Perceptions of Producers of Small Wooden Objects in Brazil's Central-West Region about Highlighted Attributes of Nine Species from the Caatinga Biome

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Abstract

Brazil has regions where the potential for wood supply is substantial and the lack of knowledge about forest species becomes a possible barrier to its acceptance, as is the case of the wood from the Caatinga biome. This research aims to identify the highlights attributes of wood from this biome in the perception of producers of small wooden objects as a premise for market studies. For this purpose, nine species of this biome were used as study objects for exploratory research with semistructured interviews and use of word cloud and similarity analyses with the IRAMUTEQ software. As a result, it was found that, in the perception of the producers, Caatinga biome species have peculiarities with the ''color'' aspect of the wood, which is the attribute considered important in adding value to products and, moreover, making it possible to group the woods according to their subjective peculiarities. It was found that a more effective participation of little-known species and an increase in demand due to greater acceptance in the market could enable the use in association with and/or as a replacement for traditional woods. In addition, the analysis of qualitative data with IRAMUTEQ is still incipient in the scientific forestry area; the present research contributes methodologically, demonstrating that its use increases the rigor of the investigation and the identification of prominent attributes of wood species, specifically those of the Caatinga studied, as alternatives for the market beyond firewood and charcoal.

Introduction

Brazil has a vibrant timber forest market that has contributed to Brazilian commercial balance (De Sousa et al. 2010). The importance of the wood sector in Brazil is mainly represented by solid wood, paper, furniture, and cellulose, products that contribute to the national economic scenario and Brazilian agribusiness, and represented by the forest industry with 4.7 percent of the national gross national product (Ribaski 2018).

Among six Brazilian biomes (Fig. 1), the Amazon has the biggest visibility in the market (Farani and Oliveira, 2019). However, the country has other regions with high potential for wood supply; the lack of knowledge about the forest species is one of the potential barriers to its acceptance.

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Figure 1.—Brazilian biomes.

Although the forest-based industries consume a large volume of wood, mainly from species of the *Pinus* and *Eucalyptus* genera, a significant part of the consumed wood has its origin from native forests (Teixeira et al. 2009; Souza, 2019; Souza et al. 2020).

The Brazilian Caatinga biome has a significant area of regional coverage (735,000 km^2) and has proven potential wood supply (Vasconcelos et al. 2019). Forest inventories are estimated as a real volume of 112.9 m^3/ha and basal area of 3.08 m^2/ha, mainly as a wood source directed for the production of firewood and charcoal in the region (Napoleão Andrade et al. 2019).

However, the Caatinga has suffered negative effects resulting from anthropic action and disorderly removal of its forest resources (Bezerra et al. 2014, Farias and Melo 2020). Although there is a current scenario with sustainable forest-management plans, these are based on the extraction of wood species mostly for the firewood and charcoal markets (Farias and Melo 2020).

Based on the diversity of forest species in the biome and the technical peculiarities of some of the woods, namely, anatomy and colorimetry (Seabra et al. 2018), natural resistance (Da Silveira et al. 2019), workability (Granzotto et al. 2017), and physical and mechanical properties (Wimmer et al. 2017), alternative use of these woods, such as the manufacture of small wooden objects (SWOs), can add value to the species and generate products from these forest resources and also supply the market demand (Farias and Melo 2020, Brand 2017).

SWOs can be categorized as utilitarian, decorative, personal use, and other household items (Bartholomeu et al. 2020). The production of SWOs is important given their economic viability, as the products can be diversified and the final price of the pieces can be a facilitator for the flow of production (Santos and Lopes 2009; Pompeu et al. 2018).

It is common to identify and/or use wood of certain species only considering visual aspects (Barros et al. 2014). From analogous comparisons in relation to these characteristics, it becomes possible to obtain the valuation of certain woods (Bonfatti and Lengowski 2018).

In a study carried out by Seabra et al. (2018), nine species found in the Brazilian Caatinga biome were characterized with a wide variety of colors and densities ranging from 0.69 to 0.98 g/cm^3, including the following: rama de bezerro (*Pityrocarpa* sp.), piquiá cascudo (*Aspidosperma* sp.), ipê roxo (*Handroanthus* sp.), chapada (*Terminalia fagifolia*), pau amarelo (*Pterodon* sp.), birro branco (*Diptychandra aurantiaca*), sipaúba (*Combretum glaucocarpum*). jacarandá de sangue (*Swartzia psilomena*), and coração de negro (*Machaerium* sp.) The authors pointed out that they presented characteristics with potential for the forest products market.

Subjective factors have a considerable part in marketing decisions and are revealing as important sources of knowledge in the marketing sphere (Pereira et al. 2018). The lack of information about the potential of wood species from the Caatinga biome in Brazil may be one of the possible barriers to their use. Thus, understanding producers' reasons for choosing using materials, analyzing the preference as to the characteristics of these woods and their indication or use considering the visual aspects becomes relevant in sustainable use.

In this context, these studies represent a planning tool that directs the actions of management of wood products in communities. In addition, such studies point out weaknesses and potentialities so that actions are assertively carried out by the sectors involved (Coelho et al. 2018). This research aims to identify the attributes and highlights of wood from the Caatinga biome in the perception of producers in the SWO market segment as a premise for market studies. The knowledge of these attributes is important for the elaboration of products and marketing strategies, meeting the consumers' needs and expanding the SWO market share.

Materials and Methods

To reach the proposed objective, an exploratory study was carried out with application of semistructured interviews with SWO producers in Brazil's capital, Brasília, Federal District, and surrounding areas. The interview script can be found in Appendix 1.

First, the collection of woody material was carried out in a partnership between the Forestry Products Laboratory of the Brazilian Forest Service and the Wood Technology Laboratory of the Department of Forest Engineering at the University of Brasília. The woody material samples were collected in four settlements in the Midwest region of Piauí (Arizona I, Arizona II, Serra do Batista, and Canaã) located in the municipality of Lagoa do Sítio in Piauí State.

To ensure that the trees provided enough material for the preparation of the specimens, the minimum cut diameter was set at 20 cm high and 4.5 meters across. As the settlement areas destined for management were already divided into parcels, the collection was limited to one individual per species in each one, in order to guarantee a greater representation of the collected material. The trees were cut and sectioned with a chainsaw. Due to the reduced dimensions of the trees and the demand for material, analysis, and preparation of specimens, the sectioning of the logs occurred systematically, in discs with predefined dimensions, promptly destined for laboratory research, including in this study.

The samples were collected, identified (popular names), dried, and sent for botanical identification in herbaria in the Federal University of Bahia, Federal University of Ceará, and Federal University of Feira de Santana. The identified species are *Pityrocarpa* cf. *moniliformis* (rama de bezerro), *Aspidosperma* cf. *multiflorum (*piquiá cascudo), *Handroanthus* cf. *impetiginosus* (ipê roxo), *Terminalia fagifolia* Mart. (chapada), *Pterodon* cf. *abruptus* (pau amarelo), *Diptychandra aurantiaca* Tul. (birro branco), *Combretum glaucocarpum* Mart. (sipaúba), *Swartzia psilomena* Harms (jacarandá de sangue), and *Machaerium* cf. *acutifolium* (coração de negro).

From the wooden discs of the above-mentioned species, the radial, tangential, and transversal faces of the heartwood and sapwood (when distinct in the sample) were exposed and sectioned in order to obtain nine samples, one for each species, with dimensions of 13.5 cm height, 13.5 cm length, and 2 cm width for the largest exposed area of the tangential face.

Then, interviews were conducted with 11 SWO producers in the Federal District and surrounding areas, from December 11, 2019, to March 1, 2020. According to Farani and Oliveira (2019), Federal District is one of the regions of the country that most consumes native wood. Therefore, the snowball method was adopted to expand the sample of respondents from the first respondent, allowing the identification of other producers with similar competence, with a sample increase by progression (Baldin and Munhoz 2011).

The present study used interview sessions to elicit information about socioeconomic profile of the interviewed and their perceptions in relation to the above mentioned Caatinga woods. The perceptions of producers about the wood was analyzed with the help of the IRAMUTEQ software (Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires; Ratinaud 2014). Textual analysis of word cloud and similarity were carried out (Marchand and Ratinaud 2012; Souza et al. 2018; Goulart et al. 2020). Therefore, it was necessary to build a corpora (set of texts) composed of the producers' claims about their perceptions regarding what most attracted attention in relation to each of nine species of Caatinga presented in the samples of woody material. Based on the analysis, it was possible to identify the highlighted attributes of the woods focused on in the study.

Results and Discussion

Of the total number of producers interviewed, 72.72 percent were male, with education from elementary school to graduate school. Among them, 63.63 percent used the marquetry technique as a way of adding value to products; 90.91 percent knew which wood species they use on their production based in their popular name; and only 36.36 percent did not buy wood from lumber companies and used wood from naturally felled trees in rural areas; 90.90 percent of producers did not know the species from Caatinga biome.

After the presentation of nine wood samples (as detailed in the methodological procedures) the producers were asked to expose their perception about the highlight or attribute of each wood that would contribute to the addition of value in their production of SWOs.

In the analysis of the corpus of the transcriptions of the producers' claims, 1,202 occurrences of words were observed, 293 distinct forms and 152 words that appeared only once in the text. The verification of the representativeness of the wood's highlight or attribute and the peculiarities of each was possible through the word cloud method. The words with equal lexicographic formation with bigger representation (Fig. 2) were ''color, heartwood, beautiful, well'' appearing 64, 29, 27, 21 times in the textual corpus, respectively.

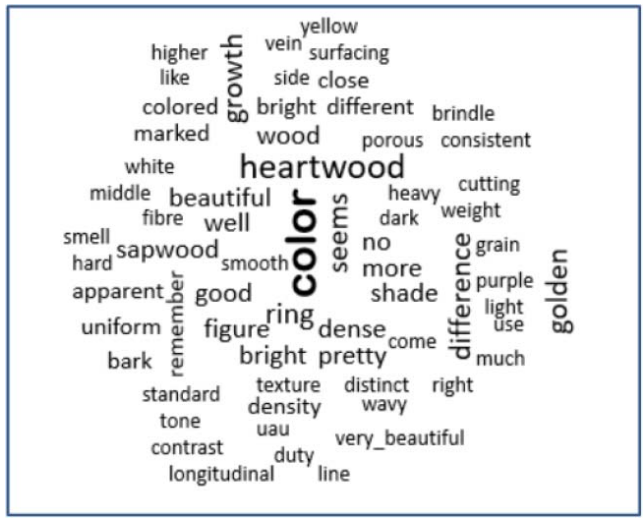

Figure 2.—Word cloud of the highlighted attributes of the nine wood species of the Caatinga biome.

The results indicate that the species from the Caatinga have colorimetric peculiarities in relation to the heartwood, adding beauty to the piece. The ''color'' characteristic was the bigger highlight or attribute of the Caatinga woods, proving claims that they present exotic characteristics to the market with different shades of colors.

Considering the similitude analysis of the general corpus with all species, based on the analysis of graphs, it is possible to identify the strongest co-occurrences between the lexical forms (Marchand and Ratinaud 2012). In this analysis, the most representative, central, and largest lexical forms represented in the graph are considered. As well, the strongest correlations are those that have thicker connecting traits (Marchand and Ratinaud 2012), thus it is observed a greater emphasis given to the forms ''color,'' ''heartwood,'' ''good,'' ''beautiful,'' ''ring,'' and ''sapwood'' (Fig. 3).

The analysis, based on the interviewed producers' reports, indicates that the highlights orattributes of the Caatinga wood species were centered on ''color,'' presenting ramifications by dense lines formed by five key terms of groupings: ''heartwood,'' ''beautiful,'' ''well,'' ''ring,'' and ''very'', since they have a high correlation.

Starting from the word ''color,'' the word ''design'' branches off, followed by the word ''heartwood,'' which branches off into the words ''sapwood,'' ''apparent,'' ''bigger,'' ''constrast,'' and ''side.'' This confirms observations related to the design and colors of the heartwood and sapwood of the woods mentioned.

Through the central word ''well,'' new ramifications with terms such as ''marked,'' ''vein,'' ''bark'' are observed. These correlations between words suggest that the colors of the woods observed directs attention to their density, in addition to presentation of ''well-marked veins'' and ''bark and vein well marked.'' The ''vein'' mentioned by the producers technically refers to the longitudinal markings of

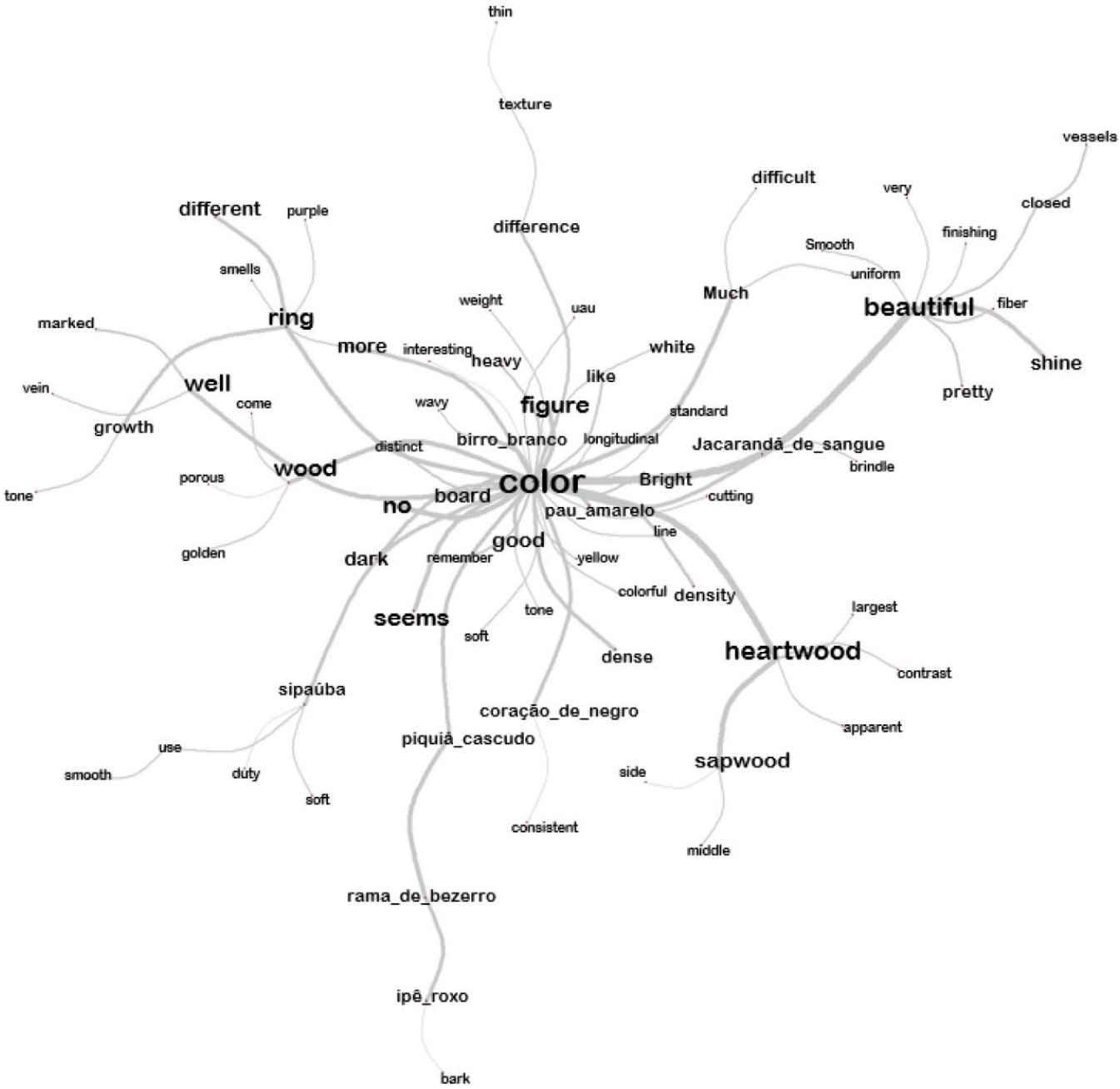

Figure 3.—General similitude analysis of the nine wood species from the Caatinga biome.

the growth rings when observing the wood in the tangential cut, which generates a variation of colors.

The word ‘‘beautiful’’ is also branched from the central word, followed by the word ‘‘interesting,’’ where different words are branched off, such as: ‘‘bright,’’ ‘‘beautiful,’’ ‘‘fiber,’’ ‘‘finish,’’ ‘‘pore,’’ and ‘‘closed.’’ These correlations suggest that the woods are considered beautiful, shiny, with a nice finish and well-closed pore (suggesting a higher density). These considerations generate good answers from producers in relation to these woods.

From the ramification of the word ‘‘ring’’ other different words arise, such as ‘‘different,’’ ‘‘growth,’’ and ‘‘longitudinal.’’ Thus, it is possible to confirm the correlation between the colors of the rings is different from the common woods in the SWO market, showing different patterns of ring growth.

From the lexical form ‘‘color,’’ it branches to the word ‘‘wood,’’ indicating the peculiar characteristic of the color of the Caatinga woods. Also from the word ‘‘color’’ originates, although less strongly demarcated by the branched line, the words ‘‘soft,’’ and ‘‘lighter,’’ and it is noteworthy that these words were also significantly associated with the claims correlated with the lighter woods among the observed, such as sipaúba and pau amarelo.

The most mentioned and highlighted characteristics are the colors of the wood, its variations between the growth rings, and its nuance of colors in its heartwood. This indicates fundamental aspects about the highlighted attribute correlated with the acceptance of new species in the

wood market. As discussed by Bonfatti and Lengowski (2018) the attribute ''color'' is as an element of great importance in woods, being the visual aspect impact that overlapped when it's perceived other attributes of a product.

The color of the wood can change according to external factors (climate conditions, density, extractive content, humidity range, tree age, and silvicultural treatments, among others) (Garcia et al. 2014); however, when investigating the variation of the wood color of *Eucalyptus dunnii* Maiden, color showed little variation between trees and within the same tree, as the external factors do not detract from the original color of the species (Vanclay et al. 2008).

Design makes a product differ from other objects, not only in terms of esthetics, but also in the use of new materials, technologies, and finishing surfaces (Vieria et al. 2017). Surface design is linked to the expressive perceptual characteristics of the surfaces of objects through visual, tactile, and relief textures (Oliveira and Freitas 2016) and the use of marquetry techniques (Vieria et al. 2017). Also, it can reinforce or minimize the interactions between the object and the subject, making it an even more aggregating factor in the SWO market.

However, due to the fact that the woods in question already present differentiation in relation to the woods commonly present in the market, the technique of adding value through design may or may not be necessary to add even more value and attractiveness.

Results disaggregated per species

Considering the importance of also identifying the perception of respondents about each species, corpora texts were created separated by species from the corpus of general perception; the similarity analysis by species was carried out following the same procedure presented above (Fig. 4).

*A. Birro branco (*Diptychandra aurantiaca *Tul.), Fabaceae*.—For the birro branco species, the highlighted attribute was ''ring'' (Fig. 4A), related to ''growth,'' its ''drawing'' ''wavy'' and the ''color'' ''beautiful.''

Seabra et al. (2018), for example, classified the wood, based on colorimetric values of Camargos and Gonçalez (2001), as ''yellow-brown'' (tangential heartwood side) and ''light yellow'' (tangential sapwood side) and Wimmer et al. (2017) presented values of 0.81 g/cm^3 of basic density for this species, which can be considered as heavy wood, according to the classification of Melo et al. (1990). Also, the birro branco species has few defects in workability tests (Granzotto et al. 2017) and has ''high strength'' with exposure tests to white rot fungi and brown rot (Da Silveira et al. 2019), which can be a satisfactory point in the SWO production process and in the durability of its products.

In addition to its technical properties, the species has the word ''ring'' as the most mentioned in relation to the producers' claims, and it could be an indicator that the birro branco species has aggregating value due to the color pattern as a consequence of its ring growth pattern in cross section and presence of design on the tangential face.

*B. Chapada (*Terminalia fagifolia *Mart.), Combretaceae*.—The chapada species presented the highlighted attribute of the word ''color,'' which branches into words such as ''good,'' ''dark,'' and ''heavy'' (Fig. 4B).

It can be said that the chapada species has aggregating value due to its dark colors associated with its high density. In previous studies, Seabra et al. (2018) classified the wood, based on colorimetric values of Camargos and Gonçalez (2001), as ''olive'' (tangential heartwood side) and ''yellowish olive'' (tangential sapwood side); Wimmer et al. (2017) presented values of 0.98 g/cm^3 of basic density for this specie, which can be considered as heavy wood according to the classification of Melo et al. (1990). As for Granzotto et al. (2017), the chapada species performed well in workability tests and presents ''high resistance'' when testing exposure to white rot fungi (and brown rot (Da Silveira et al. 2019). These technical characteristics are related to the interviewed visual analysis and highlight how these technical properties can add value to the species for the SWOs.

In addition to its technical properties, Ayres et al. (2010) note that the chapada species has pharmacological properties and, in popular medicine, the bark of the stem is used to combat thrush and tumors. Moreover, the species is popularly known as captain or ''capitão-do-mato,'' being a honey tree that is ornamental, with fruits used in handmade products and wood that can be used in joinery and civil construction.

*C. Coração de negro (*Machaerium *cf.* acutifolium*), Fabaceae*.—The coração de negro species also presented ''color'' as a central lexical form and a prominent tribute, where ''wood'' branches out into ''it looks like,'' ''purple,'' ''beautiful,'' ''ring,'' ''sapwood,'' and ''growth,'' ''well,'' and ''very beautiful'' (Fig. 4C). The highlighted attribute of this species can be considered to be the wood color, considered beautiful, associated with a purple color, with a beautiful growth ring pattern present in the sapwood.

It can be said that the coração de negro species can have greater added value when the piece is associated with its color variation, its purplish tone, and its growth ring patterns. Seabra et al. (2018) classified the wood, based on colorimetric values of Camargos and Gonçalez (2001), as ''"purple-brown'' (tangential heartwood side) and ''yellowish olive'' (tangential sapwood side); Wimmer et al. (2017) presented values of 0.92 g/cm^3 of basic density for this species, which can be considered as heavy wood according to the classification of Melo et al. (1990); the species showed a good result in workability tests (Granzotto et al. 2017) and presents resistance when in tests of exposure to to fungi to white rot fungi and brown rot (Da Silveira et al. 2019). The interviewed subjects' visual analyses are similar: they highlight how these technical properties can add value to the species when used in SWOs.

D. Pau d'arco roxo (ipê roxo; Handroanthus *cf.* impetiginosus*), Bignoniaceae*.—The purple ipê roxo species presented ''heartwood'' as the central word, expanding to the words ''dark,'' ''sapwood,'' and ''bark,'' ''wood'' and from the word ''wood'' it branched into the words ''work'' and ''tone.'' From the word ''color,'' its branched into the words ''distinction,'' ''beautiful,'' and ''dense,'' ''good,'' ''more,'' and ''heavy'' (Figure 4D). With these lexical forms, the highlighted attribute of the ipê roxo species can be considered to be the dark heartwood, considered to have a beautiful, dense color and with a distinction between heartwood and sapwood.

The ipê roxo species may have greater added value when the piece is associated with the highlight of the dark heartwood and its density. Seabra et al. (2018) for example,

classified it, based on colorimetric values of Camargos and Gonçalez (2001), as ''olive'' (tangential heartwood side) and ''yellowish olive'' (tangential sapwood side) and Wimmer et al. (2017) presented values of 0.83 g/cm^3 of basic density for this species, which according to the classification of Melo et al. (1990), can be considered heavy wood.

The ipê (genus *Handroanthus*) is a widely commercially used species. The interviewed people claimed that they already use wood for the production of SWOs; however, they were unable to say which species of ipê it could be. Acoording to Teixeira et al. 2018), many species of ipê, such as *Handroanthus* sp., *Handroanthus impetiginosus*, and *Handroanthus ochraceus*, have similar technical properties and are commercialized within the same class of wood, requiring micro-level investigations to separate the species.

*E. Jacarandá de sangue (*Swartzia psilonema *Harms.), Fabaceae*.—The jacarandá de sangue species presents attributes such as ''heartwood'' and ''color,'' applying this term in the software the color branches into the words ''look,'' ''very different,'' and ''dark.'' In a second layer, the word ''heartwood'' branches into the words ''sapwood'' and ''bright'' (Fig. 4E). From the lexical forms presented, it can be said that this wood presents peculiarities in relation to the brightness of the heartwood and sapwood correlated to dark color that are very different from what is found in the market (heavy wood with dark color).

It can be inferred that the jacaranda de sangue species may have a greater added value when its characteristics correlated to the brightness of the heartwood and sapwood and the abrupt contrast of its light and dark colors are highlighted.

The sharp contrast of light and dark colors is confirmed by Seabra et al. (2018) who classified the wood based on colorimetric values of Camargos and Gonçalez (2001) as ''light yellow'' (tangential heartwood side) and ''purplish-brown'' (tangential sapwood side). According to Wimmer et al. (2017), this species presented values of 0.80 g/cm^3 of basic density, which can be considered a heavy wood according to the classification of Melo et al. (1990); in addition, it has ''few defects'' in workability tests (Granzotto et al. 2017) and resistance to fungal exposure tests (Da Silveira et al. 2019), being a satisfactory point in the SWO production process and in the durability of wooden work.

*F. Pau amarelo (*Pterodon *cf*. abruptus*), Fabaceae*.—The pau amarelo species presents the highlighted attribute being the ''brightness'' and from it branching out in strong correlation with the words ,wood,'' ''beautiful,'' ''heavy'' and ''color,'' ''good,'' and ''yellow'' (Fig. 4F). It is considered a heavy wood, light in color and with a strong yellowish color, which has a peculiar shine. However, producers also presented justifications about the neutral, monochromatic color and noted that there would be a need to work it together with another wood with a different color.

Thus, it can be inferred that the pau amarelo species would have bigger added value when its brightness and its high density associated with light-colored wood are highlighted. Burger and Richter (1991) claim that darker woods are heavier and more resistant than lighter woods. Estuqui Filho (2006), in his study on the durability of wood in architecture, suggests that dark woods are more durable and require no treatment; on the other hand, lighter woods need greater care in relation to wood decay and the proliferation of stain-causing fungi, which contrasts the characteristics of this species (light color associated with high density) can can be a value-added factor and a peculiarity for the SWO market.

Seabra et al. (2018) classified this wood, based on colorimetric values of Camargos and Gonçalez (2001), as ''yellowish olive'' (tangential heartwood side) and ''light yellow'' (tangential sapwood side). Wimmer et al. (2017) presented values with 0.75 g/cm^3 of basic density for this species, which can be considered as heavy wood according to the classification of Melo et al. (1990); the species showed ''few defects'' in workability tests (Granzotto et al. 2017) and shows ''resistance'' when in tests of exposure to fungi (Da Silveira et al. 2019) which could be a positive thing in the durability and viability of future wooden art work.

*G. Piquiá cascudo (*Aspidosperma *cf*. multiflorum*), Apocynaceae*.—The piquiá cascudo species presents the central attribute ''color'' that branched out to the words ''no,'' ''lighter,'' and ''more,'' associated with ''side'' and ''good'' (Fig. 4G). The species presented peculiarities in relation to its nonlight color, i.e., dark, with color distinction between the two longitudinal faces presented to the wood products producers. The peculiarity of this wood, noted in previous studies Seabra et al. (2018), is in the presentation of the wood in the context of its association with the bark.

Due to the fact that this study focuses on wood that are generally commercialized in logging companies and sawmills (in longitudinal section of the heartwood, without bark and usually without sapwood), the emphasis is not on attributes in relation to a wood's bark, but in relation to light color.

According to the producers, the piquiá cascudo species has added value when its ''not light'' color is highlighted; however, to have a real value aggregation to this wood, it is suggested that the nondisposal of its bark, as well as heartwood and sapwood, be considered in the context of its commercialization and cutting in sawmills.

Seabra et al. (2018) classified the wood, based on colorimetric values of Camargos and Gonçalez (2001), as ''light olive'' (tangential heartwood side) and ''light yellow'' (tangential sapwood side). Wimmer et al. (2017) presented values of 0.69 g/cm^3 of basic density for this species, which can be considered medium-density wood according to the classification of Melo et al. (1990); the species showed ''few defects'' in workability tests (Granzotto et al. 2017) and presents ''resistance'' when in tests of exposure to fungi (Da Silveira et al. 2019), which can be a positive point in SWO production.

*H. Rama de bezerro (*Pityrocarpa *cf*. moniliformis*), Fabaceae*.—The rama de bezerro species presented the central attribute of ''color'' and from it branched the word ''design,'' ''different,'' ''vein,'' and ''tone''; the word ''color'' is strongly associated with the word ''brightness'' with thicker connecting lines (Marchand and Ratinaud 2012) associated with ''pretty,'' ''beautiful,'' and ''good'' (Fig. 4H).

The rama de bezerro species can add value when its color, brightness, and nuance of colors are highlighted by what the producers claim as ''veins,'' which are technically the growth rings observed in the tangential longitudinal section.

The peculiarity of the color variation of this species is confirmed through previous studies of Seabra et al. (2018), which classified this wood based on colorimetric values of

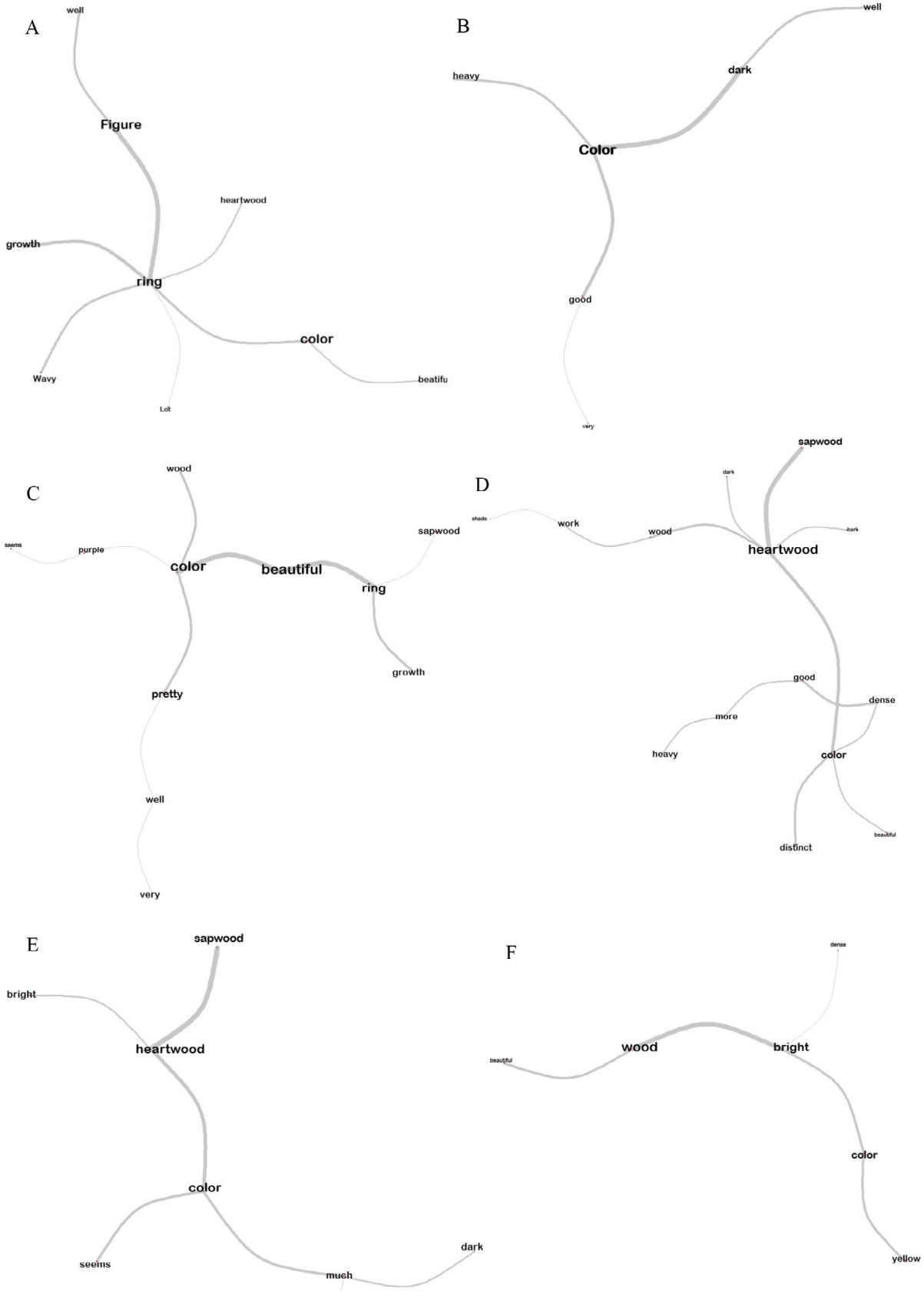

*Figure 4.—Similitude analysis per species. (A) Birro branco (*Diptychandra aurantiaca*), (B) chapada (*Terminalia fagifolia*), (C) coração de negro (*Machaerium *cf.* acutifolium*), (D) ipê roxo (*Handroanthus *cf.* impetiginosus*), (E) jacarandá de sangue (*Swartzia psilomena*), (F) pau amarelo (*Pterodon *cf.* abruptus*), (G) piquiá cascudo (*Aspidosperma *cf.* multiflorum*), (H) rama de bezerro (*Pityrocarpa *cf.* moniliformis*), (I) sipaúba (*Combretum glaucocarpum*).*

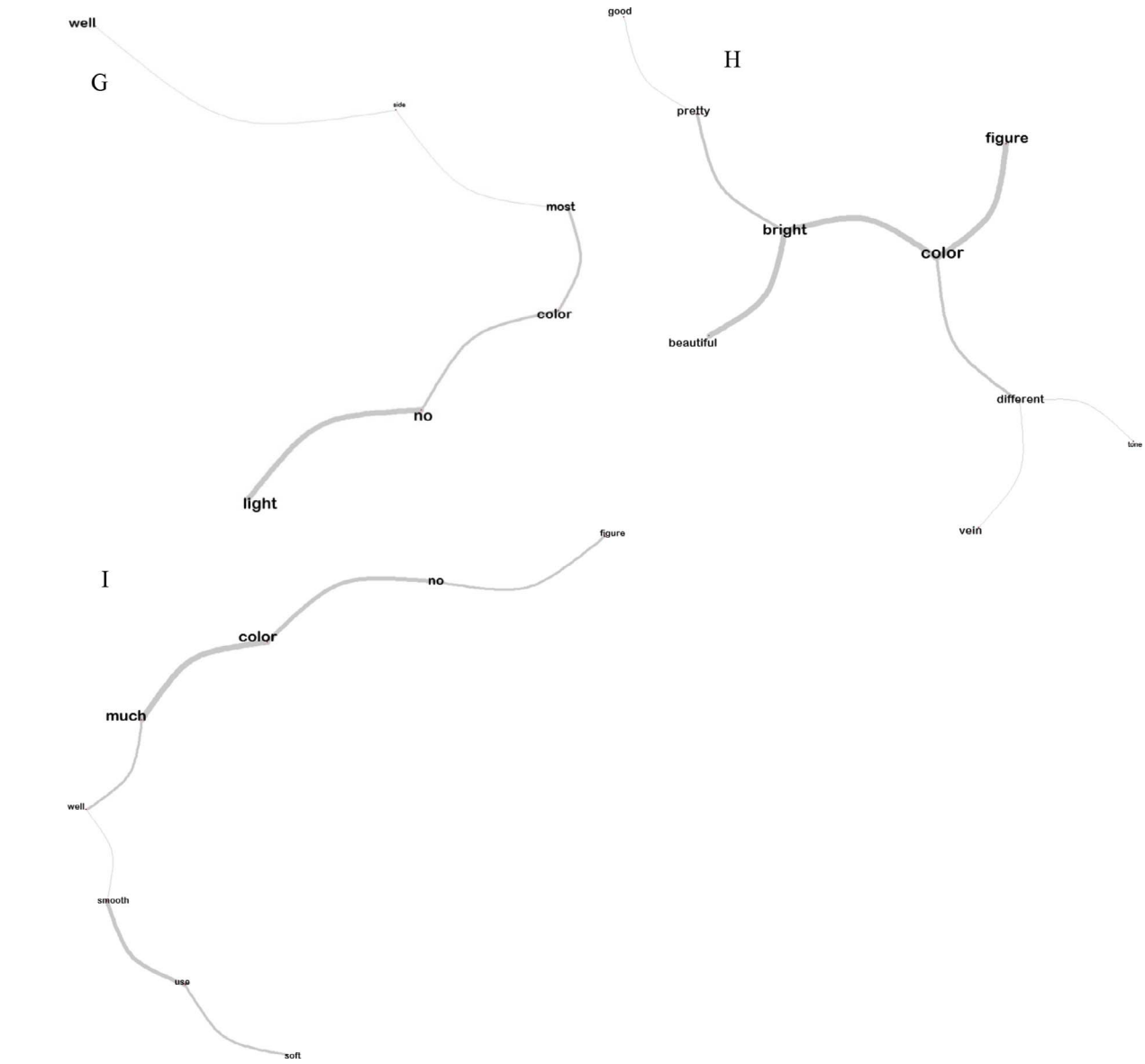

Figure 4.—Continued.

Camargos and Gonçalez (2001), dividing it (with indistinct heartwood and sapwood) into three colorimetric regions from their tangential faces, such as ''light yellow'' (region 1) and ''olive brown'' (regions 2 and 3). In addition, Wimmer et al. (2017) presented values of 0.73 g/cm^3 of basic density, so it can be considered as heavy wood according to Melo et al. (1990); the species showed ''few defects'' in workability tests (Granzotto et al. 2017) and ''resistance'' when testing exposure to fungi (Da Silveira et al. 2019), being a positive point in the SWO production.

*I. Sipaúba (*Combretum glaucocarpum *Mart.), Combretaceae*.—The sipaúba species presented the word ''very'' associated with the word ''color,'' as well as ''no,'' ''design''; from the word ''very much'' it also branches or to words like ''good,'' ''slight,'' ''use,'' and ''soft'' (Fig. 4I). The associations confirm that this wood has a peculiar color, without drawings, very light and ''soft.'' The color of the wood presents itself as peculiar and ''without'' added value characteristics; however, the unique characteristics of this wood are its own included phloem, and porosity, which can be an aggregating factor.

Seabra et al. (2018) classified the wood, based on colorimetric values of Camargos and Gonçalez (2001), as ''yellowish olive'' (heartwood and sapwood indistinct); Wimmer et al. (2017) presented values of 0.73 g/cm^3 of basic density for this specie, which can be considered as heavy wood according to the classification of Melo et al. (1990). Thus, the claim ''soft wood'' may be more associated with porosity and phloem included than with the density of the wood itself, since technically it is classified as heavy. Furthermore, in previous studies the species performed ''bad'' in workability tests (Granzotto et al. 2017) but also with resistance when in tests of exposure to fungi (Da Silveira et al. 2019), which can be a satisfactory point in the production of SWOs and its own durability.

The general and per species similitude analysis allows us to understand how SWO producers and at the same time wood consumers are able to sense the attributes that can be

better used and highlighted with the achievement of adding value to the small objects and, consequently, ensure a greater appreciation of it.

From these analyses, it was possible to group the woods according to their subjective peculiarities:

- coração de negro, jacarandá de sangue (color dualities; with no need to use marquetry to enhance wood),
- sipaúba (light, porous wood, phloem included),
- birro branco, pau amarelo (light and at the same time dense woods, different from what usually occurs in the wood market),
- piquiá cascudo e rama de bezerro (particularities in the color variations in its growth rings and wavy growth rings), and
- ipê roxo and chapada (dark and heavy woods).

The use of these wood species from Caatinga for objects with greater added value, such as SWOs, is in addition to current market use as firewood and charcoal. Observing the ''color'' characteristic as being the key highlighted attribute is an important information for the market, since 63 percent of the interviewed producers claim that they use marquetry techniques to join woods of different colors as a way to add value to their products.

Conclusion

The potential uses of species from the Caatinga biome are not well known, and the lack of knowledge about their acceptance in the market forms a barrier to sustainable exploration of the biome's woods. Identification of the highlighted attributes of wood from the Caatinga biome in the perception of producers in the SWO market segment is an important premise for market studies since they can be resignified, transforming subjective preferences into tangible characteristics and possibly adding value in production.

It was verified that a more effective participation of little-known species and an increase in demand due to a greater acceptance in the market can enable their use in association with and/or as a replacement of traditional woods. For the species from Caatinga biome considered in the study, color was identified as the main value-adding differential.

The technique used can be extrapolated to the analysis of other species, including in other regions of the world. The identification of valuable aspects of the species through wood market professionals is essential and complements the knowledge of academics who study the physical and mechanical characteristics of wood.

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Appendix 1.—Interview script.

(1) Information for socioeconomic profile:
Gender: __ Age: __ Level of education: _____
Occupation: _____ Family income: ____
(2) Perception of producers:
  (1) Look at the Caatinga wood (presentation of the woody material to the interviewees)
  (2) For each species, which wood attribute caught your attention?

A. *Birro Branco*

B. Chapada

C. Coração Negro

D. Pau D`Arco

E. Jacarandá de Sangue

F. Pau Amarelo

G. Piquiá Cascudo

G. Rama de Bezerro

G. Sipaúba