

Amazonian Seeds and Fruits Used in Indigenous Body Ornaments: A Literature Review

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Abstract: Ethnographic collections in Europe and the Americas hold numerous Indigenous body ornaments from the Amazon, often with little associated data on their geographical and cultural origin. Several of these objects contain plant seeds and fruits. Identification of the botanical material in those body ornaments could be a helpful tool in provenance research, also serving as reference for archaeobotanical and museum studies. A literature review on seed and fruit species documented as used as beads in body ornaments in the Amazon was conducted. Although the information was scattered among ethnobotanical, taxonomical, and anthropological sources, at least 224 species within 42 plant families were successfully retrieved from 54 publications. Fabaceae and Arecaceae were the most species-rich families, with 58 species supplying seed beads for the production of necklaces, bracelets, aprons, rosaries, etc. While the genera *Astrocaryum*, *Attalea*, and *Ormosia* yielded the highest number of species used, seeds of *Coix lacryma-jobi* and *Cascabela thevetia* were most often mentioned in the literature, probably because they are easily identifiable. We hope that our list of seed and fruit species will help to identify museum objects and archeological vestiges, and serve community projects engaged in producing material culture from seeds and fruits, while revitalizing and revaluing Indigenous knowledge.

Keywords: Amazon, Body ornaments, Indigenous peoples, Jewelry, Seeds

Introduction

Ethnographic museums in Europe and the Americas hold many Amazonian Indigenous artifacts with little or no associated data on geographical and cultural origin. Many of these objects, especially body ornaments, contain seeds, fruits, or other plant parts. Who made them, when, from what botanical material, and where they come from is often unknown, as little associated data on geographical and cultural

origin has been provided when these objects entered the museums (Caromano et al. 2024; Kaki et al. 2023).

Due to colonial and missionary activities and the introduction of European glass beads centuries ago, a large part of body ornaments (necklaces, bandoliers, belts, earrings, etc.) traditionally made with seeds, fruits, shells, or bones are no longer worn or manufactured by the people that once made them (Guppy 1958; Roth 1924). As the related Indigenous knowledge about these objects has not been fully documented, or was lost over time, and some of the cultural groups that made them may no longer exist, these body ornaments have often been disregarded or neglected in terms of research (Caromano et al. 2024; Martins 2021).

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Still, such biocultural collections hold immense potential to reveal local epistemologies, interactions between Indigenous peoples and the forest, broad systems of connection between distinct groups, and stories of the impact of colonialism (Martins 2021). The choices made about the materials that compose body ornaments have a deep connection with Indigenous conceptions of fabrication of the body (Viveiros de Castro 1979), which is dynamic and intertwined with what comes in contact with its surface or adorns it (Lagrou 2013; Miller 2007; Overing 1991). Indigenous ornaments not only contribute to the fabrication of bodies, but also guide their movements. The production and use of body ornaments involve expeditions to collect seeds or exchange them with relatives or other groups (Miller 2007). The paths in search of seeds provide moments of recognition of landscape and territories, of environmental management to promote useful species and the maintenance of sociality among neighboring groups.

Ethnographic collections harbor histories of plants exchanged in local and regional levels and, due to the contact with colonization fronts, artifacts also tell stories of plants that were introduced from faraway lands in a global system of colonial exploitation and imperial expansion (Martins 2021). The study of these artifacts can provide information on how Indigenous perceptions and agency chose to incorporate these new plants into their own worlds. It was only after familiarization and comprehension of reproductive and ecological aspects that these new resources were introduced into wider systems of plant use and into artifactual repertoires essential to the construction of Amerindian bodies (Caromano 2019).

Therefore, we argue that seeds from historical ethnographic collections encapsulate Indigenous plant knowledge and histories of encounters, trade, environmental changes, and colonial influences and that their identification opens a new avenue for museum studies of benefit and interest to the scientific community as well as native stakeholders. The analysis of the multifaceted factors involved in changes or continuities in the selection of seeds for the manufacture of body ornaments is challenging and requires seed identification, which is a significant effort that demands gathering data on the plant species

traditionally used by diverse Indigenous peoples in the composition of their material culture (Caromano 2019).

The identification of the plant material in these ornaments could be a helpful tool in provenance research for South American museum objects, as many Amazonian plant species have a limited distribution range (Hubbel et al. 2008). The identification of seeds or fruit species present in museum objects can provide information on the place where the materials were sourced, and thus probably where the objects were made, which may lead to the cultural identification of their makers (Caromano et al. 2024). In turn, the Indigenous peoples whose ancestors have manufactured the objects can be contacted and included in further research, which may help with ongoing and future efforts to revitalize local knowledge and reconnect to (lost) cultural heritage (Cascon et al. 2025; Fonseca-Cruel et al. 2019).

In the context of the research project *Seeds in Amazonian body ornaments: encapsulated Indigenous histories, aesthetic and environmental knowledge* (Caromano 2019), direct object analysis has been carried out on Indigenous body ornaments from the Amazon, kept in museums in the Netherlands, the UK, and Brazil (Caromano et al. 2024; De Ruiter et al. 2025; Kaki et al. 2023). This project, led by the first author, had a particular focus on objects from the Guianas (Guyana, Suriname, and French Guiana).

The processes of colonization, which introduced a variety of new plant species to the New World (Voeks and Rashford 2012), also resulted in the formation of early Amazonian ethnographic collections, sent first to cabinets of curiosities and later to European museums (Feest 1993). We propose that this long-term process of collecting allows the study of seed ornaments in a diachronic perspective, identifying changes in species selection, but also changes in the availability of certain resources or interruption of access to specific ecosystems (Caromano 2019).

Very little research has been done on seeds and fruits used in Indigenous, Neotropical body ornaments. The Amazon is extremely diverse in plant species, and for many species, the seeds (and sometimes even the fruits) are unknown to science (Draper et al. 2021). For those species that are well-described, the taxonomic literature generally provides good descriptions and

drawings of fruits (e.g., Van Roosmalen 1985), but little visual information, in the form of clear illustrations or pictures of seeds (for an exception, see Cappers et al. (2009) and Cornejo and Janovec (2010). Ethnographers and anthropologists have published extensively on Indigenous material culture in the Amazon, including body ornaments, for example, Roth (1924) and Ahlbrinck (1931) for the Guianas. These studies, however, hardly provide scientific names for the botanical (or zoological) material used to make these artifacts or mention only Indigenous names of plants that have not yet been connected to scientific names by (ethnobotanical) research. Historical explorers in the Amazon were mainly looking for Indigenous knowledge on fibers, precious wood, medicine, dyes and rubber, while modern ethnobotanists have mainly focused on the use of edible and medicinal plants of the Amazon, and to a lesser degree on jewelry (Duke and Vasquez 1994; Odonne 2014). As a result, information in this body of literature on fruits and seeds used in Amazonian body ornaments is scattered and incomplete.

To facilitate current and future research on Amazonian body ornaments and other artifacts with seeds housed by museums, we conducted a literature review on plant species from which the seeds and/or fruits are used as beads in body ornaments made by Indigenous groups or other local peoples throughout the Amazon. With this literature review, we aimed to answer the following research questions:

- 1) Which plant species have yielded fruits or seeds used as beads in Amazonian body ornaments?
- 2) Which of these plant families and genera have the highest diversity in species used?
- 3) Which species are most frequently mentioned in the literature as being used in body ornaments?
- 4) Do species frequently used in body ornaments also reflect their abundance in the Amazon?
- 5) Which Amazonian regions have been frequently studied with regard to body ornaments, and where is research lacking so far?

We constructed a database with scientific and local names, locations, and (Indigenous) peoples from which these body ornaments were studied. We also provide links to visual information on

seeds to enable comparison with seeds and fruits in museum objects. Our geographical mapping of research locations retrieved from this literature review shows where ethnobotanical research on this subject has taken place and where it is missing so far. We hope that our list of seed and fruit species will be helpful in identifying museum objects, archeological vestiges of body ornaments, and for community projects engaged in producing material culture from natural materials. While archaeobotanical research in the Amazon often approach macro-vestiges, especially seeds, from food or environmental perspectives (Caromano et al. 2013; Cassino et al. 2021; Iriarte et al. 2020), our literature survey indicates that some of these seeds may have had quite other uses in the past.

Methods

LITERATURE REVIEW

As we assumed that most taxonomically verified information on Indigenous seed and fruit use would be available in the digitized ethnobotanical literature, we conducted a literature review in Google Scholar and the electronic archives of the scientific journals *Economic Botany*, *Ethnobotany Research and Applications*, *Human Ecology*, *Ethnobiology and Conservation*, *Journal of Ethnobiology*, and *Journal of Ethnobiology and Ethnomedicine*, using the keywords: “seed(s),” “fruits,” “jewel(ry),” “ornament,” “adorn,” “necklace,” “(handi-)craft,” “bead,” “Indigenous,” and “Amazon.” In addition to these keywords, surveyed in English, Portuguese, Spanish, French, and Dutch, we also searched these same literature sources for local and scientific names of fruits and seeds used in body ornaments. Our inclusion criterion was that the publication should mention seeds or fruits used in Amazonian body ornaments. We did not have specific exclusion criteria and did not limit our review to a specific time period (although we stopped in January 2026), and included dissertations and theses. Consultation was extended to books about the general use of seeds for the manufacture of (modern) craftwork in the Amazon, such as Brabé (2015), Dufayard (2010), and Vidal (2011). Our search strategy reached

saturation for those publications that were available online via Google Scholar.

Since the majority of Amazonian Indigenous body ornaments housed in Dutch museums were collected in the early twentieth century in Suriname, a former Dutch colony (De Ruiter et al. 2025; Kaki et al. 2023), we reviewed several anthropological monographs on Indigenous peoples in the Guianas from the same period (Ahlbrink 1931; Crevaux 1883; De Goeje 1904, 1906; Im Thurn 1883; Penard and Penard 1908; Roth 1924, 1929) to verify whether they contained information on seeds or fruits used in the manufacture of body ornaments by Indigenous peoples and other traditional communities. Since the specific focus of our project was on the Guianas, our literature searching strategy had an inherent geographic bias towards this region as well. When seeds and fruits were mentioned only by their local Indigenous or Creole names, we tried to match them with scientific names by consulting the published works on vernacular plant names of Suriname (van 't Klooster et al. 2003) and Guyana (Forte 1996).

LIST OF SPECIES AND ASSOCIATED INFORMATION

We compiled a spreadsheet database with the scientific names and families of seeds and fruits mentioned as used for raw material for body ornaments in the literature. Per reference, we listed the specific material objects, geographic region, and (if mentioned) Indigenous peoples and local names (Supplementary Table 1). When the same plant species was reported as used for beads among the same ethnic group in the same region, we merged the references into one record, citing two references.

We used the geographic delimitation of the Amazon set by RAISG (Amazon Network of Georeferenced Socio-Environmental Information (www.raisg.org)). We updated species names using the database of Plants of the World Online (POWO <https://powo.science.kew.org/>). To check whether a species mentioned in the literature occurred in the Amazon, we used the occurrence data of GBIF (www.gbif.org). GBIF data are based on digitized herbarium specimens. Given the risk of incorrect identifications of Amazonian specimens in herbaria worldwide (Cardoso et al., 2017), the species occurrence

data of GBIF may be inaccurate in some cases, although it is not possible to establish exactly which data. When seeds or fruits of wild plants were used in body ornaments in a certain area in the Amazon, but the species itself did not occur there (no vouchers or observations available on GBIF), we mentioned only the genus, as we assumed that the species was misidentified.

We searched for clear images of seeds (or fruits), preferably in the context of their use in body ornaments, within the retrieved ethno-botanical literature, taxonomic revisions, and specific works on Amazonian seeds in body ornaments (e.g., Cornejo and Janovec 2010). We also searched for online images of seeds, preferably on websites with taxonomically verified collection data, such as those of POWO and GBIF, using the current scientific names and synonyms. If available, we added (online) links to seed images to our spreadsheet database. Information on local domestication status and vegetation types in which the plant species occurred was entered into our spreadsheet only if this was mentioned in the specific literature reporting these seeds and fruits used in body ornaments. We did not enter general information on domestication or natural vegetation types of the different species, as these may differ across the Amazon.

For a visual overview of the research on plant parts used in body ornaments, a map of the Amazon was created with the program QGIS (<https://www.qgis.org>), which included the coordinates of the research locations from the literature (if mentioned) or otherwise estimated locations based on the rivers or towns mentioned in the references or the territories of Amazonian Indigenous peoples: Bulkan (2013) for Guyana, ISA Terras Indígenas no Brasil (<https://terrasindigenas.org.br>) for Brazil, VIDS (<https://vids.sr>) for Suriname, and IWGIA for French Guiana (<https://iwgia.org/en/>).

Results

PLANT DIVERSITY IN BODY ORNAMENTS

In the 54 published works retrieved during our literature survey, we identified a total of 42 plant families, 136 genera, and at least 224 species of which (parts of) the seeds and/or fruits were

reported as used in body ornaments in the Amazon region (Supplementary Table 1). The number of 224 species is a conservative estimate, as many taxa were listed in the literature with their genus or family name only. A total of 19 different local names, of which (largely unidentified) plant parts were used as beads, could not be linked to any plant family. All plant species are listed with the associated information on family, plant part, Indigenous group, geographical location, links to visual information on seeds, and references in Supplementary Table 1. Unidentified seeds are listed at the bottom of the table.

Two families emerged as the most species-rich concerning the supply of seeds for body ornaments: Fabaceae with 69 species and Arecaceae with 57 species, followed from a distance by Burseraceae (7 spp.), Sapotaceae and Cucurbitaceae (each 6 spp.), and Euphorbiaceae (5 spp.). The remaining 36 families were listed with four or fewer species. Species identified to genus level were only counted if no other species of that genus had been reported.

The palm genus *Astrocaryum* stands out with nine different species used as seed sources, followed by other palms in the genera *Attalea*, *Bactris*, and *Oenocarpus* (Table 1). Regarding non-palms, the genera *Ormosia* and *Protium* yielded probably even more species used as beads than reported in this graph, as several publications did not identify the seeds to species level (Supplementary Table 1). González-Pérez et al. (2013), for example, reported that the Kayapó

Indigenous group in Brazil used six different *Ormosia* species, but the authors identified only two of them to the species level. It is possible that in some studies (as, for example, in cases where the authors did not have the possibility to directly analyze or relied on the oral description of the seeds), the similar-looking but smaller seeds of *Abrus precatorius*, also colored red and black, were erroneously identified as *Ormosia* sp.

The dominance of Arecaceae and Fabaceae is also visible in Table 1, with nine genera representing a total of 58 different species. Seeds of the genus *Astrocaryum* were frequently mentioned as source material, but they are often heavily modified and therefore difficult to identify (Caromano et al. 2024; Kaki et al. 2023). The species most often mentioned in the literature (Table 2) probably do not only reflect those that are frequently used in body ornaments, but also those that are the easiest to identify. Examples are the cultivated ornamental trees *Adenanthera pavonina* L. and *Cascabela thevetia* (L.) Lippold, and in particular the widely used Asian grass *Coix lacryma-jobi* L. (Job’s tears), of which the shiny enamel-colored seed is readily converted into a bead by pulling out the dried floral remains, which creates a hole for stringing (Fig. 1). The use of *Cascabela thevetia* in anklets was already reported and illustrated in early seventeenth century for Dutch Brazil and therefore was well known as being used in body ornaments (Alcantara Rodriguez 2023: 78–87).

TABLE 1. THE MOST DIVERSE GENERA REPORTED AS YIELDING BEADS FOR AMAZONIAN BODY ORNAMENTS AND THE NUMBER OF REFERENCES MENTIONING SPECIES IN THESE GENERA

Genera	Number of species	Number of references
<i>Astrocaryum</i>	9	22
<i>Ormosia</i>	8	16
<i>Attalea</i>	6	16
<i>Protium</i>	6	6
<i>Erythrina</i>	6	8
<i>Bactris</i>	6	6
<i>Cayaponia</i>	4	5
<i>Oenocarpus</i>	4	6
<i>Mucuna</i>	4	10
<i>Parkia</i>	4	5

TABLE 2. PLANT SPECIES MOST OFTEN MENTIONED IN LITERATURE AS YIELDING SEEDS AND FRUITS USED IN AMAZONIAN BODY ORNAMENTS

Species	Number of references
<i>Coix lacryma-jobi</i> L	17
<i>Cascabela thevetia</i> (L.) Lippold	13
<i>Attalea maripa</i> (Aubl.) Mart	11
<i>Astrocaryum tucuma</i> Mart	9
<i>Sapindus saponaria</i> L	9
<i>Adenanthera pavonina</i> L	9
<i>Canna indica</i> L	8
<i>Iriartea deltoidea</i> Ruiz and Pav	7
<i>Socratea exorrhiza</i> (Mart.) H. Wendl	7
<i>Hymenaea courbaril</i> L	6



Fig. 1. Examples of Indigenous body ornaments made with native Amazonian and introduced seeds. **a** Tikuna necklace with *Coix lacryma-jobi* seeds and *Astrocaryum* sp. endocarps cut in zoomorphic shapes, Upper Solimões River. National Museum of Indigenous Peoples, Brazil (inventory number 11.2.18). **b** Palikur necklace with seeds of *Canna* sp., *Ormosia* sp., *Coix lacryma-jobi*, and *Cardiospermum halicacabum*, Oiapoque River. Museum of Archaeology and Ethnology of the University of São Paulo, Brazil (inventory number RG 1997/186). Photographs: Caroline Fernandes Caromano

This identification bias in historical ethnographies can distort our current understanding of traditional ecological knowledge, potentially obscuring the use of more cryptic or rare species in body ornaments.

LACK OF TAXONOMIC DESCRIPTIONS AND VISUAL DATA

With c. 14,003 seed plant species, the Amazon forest harbors an exceptional floristic diversity. Still, many plant species remain undiscovered or insufficiently described by taxonomists, and herbaria worldwide have a high percentage of incorrectly named specimens from the Amazon (Cardoso et al. 2017). It was challenging to find good images of the Amazonian seeds reported as used for beads in the literature. For many Amazonian species, clear illustrations of fruits and seeds are lacking. For example, we could not find clear images of the seeds from *Tabernaemontana cuspidata* Rusby, *Cyperus corymbosus* Rottb., *Erythrina amazonica* Krukoff, *Leptolobium nitens* Vogel, *Ormosia amazonica* Ducke and *Ocotea floribunda* (Sw.) Mez (Supplementary Table 1). During botanical field studies, separate seeds are not always collected, and botanical drawings of Amazonian fruits often lack seeds

(Cornejo and Janovec 2010). An exception is the book series on Brazilian trees by Lorenzi (2020, 2021, 2022), which contains excellent pictures of seeds for every species. Despite the large-scale digitization of herbarium specimens, publicly available via GBIF and POWO, seeds are hardly visible in these images as they are hidden in closed envelopes on the sheets or remain undigitized in carpological collections. Taxonomic descriptions sometimes mention “seeds used in arts and crafts,” but often without further (visual) details.

Botanists are keen on collecting specimens that contain leaves, flowers, fruits, and seeds, but hardly collect seeds without other botanical material attached. The pictorial guide on Amazonian seeds of Cornejo and Janovec (2010) contains good images, but mentions genus names only. Illustrated books on Amazonian edible fruits hardly contain clear pictures of seeds (e.g., Smith 2023). Popular websites like palmpedia (<https://palmpedia.net/wiki/index.html>) often have good images of all palm parts, but no taxonomic literature is provided to verify their identifications.

Some research has been done on Indigenous body ornaments kept in museum collections, such as the necklaces, belts, aprons, and ear and arm ornaments housed by the Carnegie Museum

of Natural History (CMNH) described by Harding (2003). However, her focus was on beads of animal origin, so the plant species included in the material culture were often left unidentified. According to Harding (2003: 53), this was because “Most beaded items contain botanicals—seeds, nuts, and beans, and the occasional bamboo tube. It has been very difficult to identify the plant origins for many of the seeds and nuts, mostly because botanists do not consider them important in the classification and identification of the plants, and may collect in the wrong season for fruit.”

There may be misidentifications in the list of 224 plant species that we retrieved from literature, as few of the studies we retrieved from literature based their identifications on botanical vouchers. Even if specimens were collected of plants that yielded beads, and were deposited in a herbarium so that verification was possible (e.g., González-Pérez et al. (2013) on Kayapó handicrafts), several of the species reported by the authors could not be identified. This resulted in 19 “indets” on the bottom of our species list (Supplementary Table 1). Many ethnobotanical studies we retrieved provided reliable species information, but almost none provided images of the seed beads. On the other hand, the popular books on Amazonian fruits and seeds used in modern jewelry and handicrafts (e.g., Brablé 2015; Dufayard 2010; Vidal 2011) contain good images of seeds, but they do not mention how species were identified and provide no references to specific Indigenous groups using those species. Geographical locations are also vaguely indicated (e.g., “tropical America,” “the Amazon”), and images lack legends and sometimes scientific names. Therefore, the taxonomic information in these works is difficult to verify.

UNCLEAR PLANT PARTS

Several ethnobotanical studies did not list the specific plant parts involved in the making of body ornaments. Sometimes, we could extrapolate this through other literature sources which mentioned the use of seeds or fruits of the same species. Species like *Cyperus corymbosus* Rottb. (Balée and Gély 1989) and *Miconia* sp. (Lizot 1988) have such small seeds that they are difficult to use as beads, while those of the tree *Aspidosperma* spp. (Dufayard 2010) are thinly

winged and also seem unfit for jewelry. We did include some of these doubtful species in our analysis, as we did not have evidence that parts other than seeds or fruits were used.

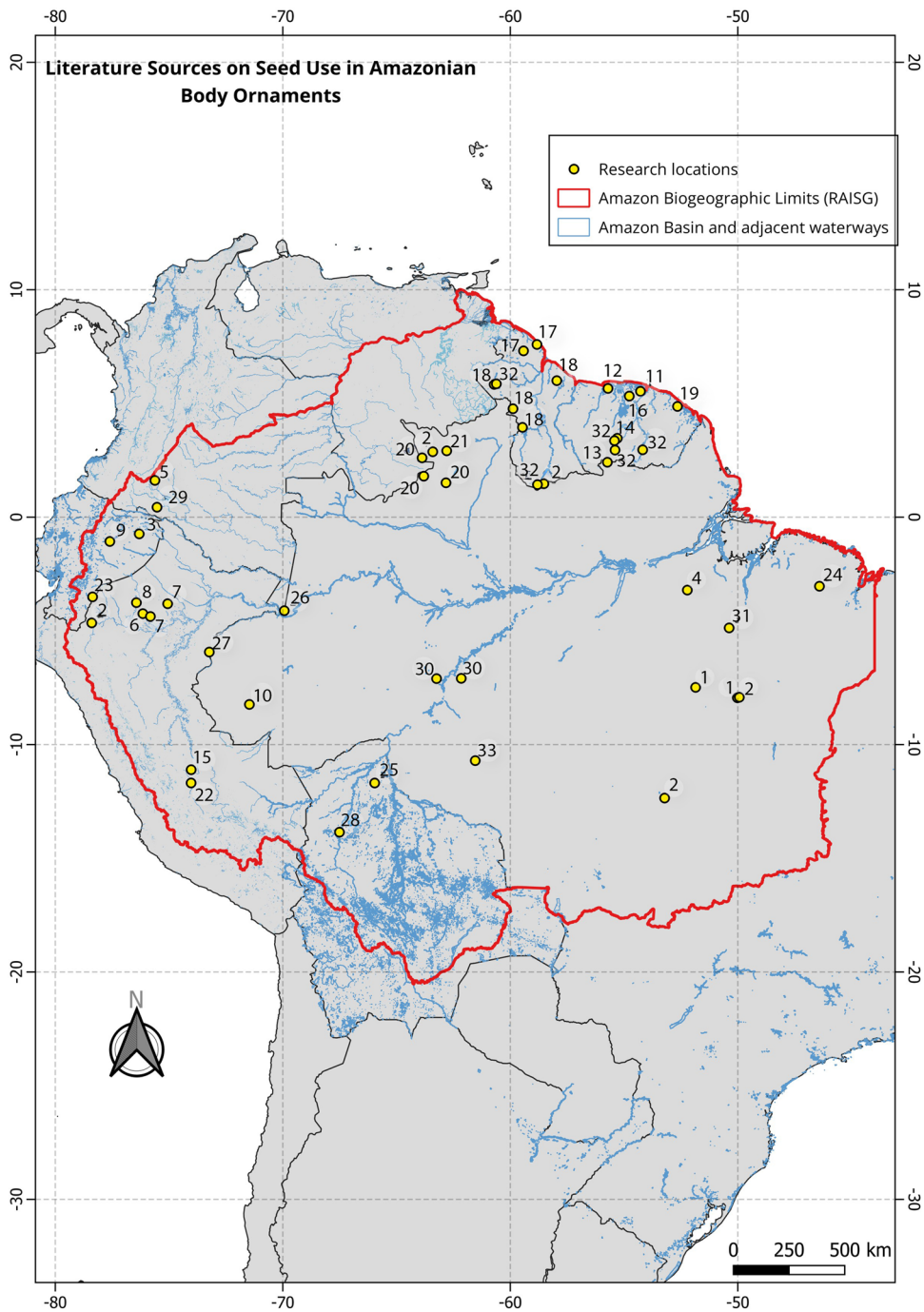
The Malvaceae species *Eriotheca globosa* (Aubl.) A. Robyns and cultivated cotton (*Gossypium barbadense* L.) were mentioned as used in ‘personal adornment’ in Bolivia (Boom, 1989) and Brazil (Balée and Gély 1989). Since no further details were provided and both species produce fruits that contain many fibers, we assumed these were used to spin thread and therefore left them out of our analysis. For many palm species, “seeds” are mentioned as the used material in literature, while it is probably the bony endocarp that is carved into beads. We have copied the plant part as indicated in the literature, also because most studies did not provide pictures of the beads mentioned.

OTHER PLANT PARTS EMPLOYED IN BODY ORNAMENTS

Occasionally, references were made of leaves and inflorescences included in body ornaments, such as the necklaces of the Tacana in Bolivia that consisted of leaves of *Anthurium oxycarpum* Poepp. and inflorescences of the small palm *Chamaedorea angustisecta* Burret, both chosen for their fragrance (Bourdy et al. 1999). Harding (2003) mentioned the use of (unidentified) tubers as necklaces by the Yanomami to increase their sexual desirability. We have left out these and other ornaments that were explicitly mentioned to be made from wood, stems, fibers, roots, leaves, or flowers from our analysis. Still, this subject merits research. The same may be said for the string material of body ornaments, as more than the standard cotton fibers are used to weave ornaments, such as threads of several wild and cultivated Bromeliaceae, palm fibers, and rhizomes of ferns in Ecuador (de la Torre et al. 2008).

DISTRIBUTION OF RESEARCH ACTIVITIES

Although we have not been able to retrieve all research locations from the published literature, as many did not provide coordinates, our literature review shows that most research has taken place in Ecuador, northern Peru, and the Guianas, with large parts of the Central Amazon not



yet covered by research (Fig. 2). While in Peru, several papers were based on voucher collections (e.g., Soler Alarcón and Peixoto 2008; Sosnowska et al. 2015), most studies in the Guianas

were ethnographic and hardly provided yet any plant identifications. Therefore, a dot on the map does not mean that the particular area has been sufficiently covered by sound ethnobotanical

◀ **Fig. 2.** Locations in the Amazon region where research has been done on seed or fruit species used in Indigenous body ornaments. Literature sources: 1. González-Pérez et al. (2013); 2. Harding (2003); 3. Céron et al. (2010); 4. Campos and Hamada (2014), Oliveira et al. (2014), Barbosa et al. (2018); 5. Frausin et al. (2008); 6. Balslev et al. (2010); 7. Perrault-Archambault and Coomes (2008); 8. Soler Alarcón and Peixoto (2008); 9. Anderson (2004); 10. Campos and Ehringhaus (2003); 11. Ahlbrink (1931); 12. Hensen (1892); 13. De Goeje (1904, 1910); 14. Crevaux (1883); Hoffman (2009); 15. Sosnowska et al. (2015); 16. Penard and Penard (1908); 17. Van Andel (2000); 18. Roth (1924, 1929); 19. Dufayard (2010), Brablé (2015); 20. Milliken et al. (1999); 21. Lizot (1988); 22. Caromano et al. (2013); 23. Bianchi (1982), Pohle and Reinhard (2004), Vera (2012); 24. Balée and Gély (1989); 25. Boom (1989); 26. Cadena Vargas et al. (2007); 27. Fleck-Zuao et al. (2012); 28. Bourdy et al. (1999); 29. Lechter de Furmanski et al. (2015); 30. Nimuendajú (1948a); 31. Nimuendajú (1948b); 32. Kaki et al. (2023); 33. Molina et al. (2025)

studies based on verifiable herbarium collections. Sometimes a specific location was subject of research more than once, for example, the craft market at the Brazilian town of Altamira, in the state of Pará (Barbosa et al. 2018; Campos and Hamada 2014; Oliveira et al. 2014). When the same species were reported, and very likely to be used by the same people, we combined the references into one row in our database (Supplementary Table 1), and counted them as one in our analysis of the number of references mentioning the use of a certain species.

We are aware that our literature review must have missed research that has not been published in ethnobotanical journals and/or was not indexed in Google Scholar. Grey literature about seeds used in body ornaments may exist for areas not covered in our map, such as southern Venezuela, southeast Colombia, or areas along the Amazon River. Much information on Indigenous body ornaments probably remains “hidden” in ethnographic monographs that are not yet digitized or available online, listing seeds by their local (Indigenous) names. Our study presents a larger number of ethnographic references from the Guianas than from other Amazonian areas, reflecting our research focus in the region. The fact that the Central Amazon is least covered by research on the use of seeds for body ornaments is curious. This may be due to an inaccessibility to certain areas distant from the main course

of the Amazon River and its larger tributaries. However, the absence of data for the area near the main rivers in the Central Amazon was unexpected, since it is generally well-covered by other researchers and research institutes, such as the INPA (the National Institute of Amazonian Research in Manaus). Possibly, additional information on seeds in body ornaments is present in publication formats not retrieved by our survey, such as unpublished reports or articles in non-indexed journals and books.

BIAS OF ETHNOBOTANICAL STUDIES

Several large-scale studies have been done on useful plants in Amazonian countries, but the older publications hardly mention the use of seeds for body ornaments, such as the Manual of useful plants of Venezuela (Pittier, 1926), or are organized by species and do not present an index which would allow searching for specific uses, such as the six-volume dictionary of useful plants of Brazil (Pio Corrêa, 18774-1934). Some studies mentioned seeds used for “crafts,” without specifying the type of object (e.g., Barbosa et al. 2018; Campos and Hamada 2014). As these authors either defined most crafts as “biojewelry” or added pictures of the crafts, we did include the seed species mentioned. Herbarium specimens hardly ever mention the use of seeds for body ornaments on the label or digitized associated documents, with a few exceptions, such as Timothy Plowman’s collection of *Cayaponia capitata* Cogn. along the Río Ampiyacu in Peru (<https://www.gbif.org/occurrence/1823418131>), of which the label reads: “Chacapa-seeds dried and sliced in half to make beads for dancing necklaces, mostly worn around the ankles.”

BIAS OF ANTHROPOLOGICAL STUDIES

Indigenous body ornaments have been of great interest to anthropologists active in the Guianas in the late nineteenth and early twentieth century, such as Crevaux (1883), De Goeje (1904, 1906), Im Thurn (1883), Penard and Penard (1908), Roth (1924, 1929), and missionaries interested in ethnology, such as Ahlbrink (1931). Their monographs contain detailed descriptions and images of Indigenous peoples in traditional clothing and body ornaments, but hardly provide

scientific names of the plants associated with this materiality. The British explorer Everard im Thurn, famous for his work *Among the Indians of Guiana* (1883), produced elaborate drawings of Indigenous material culture but did not mention a single seed species used. Some ethnographers, like Walter Roth, were aware of this gap in their scientific knowledge. “In my own wanderings through the Arawak, Warrau, Wapishana, Patamona, Makusi, and Arekuna country, I have observed dozens of different kind [*sic*] of seed - large and small, black, brown, and red, threaded into necklaces, etc., but, unfortunately, have had no means of scientifically identifying any of them” (Roth 1924: 434–435).

Apparently, the ethnographers were not able or, in some cases, not interested to seek external botanical expertise to identify the plant species used in the Indigenous material culture. Anthropologist Claudius de Goeje, who collected large numbers of Indigenous artifacts made from seeds in southern Suriname (De Goeje 1904, 1906), took part in Dutch expeditions that included a botanist (G.M. Versteeg), but none of the scientists showed interest in registering Indigenous plant uses (De Ruiter et al. 2025).

Of the 122 local names that we could not link to a family name, ten came from these ethnographic works (see bottom of Supplementary Table 1). The Indigenous plant names, documented a century ago, may have gone out of use, but for some languages (e.g., Trio, Wayana, Arekuna), very little ethnobotanical knowledge has yet been published. For ten local names documented by Roth (1924, 1929), we were able to find a (tentative) scientific name in the extensive literature on vernacular plant names in the Guianas, but also by using our own database on plants used in body ornaments. Some ethnographic works (e.g., Ahlbrink 1931; Roth 1924) provide exhaustive descriptions and drawings on the manufacturing process of objects and contain images of Indigenous individuals with body ornaments, but details of the seeds cannot be seen on their photographs. In some cases, hard copies of these older ethnographic monographs are difficult to access, and if online versions are available, the images are not provided in high resolution.

Several of the collections made by these ethnographers are nowadays housed at museums in Europe and the Americas. The Dutch National

Museum of Ethnology has digitized its collections and published them online (<https://collectie.wereldmuseum.nl/>), which greatly facilitates the selection and initial investigation of Amazonian seeds used in Indigenous artifacts from the Guianas and other areas of the Amazon, posteriorly refined by the direct analysis of the objects (Caromano et al. 2024; De Ruiter et al. 2025; Kaki et al. 2023). The online collections of the British Museum (<https://www.britishmuseum.org/collection/>), the Museum of Archaeology and Ethnology of the University of Sao Paulo (<https://mae.usp.br/acervo-on-line/>), and the Brazilian National Museum of Indigenous Peoples (<https://tainacan.museudoindio.gov.br/>) are also digitized and have undergone the same processes of prior virtual analysis and preliminary identification of possible species, followed by subsequent direct analysis of selected ornaments. The Walter Roth Museum in Georgetown (Guyana) and the Surinaams Museum in Paramaribo (Suriname) also house considerable collections of Indigenous body ornaments, among which body ornaments collected by Roth himself, but they have neither digitized their collections nor made their catalogs publicly available.

NOT “JUST” AN ORNAMENT

The ethnographic literature surveyed often mentioned that body ornaments did not only have a decorative function. Penard and Penard (1908: 96) observed that “Surinam Carib children prefer to wear jaguar teeth around their neck, which brings them under the protection of this animal’s spirit.” Roth (1924) mentioned that Atorai and Wapishana parents tended to tie animal teeth around their children’s necks to make them good hunters. He also reported that “Caribs and Wapishana also make necklaces out of aromatic seeds as a cure or preventive for cough, cold, and fever” (Roth, 1924:433). Other aromatic seeds (probably of *Ocotea floribunda* (Sw.) Mez) were made into jewelry to drive away evil spirits (Penard and Penard 1908). Cofán people in Ecuador strung the aromatic fruits of *Eugenia* species into necklaces to use as body perfume (De la Torre et al. 2008).

The red-and-black seeds of *Abrus precatorius* L. were probably introduced to South America by enslaved Africans who had these poisonous

seeds hidden in amulets tied to their bodies to protect themselves against evil powers (McClure 1982). A handful of ground seeds of this vine is sufficient to poison a person (van Andel and Ruysschaert 2011). Therefore, carrying some *A. precatorius* seeds around in a body ornament or amulet may thus indeed be useful in case of extreme emergency.

NOT ALL BODY ORNAMENTS ARE INDIGENOUS

According to Roth (1924:1924 439), Indigenous Peoples learned to make finger rings from Afrodescendants in French Guiana and Suriname. Very little is known about the historic exchange of ethnobotanical information between Indigenous peoples and enslaved Africans in the Guianas (Price 2010; Van Andel et al. 2012). Some of the artifacts in museums that are labeled as “Indigenous” may have been manufactured by other or non-Indigenous peoples, and it is therefore necessary to consider that colonial contexts of encounters and exchanges between different peoples in some cases have resulted in convergences in material culture (White 2015).

According to Benjamins and Snelleman (1914–1917), necklaces from *Omphalea diandra* L. seeds were made only by Indigenous peoples and sold for a good price in the Surinamese capital Paramaribo. In the early 1900s, Creoles from Albina (coastal Suriname) and prisoners in the nearby town of St. Laurent du Maroni (French Guiana) started manufacturing and selling these necklaces. While urban populations were copying and selling the material culture of Indigenous peoples, trade networks of beads (e.g., *Abrus precatorius*) and bead ornaments went in the opposite direction: from cities to the Amazon forest. When describing the unidentified “aruwepe” seed beads, Ahlbrink (1931:105) mentioned: “The French make necklaces of the very small black seeds of this shrub, which are much appreciated by the Caribs of the Maroni River.” Two other ethnographers, the Penard brothers, mentioned “strings of arowepi, which were manufactured from the bones of a sawfish with the local name *krarien*, or, as they say, of the bones of [Dutch] soldiers killed by the Maroons; these are called *wit-arowepi* but are no longer used” (Penard and Penard 1908:95). When constructing our database, we found in the literature (van ‘t Klooster et al. 2003) that the

Carib name “aruwepe” was linked to the introduced Asian grass *Coix lacryma-jobi*, although the seeds are medium-sized and grey instead of small and black and the source plant is an herb instead of a shrub. It seems as if the seeds of this widely available grass species have replaced beads made out of sea creatures such as shells and sawfish (probably *Pristis perotteti*), but also beads manufactured from terrestrial animal bones. The durable seeds of the abundantly available (and easy to grow) weedy grass *Coix lacryma-jobi* already have a hole and do not need to be pierced, and have a similar grayish-white, enamel-like sheen that is reminiscent of shells or animal bones. These are but a few examples of why observations by ethnographers are important to consider during provenance research on body ornaments and material culture, of which many times insufficient information is held by museums.

Today, there is a regional production of seed ornaments focused on the tourist market in the Amazon. Seed ornaments are not only made by Indigenous peoples, but also by other local artisans, and seem to appeal to an idea of authenticity and connection with the nature by including seeds and natural fibers in the composition of the objects. This can be seen in the examples shown in Dufayard (2010), Vidal (2011), and Barbosa et al. (2018) that suggest a “rusticity” that does not necessarily correspond to the composition of body ornaments used by Indigenous peoples and traditional communities today.

NOT ALL SEEDS ARE LOCALLY SOURCED

Seeds used as beads do not necessarily grow in the same locations as the Indigenous people who once made and wore the body ornaments reside. Around 1806, the British lieutenant Thomas Staunton St. Clair (1834: 273) admired a necklace of an Arawak man near the Courantyne River (Guyana) with “seeds of a brown color which were perfumed, though so sweet to be agreeable and understood to be the ‘kishei’, difficult and rare to obtain, as they can only be had a great distance up the country.” We do not know the plant species the author was referring to, or whether the information on its distant acquirement was related to a strategy by this Arawak man in wanting to sell his kishei necklace for a higher price, but trade between

Indigenous groups has always been common, and rare seeds may have been part of it (Lar-ranaga et al. 2021). For example, in Guyana, Roth (1924: 393) reported that “Such cotton hammocks I saw with the Makusi on the Brazilian side of the Ireng River. They receive them in barter for beads from tribes, so they told me, living farther to the westward.” Although it is unclear whether Roth mentioned seed beads or European glass beads here, both were likely to be traded over long distances. A lack of knowledge of the material from which particular beads were made could be used by the trader to raise the price of an ornament. De Goeje (1910:26) reported that “during their barter with the Trio, the Saluma tell them that the glass beads that they are selling grow on bushes that they themselves plant.”

The exchange of plants is a form of reaffirming social bonds with family members and allies living in distant Amazonian territories (Machado 2012), which can also include seeds and seed beads, as well as complete body ornaments. During field research conducted by the first author among the Indigenous Tenharim in the Brazilian Amazon, a necklace originally made by another Indigenous group was proudly displayed by one of the Tenharim leaders. He explained that the necklace was obtained through an exchange with an ally during the national meeting of Indigenous peoples in Brasília (Acampamento Terra Livre).

Discussion

RARE AND ABUNDANT SPECIES

The information on the 224 Amazonian plant species that yielded seeds or fruits used in body ornaments was scattered among many publications, and most of these either lacked verified taxonomic information, clear images of seeds and/or artifacts, specifications on plant parts used, ethnic groups involved, or geographic locations. Some seed species and localities we reported may be overrepresented when various researchers had studied the same locality, such as the Altamira market (Campos and Hamada 2014; Oliveira et al. 2014). Although only a fraction of the Amazon was covered by the 54 publications we queried on this subject, the

high number of species (≥ 224) and plant families (42) suggests that a much larger diversity is currently used or has been used in the past. The widespread use of seeds of Arecaceae and Fabaceae, both the most abundant and the most diverse families in the Amazon (ter Steege et al. 2013), reflects the general floristic diversity and forest composition in the region. Moreover, Arecaceae and Fabaceae seeds are often hard and resistant to deterioration, so suitable for beads (Barbosa et al. 2018). Several of the species used in body ornaments (e.g., *Euterpe precatoria* Mart., *E. oleracea* Mart., *Oenocarpus bataua* Mart., *Iriartea deltoideia* Ruiz and Pav., *Socratea exorrhiza* (Mart.) H. Wendl., *Astrocaryum murumuru* Mart., and *Hevea brasiliensis* (Willd. ex A.Juss.) Müll. Arg.) belong to the so-called hyperdominants in the Amazon tree flora (ter Steege et al. (Ter 2013): widely distributed species that occur in large quantities. Identifying seed beads of these hyperdominant species in body ornaments which lack provenance data is thus of little help in pinpointing their geographic origin. On the other hand, being dominant, widespread, and having suitable seeds for beads does not automatically mean that Indigenous peoples will include a species in body ornaments. For example, seeds of the pioneer tree *Didymopanax morototoni* (Aubl.) Decne. & Planch., very widespread in South America (<https://www.gbif.org/species/3038523>), are only reported as beads in Suriname, French Guiana, and the Brazilian city of Altamira (Campos and Hamada 2014; de Campos and Vidal 2011; Hoffman 2009). Other species-rich and widespread families like Rubiaceae, Myristicaceae, Violaceae, and Chrysobalanaceae (Draper et al. 2021) are (almost) completely lacking from the literature, probably because their fruits and seeds are considered not aesthetically attractive or suitable for beads. Another reason for their absence in the studies we analyzed could be that their seeds are difficult to identify on family level.

Most Amazonian tree species are extremely rare (Draper et al. 2021). Body ornaments that contain seeds or fruits of uncommon species with limited distributions would in theory be good candidates for provenance research, but one should be aware of the possibility of inter-regional exchanges, which need to be evaluated in combination with other characteristics of the material culture and context. Unfortunately,

these rare species are often insufficiently collected, described, and photographed by botanists (Cardoso et al. 2017). During the digitization of herbaria, more attention should be paid to photographing seeds in carpological collections or in the envelopes attached to herbarium sheets, and providing high-resolution images of these seeds online. More taxonomic attention for the seeds of rare Amazonian species is also needed to fill this gap in information.

TRADITIONAL VS. MODERN USE OF SEEDS IN BODY ORNAMENTS

Most ethnobotanical studies we reviewed were quite recent (from the 1980s onwards) and thus largely reflect the current knowledge of seeds and fruits used in body ornaments, both for personal adornment (e.g., Cadena Vargas et al. 2007; González-Pérez et al. 2013) and for the tourist industry (e.g., Dufayard 2010; Oliveira et al. 2014; Vidal 2011). The ethnographic works we studied were published around 1900. Several body ornaments described and collected by these ethnographers are housed in museum collections, but most of them are no longer manufactured or worn. However, the use of necklaces made with seeds can also be a recent phenomenon. According to Milliken et al. (1999: 109), using seeds to make necklaces was a new fashion among the Yanomami in Watoriki (Brazil), inspired by contacts with other Indigenous groups and an incipient craft trade. The seeds of *Coix lacryma-jobi* were a recent introduction and did not yet have a Yanomami name.

The manufacture of material culture is dynamic and cultural preferences that determine whether seeds are considered to have aesthetic and other desirable qualities to be part of body ornaments can change over time. Direct studies of historical body ornaments housed in museum collections could reveal change and permanence of plant selection patterns over time are still scarce (Caromano et al. 2024; Fonseca-Cruel et al. 2019; Harding 2003). Descendants of the groups that once made body ornaments may not even recognize the museum objects anymore. Knowledge about specific plant species that once were sourced for the manufacture of beads may still be present, but memories of the ornaments and the skills to make beads may have gone lost. Collaborative research with communities

of origin in museum collections have demonstrated how the contact with historical material culture can reactivate ancestral memories about materials that are no longer used and old manufacturing techniques (Tupinambá 2022).

SEEDS VS. GLASS OR PLASTIC BEADS

With the expansion of European colonialism in the Amazon, glass beads were introduced among the Indigenous peoples of the region. These imperishable beads were quickly adopted through processes of translation and aesthetic resignification (Lagrou 2013). In combination with or replacing seeds in the composition of body ornaments, these materials found fertile ground in the Amazon, since necklaces, bracelets, and other ornaments with beads made from seeds, bones, and teeth were already so important to diverse native peoples. Historical ethnographic and photographic collections provide a good record of this widespread introduction and adoption. Already in the early 1900s, when anthropologists collected Indigenous body ornaments for museums, they observed that seeds were being replaced by industrially manufactured glass beads. “As a general rule, women will load themselves with astonishing quantities of [...] European beads in great ropes around their neck, across the shoulders, around the waist, arms, wrists, calves and ankles” (Roth 1924: 433). In southeast Guyana, Guppy (1958) saw how missionaries in Waiwai territory tried to “educate” the Waiwai to let go of their traditions and crafts, by making them “addicted” to glass beads and other Western goods. Although glass beads have been adopted since the first contacts, access to them by Indigenous peoples was limited and depended on exchange and trade with non-Indigenous actors. From the second half of the twentieth century, plastic beads began to be produced on a global scale and, from the 1970s onwards, they started to be incorporated into Amazonian body ornaments (Silva 2013). Buttons and glass and plastic beads had important criteria for substitution of the natural material: morphological similarity to certain seeds, accessibility and durability, and less labor-intensive in their production.

While many Amazonian peoples have adopted glass beads buttons, and later plastic beads, into their aesthetic corpus of body ornaments, the manufacture of ornaments with seeds has been

gaining more importance in the tourist market. Although body ornaments made with glass or brightly colored plastic beads are preferred by some Indigenous groups for reasons such as price, durability, practicality, and color, tourists tend to perceive material culture made with natural raw materials as “more authentic” and therefore more desirable (see, for example, O’Driscoll (2015: 233) about the Shuar, and Milliken et al. (1999: 109) about the Yanomami perspective).

Plastic has even reached “uncontacted” Indigenous peoples, or groups that live in voluntary isolation, like the Brazilian Akuntsu, who shaped plastic bottles and buckets found around their territory into beads, in substitution for their traditional shell necklaces (Carelli 2009; Mendes 2005). Some groups also use plastic to “reinvent” their material culture. When the Brazilian Asurini were asked why they replaced the monkey teeth in their necklaces with “perfect reproductions” cut from white PVC pipes, they said that the old necklaces required exhaustive work to obtain the animal’s teeth. Moreover, they became yellow over time. PVC necklaces, besides being made with readily available raw materials, were also easy to maintain and durable, as they could be washed with bleach or laundry detergent to keep them “always white and beautiful for the party,” and they were “lighter for dancing.” For the Asurini, the aesthetic effect was the same, and they used them in ritual contexts without any distinction from traditional necklaces. Interestingly, they did not sell these plastic bead necklaces because according to them, “white people only want to buy the real Asurini necklaces” (Silva 2013: 738–740). When exotic material like glass beads, buttons, or plastic can be incorporated into a native classification system and, in some cases, be more effective in their function as part of an ornament than seeds or teeth, one may wonder what is real traditional material.

LIMITATIONS OF THIS STUDY

We realize that our literature review must have missed many references, such as “grey literature” published in Amazonian countries and not digitized nor indexed in Google Scholar. Ethnographical monographs and missionary documents on Indigenous peoples of the Brazilian

Amazon and the Spanish-speaking countries were not retrieved during our literature survey, but may also contain (vernacular) names of fruits and seeds used in body ornaments. Even for the Guianas, for which ample literature on vernacular names is available, it was often impossible to match some vernacular names with scientific ones, due to differences in spelling or unclear information about the language of the vernacular. Some languages may have gone extinct, and for Indigenous languages like Wayana, Arekuna, or Trio, very little plant names and uses have been documented. For the vast territories of the Brazilian Amazon, information on Indigenous plant names used in body ornaments with taxonomic identifications is rare, as most existing works focused on a few species.

APPLICATION OF GENERATED KNOWLEDGE

Many Indigenous body ornaments from the Amazon are kept in museums worldwide that have not yet digitized their collections or only made them partially available online. Examples are the Walter Roth Museum of Anthropology in Georgetown (Guyana), the Surinaams Museum in Paramaribo (Suriname), the Carnegie Museum in Pittsburgh (USA), and the Emílio Goeldi Museum in Belém (Brazil). Such museum collections form a valuable resource for biocultural conservation, preserving and enhancing traditional knowledge, livelihoods, and the environment (Fonseca-Cruel et al. 2019). The botanical identification of seeds in artifacts can reveal aspects on the management and cultivation of native species and the introduction and adoption of exotic species. Therefore, we propose that study of the encapsulated knowledge present in body ornaments can make an original contribution to the fields of Ethnobotany and (Human) Ecology.

Creating digital access to these biocultural collections facilitates the integration between social, historical, biological, and Indigenous knowledge systems, although this remains a major challenge (Martins 2021). Reconnecting the museum objects with the peoples and places from which they originated can reactivate and revalorize past and present knowledge (Martins 2021). Future research on these collections should ideally be done through participatory methods that allow institutional researchers and

Indigenous communities to share data on ethnobiological collections and artifacts, enabling new knowledge of plants and peoples from multiple perspectives (Fonseca-Cruel et al. 2019).

As several ethnographers (e.g., Ahlbrink 1931; Roth 1924) give detailed descriptions and drawings of how the artifacts such as seed bead aprons were weaved, these could be reproduced once the botanical components have been identified. Local NGOs could use the information generated by this literature review to organize workshops with Indigenous groups to exchange knowledge and to commemorate and value ancestral knowledge for the manufacture of body ornaments (Cerón et al. 2010). Although many Indigenous groups already make a living by selling body ornaments and other craftwork to tourists, often made from a combination of natural and plastic beads (e.g., Barbosa et al. 2018), the manufacture of “historic” Indigenous material culture could be a valuable income-generating activity for Indigenous peoples in ecotourism projects while in the meantime valorizing Indigenous knowledge and strengthening cultural identity.

Conclusion

Our literature review of 54 published works yielded 42 plant families, 134 genera, and at least 224 Amazonian plant species employed in the manufacture of Indigenous body ornaments. Fabaceae and Arecaceae were the families that provided the most species useful to manufacture beads, but *Coix lacryma-jobi* and *Casabela thevetia* were most often mentioned. The majority of research was done in Peru, Ecuador, and the Guianas, while the Central Amazon received much less scientific attention. Good digital images of body ornaments and the seed species used to manufacture them are scarce. While ethnographic works often lack scientific names for the plant species used, (ethno-)botanical studies often lack information on seeds used for body ornaments. Our survey also shows that material culture is dynamic: beads made out of seeds, fruits, shells, teeth, or bones may be replaced if industrial material is morphologically similar, easier accessible, and (more) durable. Although certainly incomplete with regard to species diversity and geographical coverage,

our literature review has produced a useful overview of Amazonian species employed in body ornaments and can be helpful in future material culture studies, provenance research of museum objects, and archeological studies.

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Author Contribution

CFC carried out the literature survey, CFC and TvA constructed the database, CFC selected and produced the photographs, WDK made the map, photographed and identified many seeds for his MSc project, TvA identified additional seed species in the database CFC and TVA wrote the manuscript text. All authors reviewed the manuscript.

Data Availability

All generated data for this literature review are published Open Access with the published paper.

Declarations

Competing Interests The authors declare no competing interests.

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