low < 0.50 , moderate $0.50 \leq r < 0.70$ and strong $r \geq 0.70$ (Miot 2018)

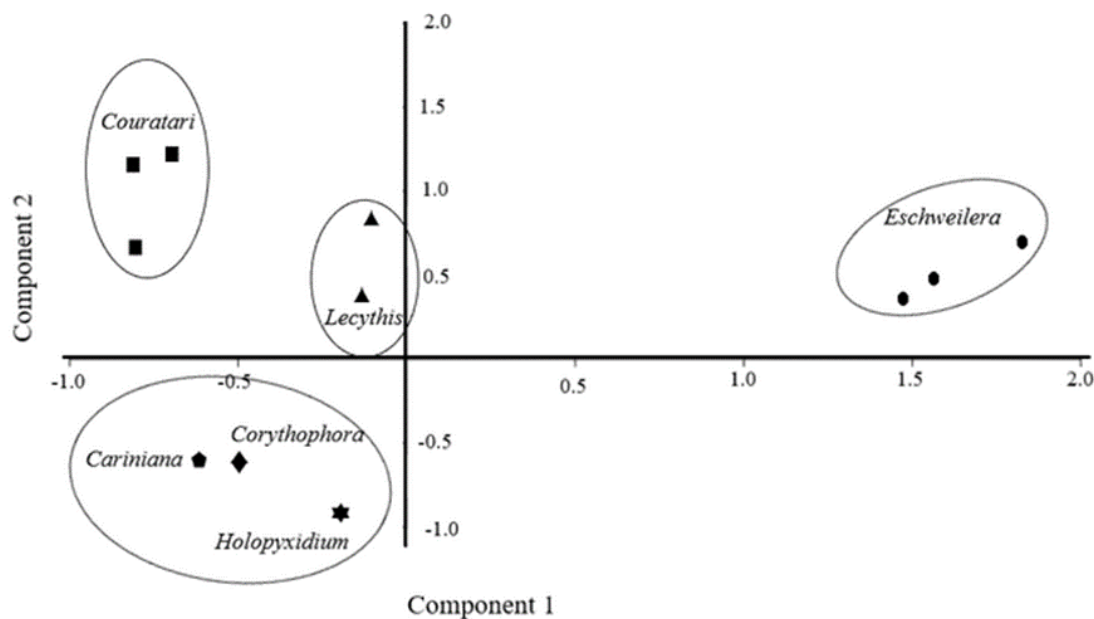


Figure 5 Clustering resulting from the analysis of chemical classes of Lecythidaceae through principal component analysis (PCA)

CONCLUSION

Extractives from the Lecythidaceae family present a diverse chemical composition, encompassing tannins, saponins, steroids, and flavonoids. Among the species analyzed, *Eschweilera odora* stands out as the most chemically rich, demonstrating positive results for a variety of compounds, including anthraquinones, coumarins, saponins, and tannins across all tested wood samples. Notably, the presence of cyanogenic heterosides was identified in *Couratari oblongifolia* and *Lecythis paraensis*, while triterpenes were exclusively associated with *E. odora*. Furthermore, *Holopyxidium latifolium* and *Cariniana integrifolia* presented the lowest moisture contents, indicating potential implications for their utilization in various applications. In contrast, *Corythophora rimosa* and *H. latifolium* were characterized by low ash concentrations, suggesting a higher purity of the extractives. *E. odora* and *Couratari guianensis* emerged as the species with the highest levels of extractives and polyphenolic compounds, underscoring their significance in phytochemical research.

This study hence, contributes valuable insights to the fields of phytochemistry, pharmacology, and chemotaxonomy by elucidating the

chemical profiles of Lecythidaceae species. The identification of specific bioactive compounds not only enhances our understanding of the ecological roles these plants play, but also opens avenues for potential biotechnological applications. The findings underscore the importance of further investigation into the potentials of these species, particularly *E. odora* and *C. guianensis*, which may serve as promising candidates for the development of natural products. Future research should focus on the isolation and characterization of these compounds, as well as their biological activities, to fully exploit the potential of Lecythidaceae species.

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