CHARACTERIZATION AND QUALITATIVE-QUANTITATIVE ANALYSIS OF AFFORESTATION IN SQUARES OF THE CENTRAL AREA OF THE CITY OF ARAPIRACA, ALAGOAS

ABSTRACT

In cities, afforestation presents as an important issue related to the human comfort and environmental responsibility. This study characterized and analyzed the urban trees of three main squares of the city of Arapiraca, Alagoas state – Brazil –, investigating the species that occur, number of trees and their health condition. We performed a literature review, field visits, application of a qualitative-quantitative form; sample collection, filing of collection data and photographic production. Of the 65 trees studied, the most frequent species were Pachira aquatica Aubl., Erythrina indica Lam. and Schinus terebinthifolia Raddi. The most frequent families were Malvaceae (27.7%), Fabaceae (26.2%) and Areceaceae (15.4%). The trees’ health condition was considered unsatisfactory due to phytopathogenic actions, inadequate prunings. The trees affect electric and telephone wiring and are object of mechanical injury/aggression. We expect that these results guide the public policies in the creation of a Management Plan for Urban Afforestation in the city of Arapiraca.

Keywords: Urban trees; Public spaces; Planning urban environment

CARACTERIZAÇÃO E ANÁLISE QUALI-QUANTITATIVA DA ARBORIZAÇÃO EM PRAÇAS DA ÁREA CENTRAL DA CIDADE DE ARAPIRACA, AL

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RESUMO

Nas cidades, a arborização se apresenta como uma importante problemática relacionada com o conforto humano e questões de responsabilidade ambiental, por exemplo. Este estudo caracterizou e analisou a arborização das três principais praças do centro da cidade de Arapiraca, Alagoas, observando as espécies que ocorrem, a quantidade de árvores e sua fitossanidade. Foram realizadas visitas de campo; aplicação de formulário qual-quantitativo; coleta de material; preenchimento de ficha de coleta e produção fotográfica. Das 65 árvores contabilizadas, as espécies mais frequentes foram Pachira aquatica Aubl., Erythrina indica Lam. e Schinus terebinthifolia Raddi. As famílias mais frequentes foram Malvaceae (27.7%), Fabaceae (26.2%) e Areceaceae (15.4%). As árvores foram consideradas, fitossanitariamente, insatisfatórias devido à fitopatógenos, sofrem com a prática de podas, conflitam com equipamentos urbanos e são alvos de injúrias/agressões mecânicas. Espera-se que tais resultados possam orientar as políticas públicas na criação de um Plano de Manejo da Arborização em Arapiraca.

Palavras-chave: Árvores urbanas; Espaços públicos; Fitossanidade; Planejamento urbano ambiental

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3. The term is used in this study, similarly to Rodrigues (2005), to designate a group of issues interconnected and not only an isolated problem. In this case, particularly, it refers to urban afforestation not as a problem to be dealt with by cities, but as an element present in a given site that relates to environmental, social, political factors.
INTRODUCTION

Improving environmental conditions in cities is essential, therefore, discussions about the urban afforestation becomes an important issue, especially regarding streets, parks and other spaces for collective use necessary to urban centers.

Public squares, focus of this study, represent for cities, in general, one of the most popular sites that provide leisure/recreation, contemplation of the landscape or elements of nature, social interaction, among other benefits.

For Silva (2009), the squares are representative sites for distinct events by allowing the formation and social aggregation. Nevertheless, the genesis of squares is tied to the history of cities, making them one of the most common public spaces in different regions, regardless of social, political, economic or environmental differences.

In short, squares are an important area due to many factors, namely recreational, ecological, social, political or educational.

In this sense, afforestation of squares has emerged as one of the most representative urban issues, perceived just like any other urban infrastructure (TARNOWSKI; MOURA, 1991) or simply forgotten by the policies of city planning. Trees have become part of discussions involving the concepts of conservation and environmental education.

One of the first issues concerning urban afforestation refers to its concept, much discussed in the literature. In this paper, the concept of afforestation adopted refers to adult tree vegetation (LIMA et al., 1994), located in public spaces that integrate urban green areas. This definition is similar to the concept of Rocha and Werlang (2005), who maintain that urban afforestation is characterized by the planting of trees in certain areas of the city.

It is believed that the afforestation design in cities takes on a more confused characteristics due to lack of clear and objective definition of its concept, which affects certain actions to improve and optimize its benefits.

In cities, afforestation is perceived as an element that can perform a variety of functions such as protection of soil, water, air; temperature reduction; urban fauna sheltering; conditions for leisure/recreation and enhancement of certain part urban soil, as reported in studies of Gomes and Amorim (2003), Nucci (2001), Silva (2009), Fernandes (2008), Rezende and Santos (2010), Cavalheiro and Del Picchia (1992), Brun et al. (2007), Yamamoto et al. (2004), among others.

In tropical cities of hot climate, as is the case of Arapiraca city – Alagoas state – Brazil –, the need for an urban forestry is justified as a way to contribute to weather and soil conditions. Each city has its own climate and soil type characteristic, which makes it necessary to choose appropriate tree species to fit those conditions so they can offer their potential benefits. They also require periodic care to avoid, for example, introduction and proliferation of phytopathogenic agents; the practice of harmful actions, such as inadequate pruning; conflicts with street electric and telephone wiring and mechanical impacts. In this respect, Miranda and Carvalho (2009) argue that the dilemmas suffered by the trees in cities can be justified by the lack of information and specialized workforce.

A literature review showed that studies on urban afforestation are common, however, we notice that few studies address afforestation in places of common use such as squares or parks. Therefore, this study aimed to characterize and analyze qualitative and quantitatively afforestation of three squares: Luiz Pereira Lima, Deputado Marques da Silva and Manuel André, located in the central region of Arapiraca city – Alagoas state – Brazil. The hypothesis was that the trees in these squares consisted mostly of exotic species, showing low diversity and quantity, and health condition problem that could compromise their structure. However, the results were complex, showing important similarities and differences among the squares, diversity of trees and their current conditions.
Given that the municipality is characterized by generalized deficiency of afforestation, according to a survey reported in the Urban Report on Housing and Environmental Issues of Arapiraca city (PREFEITURA MUNICIPAL DE ARAPIRACA, 2004), the squares analyzed are relevant for urban life once these spaces have significant vegetation cover. This can be justified by their significance for local people, by their strategic location which allows their use by citizens, and by their potential related to afforestation.

MATERIALS AND METHODS

Characterization of the study area

The municipality of Arapiraca, situated in the central part of the State of Alagoas (Figure 1), covers an area of about 351.48 km² and has 214,067 inhabitants, of which 181,562 live in urban areas (IBGE, 2010a), which results in a population density of 609.04 inhab./km². The Urban Report on Housing and Environmental Issues of Arapiraca city (PREFEITURA MUNICIPAL DE ARAPIRACA, 2004) reports that the city is 264 m above sea level, distant 136 km from Maceió (state capital) and has the following geographical coordinates: South Latitude 9°75’25” and West Longitude 36º60’11”.

The vegetation of the municipality of Arapiraca is characterized by Evergreen Forest, with parts of Semideciduous Forest and cerrado/forest (MASCARENHAS et al., 2005). Romão (2008) states that the natural vegetation of the city, represented by areas of Cerrado, Caatinga and Tropical Rain Forests or Deciduous was practically eradicated, remaining only a few trees distributed along the transition areas of the Atlantic Forest and Caatinga.

Mascarenhas et al. (2005) also reported that the topography in Arapiraca is part of the Coastal Plains, with an average altitude ranging from 50 to 100 m.

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In general, soils are classified as deep with low natural fertility. In the Participative Municipal Master Plan (PREFEITURA MUNICIPAL DE ARAPIRACA, 2005), Arapiraca is characterized by high temperatures in the summer, with an annual average of 28°C. According to Amorim (2005), the annual rainfall ranges from 800 to 1000 mm, which results in a sub-humid and hot tropical climate. As it is the most important municipality in the state of Alagoas (after the state capital - Maceió), Arapiraca has a diversified agricultural production as an economic basis, represented by the cultivation of fruits, vegetables, and especially leafy vegetables. This new economic base arose from the decline of historical farming of tobacco monoculture between 1980 and 1990, which earned, in previous decades, the city’s title as the “Brazilian capital of tobacco”. The tobacco industry practiced for years contributed to the reduction of vegetation cover of Arapiraca. In the urban area, there is a widespread deficiency of afforestation, ranging from 83 to 100%, as shown in the Urban Report on Housing and Environmental Issues of Arapiraca city (PREFEITURA MUNICIPAL DE ARAPIRACA, 2004). However, the main squares in the city center, called Luiz Pereira Lima, Deputado Marques da Silva and Manuel André are examples of some public spaces that have significant tree cover, which, among others, has become an important factor for this analysis (Figure 2). Figure 2. Detail of the city center (no scale). Red rectangle represents the Manoel André Square; the blue one Marques da Silva Square and the black one Deputado Luiz Pereira Lima Square

The Luiz Pereira Lima Square, historically known as the “Town Hall” Square, because the former location of the City Hall, presented until recently poor infrastructure, because over the years it has become a “forgotten” space by the public administration. However, in 2009, it was started a renovation of this square that lasted about eighteen months, and was inaugurated in October 2010, as informed in the monument plate at the site and by personal information. After this renovation, the square became more frequented, which did not occur before due to lack of attractiveness. Despite some important changes in the site, local trees were preserved, and a few shrubs, flowers and lawn were planted for beautification, besides seven juvenile species of Bauhinia sp.

Apparatus of the square were modified after the renovation, such as playgrounds and sports facilities that gave way to a large dome used at events. The square is used only for landscape contemplation or social life. The completion of the works allowed observing that its landscape design shares many similarities with other public spaces, i.e., there is a standardization of these spaces in Arapiraca.

The Deputado Marques da Silva, inaugurated on May 28, 1994, according to site plate, has become over the years one of the sites with most intense daily influx of people due to various stores and businesses in the vicinity, a snack bar, a newsstand and flower shop on the square. Although it is one of the main squares of the city due to commerce and strategic location, it is a place with little landscape-aesthetic treatment, because despite having good tree cover, it needs more effective and periodic maintenance.

As for apparatus, the square presented only benches covered by afforestation. The intensive use of the square does not provide space for several apparatus, such as playground, sports facilities and others. The Manoel André Square, origin site of the city of Arapiraca, named in 1910 as the Gabino Bezouro Square, according to the Participative Master Plan of Arapiraca (PREFEITURA MUNICIPAL DE ARAPIRACA, 2005), is also an area of intense movement of people due the businesses and stores in the vicinity. It is a relatively

Source: Map of boundaries and division of neighborhoods (PREFEITURA MUNICIPAL DE ARAPIRACA, 2007)
extensive area, but narrow, which limits certain uses. This is one of the few public spaces that receive landscaping treatment and regular maintenance, even though this care is not extended to its afforestation. With regard to apparatus, a similar scenario to that of the Deputado Marques da Silva square is observed. Its inner space was also occupied by snack bars and newsstands.

Data collection and analysis

For the characterization of tree cover of these squares, we conducted field visits in November 2010. We catalogued the trees at each site based on the criterion of traversing the site in accordance with the methodology adopted by the IBGE (Brazilian Institute of Geography and Statistics) Census 2010b. That is, we performed a quantitative and qualitative survey of all arboreal individuals found in path in an orderly and disciplined way keeping the tree to be recorded to right hand to avoid double counting, making it unnecessary to place tags to enumerate the individuals in view of the small extension of the squares and the arrangement of trees. Before traversing the area, a starting point was marked represented by the intersection of streets or reference points facilitating, for example, a return to the tree, if necessary.

Furthermore, using a specific qualitative and quantitative form, we gathered information on plant elements, such as fruits, leaves and flowers in the form of dried specimens (sample/dried botanical structure) and we photographed with a digital camera to help identify individuals and to analyze their general health condition.

For the collection and storage of plant material, we used pruning shears (3 meters high), wooden presses, new newspapers, cardboard, corrugated metal (a piece of aluminum plate or iron), a cord to tie the batch of dried specimens, and an oven to dry the material. In the production of dried specimens, after collection of botanical material, we used a data collection form with information that helped the characterization of the trees, their identification and location in the public space. The botanical material was identified at the Laboratory of Biology, Federal University of Alagoas, Campus Arapiraca.

The identifications of species were made according to the literature (SOUZA; LORENZI, 2005; GONÇALVES; LORENZI, 2007) and morphology was compared in laboratory with a magnifying glass, analysis of herbarium specimens and photographs. For the scientific names of species, we observed the Classification System CPA II (SOUZA; LORENZI, 2005) and the website of the Northeast Center for Plant Information (CNIP). Still, it was not possible to identify all tree species due to lack of structures such as flowers and fruits.

To interpret data on the species found in the three squares, we used indices of relative frequency and diversity (α), highlighted by Rocha et al. (2004) and Rossato et al. (2008), respectively. The frequency index was calculated from the ratio between the number of individuals of a given species and the total number of individuals in the entire square multiplied by 100. The diversity index refers to the rate of the heterogeneous species, where values below 2.0 are considered indicative of squares with low diversity and values above 5.0 are considered indicative of great diversity. Therefore, it is believed that the intermediate rates of these values can indicate that the squares have a medium or significant diversity of species. These indexes were adapted to this study and were represented by simple mathematical formulas.
Qualitative analysis of the tree species

To organize the data, during the field visits we used a qualitative-quantitative form adapted to fit the objectives of this study. The original form was prepared by Silva Filho (2002) when analyzing the afforestation of public roads in the urban area of the municipality of Jaboticabal – São Paulo state – Brazil.

On this form, we recorded information such as name and address of the square, the number of individuals observed, the biological aspects of each specimen, the existence of conflicts of afforestation with electrical wiring, lighting and street signs, besides paving and occurrence tree pruning. During the field work, it was difficult to accurately identify the type of pruning practiced, so in our survey, we considered only the probable type of pruning used, as perceived by the researcher.

The biological aspects were represented by: general condition/conservation of the individual, rated as “optimal” (vigorous and healthy individuals with no signs of attack of pests, diseases or mechanical damage), “good” (individual with some signs of superficial damage, attack of pests, diseases, superficial mechanical injury), “regular” (individuals starting to decline, presenting possible attack of pests, disease or mechanical injury that damage its appearance or result in deficiencies) and “poor” (individual with advanced decline, heavy attack or damage of pests or diseases, resulting in risk of fall or death of the plant). For plant health conditions, we analyzed the trees for the presence of termites, ants, caterpillars, fungi and other pathogens; intensity of attack (light, medium and heavy); attack location (stem, root, fruit, flowers and leaves), injuries/mechanical damage (severe, medium and light intensity, considering cases of vandalism) and ecology (we observed the presence non-pathogenic insects, bird nests and lichens).

RESULTS AND DISCUSSIONS

The Luiz Pereira Lima Square had 32 trees, the Deputado Marques da Silva had 16 and the Manuel André Square had 17, totaling 65 trees, which showed an uneven distribution of tree cover in specific areas of the city, even considering the differences in length of these spaces.

The trees of these three squares were divided into 9 species, 11 genera and nine families. However, four species accounted for 50.8% of the trees grown in these public spaces (*Pachira aquatica* Aubl., *Caesalpinia echinata* Lam, *Schinus terebinthifolius* Raddi and *Erythrina indica* Lam.) The species with the highest relative frequency were: *Pachira aquatica* (27.7%), *Erythrina indica* (10.8%), *Schinus terebinthifolius* (7.7%) and *Caesalpinia echinata* (4.6%).

The results corroborate the data reported by Rezende and Santos (2010) when analyzing squares in the neighborhood Jaraguá in Uberlândia city – Minas Gerais state – Brazil –, and noted 196 individuals spread over 21 species of trees, five of which accounted for 72.94% of the trees counted.

Table 1 shows the species and plant families found in the three squares analyzed in this study, and presents some genera and unidentified individuals.

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Table 1. Tree species and plant families found in Luiz Pereira Lima (LPL), Deputado Marques da Silva (DMS) and Manoel André (MA) Squares in the city of Araripac – Alagoas state – Brazil.

<table>
<thead>
<tr>
<th>Tree species</th>
<th>Popular name</th>
<th>Family</th>
<th>LPL</th>
<th>DMS</th>
<th>MA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminalia catappa L.</td>
<td>Amendoeira</td>
<td>Combretaceae</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schinus terebinthifolia</td>
<td>Raddi</td>
<td>Fabaceae</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Erythrina indica Lam.</td>
<td>Brasileirinho</td>
<td>Anacardiaceae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caesalpinia echinata L.</td>
<td>Pau-brasil</td>
<td>Fabaceae</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Sapindus saponaria L.</td>
<td>Sabonete</td>
<td>Sapindaceae</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pachira aquatica AUBL.</td>
<td>Monguba</td>
<td>Malvaceae</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Tabebuia aurea (Silva Manso)</td>
<td>Craibeira/ôê</td>
<td>Bignoniaceae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ficus benjamina L.</td>
<td>Figueira</td>
<td>Moraceae</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Azadirachta indica A. Juss.</td>
<td>Nim</td>
<td>Meliaceae</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Bauhinia sp</td>
<td></td>
<td>Fabaceae</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Tabebuia sp</td>
<td></td>
<td>Bignoniaceae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterolobium sp</td>
<td></td>
<td>Fabaceae</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unidentified I</td>
<td>Palmeira</td>
<td>Arecaaceae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unidentified II</td>
<td></td>
<td>Arecaaceae</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Unidentified III</td>
<td>Palmeira</td>
<td>Arecaceae</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Unidentified IV</td>
<td></td>
<td>Arecaaceae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unidentified V</td>
<td></td>
<td>Arecaaceae</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The most common families were represented by: Malvaceae (27.7%), Fabaceae (26.2%), Arecaaceae (15.4%) and Anacardiaceae (7.7%). The other families had frequencies between 1.5% (Sapindaceae, Meliaceae and Moraceae) and 3.1% (Combretaceae and Bignoniaceae). Although the Malvaceae family has higher frequency, it was represented by only one species (Pachira aquatica). The same occurred with a species of the family Anacardiaceae (Schinus terebinthifolia). The family Fabaceae showed greater genera differentiation (four). When calculating the diversity index in afforestation of the squares, we observed that there are 4.4 different species in each space. On the other hand, when considering the squares individually, the highest diversity of species was found in the Deputado Marques da Silva square (3.3) and lowest in the Manuel André square (2.4). The Luiz Pereira Lima square showed an index of 2.6. The squares combined have a significant tree diversity, however, when analyzed in a comparatively and individually, they tend to have low rates of diversity. This fact was corroborated when we observed that 37.5% of the tree cover of the Luiz Pereira Lima square was composed by the species Pachira aquatica. The Deputado Marques da Silva square was also composed of Pachira aquatica (37.5%) and Schinus terebinthifolius (12%) and the Manuel André square, the species Erythrina indica (35.3%). For Brun et al. (2007), one of the factors that can compromise urban afforestation is the cultivation of a few species and irregularly, resulting in biodiversity loss. The literature commonly reports that the occurrence of the same tree species may increase the spread of certain pathogens, because if a few trees are attacked by mealybugs and/or aphids, which migrate due to environmental conditions, can damage a number of trees. Therefore, homogeneity or uniformity of tree cover is not advisable (Rodolfo Júnior. et al., 2008; Machado et al., 2006 and Yamamoto et al., 2004). Besides the issue of plant health condition, a large number of equal individuals in a square is believed to make the place somewhat less harmonious and/or attractive for contemplation. Studies, such as those above mentioned, report that in many cities in Brazil, it is common to use a few tree species in afforestation, which is not recommended in view of the numerous damages that can happen as a result. To protect tree cover against pest attacked and diseases, Santamour Júnior. (2002) recommends that no more than 10% of the same tree species or 30% of the same botanical family be used in certain places. For Milano and Dalcin (2000) the limit is higher and prescribe no more than 10-15% of occurrence

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of the same species. Given these rates, it was observed that for the Deputado Marques da Silva square, the species *Pachira aquatica* exceeded the recommended values, but the species *Schinus terebinthifolia* was within a tolerable limit. In the Lima Luiz Pereira square, the species *Pachira aquatica* also exceeded the values and in the Manoel André square, the species *Erythrina indica* did not follow the recommended rates. Regarding the occurrence of families, we found that none exceeded 30% as recommended by Santamour Júnior (2002), indicating a considerable diversity in all the squares with respect to the botanical family. However, the high concentration of individuals of *Pachira aquatica* in two of three squares, suggested the need to place special care in terms of health condition of the tree specimens, because attacks of a pathogen could decimate a large number of individuals.

Analyzing the origin of the nine species identified in the three squares, we noticed that four are typical of northeastern Brazil (*Tabebuia aurea*, *Schinus terebinthifolia*, *Caesalpinia echinata* and *Sapindus saponaria*), according to the Northeast Center for Plant Information – CNIP (2011), especially for vegetation found in the municipality of Arapiraca – Alagoas state (Caatinga and Atlantic Forest). This result differed from results found in other cities of northeastern Brazil. Calixto Júnior et al. (2009) recorded in the municipality of Lavras da Mangabeira – Ceará state – Brazil –, a prevalence of exotic species over native ones. Machado et al. (2006) found in the city of Teresina – Piauí state – Brazil –, predominance of exotic species in afforestation. Matos et al. (2010) and Santos et al. (2011) also found in the city of Aracaju – Sergipe state – Brazil –, many exotic species to the detriment of native ones, which are increasingly more difficult to be found. The species *Ficus benjamina* L. and *Azadirachta indica* A. Juss. are commonly treated as potential causes of damage to the infrastructure of cities, due to limiting factors such as the rooting system, inappropriate size for certain sites or presence of specific pathogens. The species *Pachira aquatica* may not be ideal for afforestation of public spaces, because despite its dense canopy characteristic, its relatively large fruits are considered a problem for users of these public sites. During the process of abscission, the fruits may fall down of people and vehicles, causing damages. With regard to species *Erythrina indica* and *Terminalia catappa* L., there is little reliable information in the literature referring to their characteristics of growth and development. Considering them as originating from other countries was not enough to classify them as native or exotic to the Arapiraca region. Regarding the conservation conditions of the trees, in the three squares we noticed a tree cover rated as: regular (41.5%), poor (38.5%), good (17.0%) and excellent (3.0%). These percentages may have resulted from the existence of ants (73.8%), fungi (61.5%), termites (15.0%) and other potentially pathogenic organisms (9.2%). The intensities of these attacks were recorded as average (55.4%), mild (37.0%) and heavy (7.7%). The attacks were observed mainly in the trunks (97.0%) and leaves (3.0%). Despite the variety of percentage of categories that represent the overall condition of the trees, we observe in the rates “regular” and “poor” a large number of individuals (80.0%). These data differ from those obtained by Rodolfo Júnior. et al. (2008), when assessing the condition of urban trees in neighborhoods in the city of Pombal – Paraíba state – Brazil –, and recorded about 40.0 to 50.0% of the trees in good health condition. Thus, we considered the afforestation of squares in the present study unsatisfactory (Figs. 3A and 3B). Moreover, these indices can be explained by environmental conditions in the region of Arapiraca, such as climate, rainfall, geographic location, temperature, soil type, among others. The diversity and high percentage of different organisms, potentially disease-causing to trees in the squares, underlined the need for urgent measures for their control, given that they can promote, among other damages, death of the plant. This may be aggravated in analyzing the intensity of the attack of organisms, because more than half of the trees had attacks of “mild” and “heavy” intensities (63.1%), mainly to the structure of the tree (trunk). We were also able to observe the presence of other insects such as bees, flies and wasps in 15.4% of the trees, in addition to 12.3% of lichens (a combination...
of algae and fungi), which are generally related to environmental quality. However, Raven et al. (2001) emphasize that lichens can thrive in the harshest environments on earth and, consequently, are highly widespread, and can act as substrate for fungal parasites. Therefore, caution is necessary to state that the presence of lichens can be a parameter to classify afforestation of a given site as healthy. Furthermore, we found the occurrence of injuries or mechanical damages on the trees (52.3% of cases). The intensities of these injuries were rated as “average” (30.8%) and “mild” (26.2%) (Figure 4A). On this issue, Matos et al. (2010) claim that the trees that beautify urban squares are victimized in festive periods, because they are commonly are used as support for ornamentation, which requires the use of tools (nails and staples) to affix ornaments. The nails and staples are usually left in the trees after the event and may eventually cause serious harm to the plant. Another very common type of aggression, found in the Lima Luiz Pereira and Deputado Marques da Silva squares, was the whitewashing of the tree trunks. Lime is a toxic chemical that can damage tree vitality, and its use for painting tree trunks should be abolished in Arapiraca city (Figure 4B). Other parameters assessed in the squares were problems between afforestation and urban facilities. Based on the diagnosis of all the trees of the three squares, we recorded for 35.4% of trees conflicting with street lighting, 1.5% with the electric wiring and 1.5% sidewalk damages, i.e., we found no problems involving trees and street signs. Less than half of the trees (38.4%) of the three squares had some kind of problem with urban facilities. The reduced levels of conflict with the electric wiring and sidewalks can result from the high occurrence of tree pruning in the squares. We recorded that 80% of the trees usually suffer from pruning that, among other aspects, can promote morphological changes during the development or establishment of the plant. The high frequency of pruning may be indicative of inappropriate selection of tree species for the sites (ANDRADE et al., 2008). Pruning is reported in the literature as one of the most representative forms of aggression to urban trees, however, for Schallenberger et al. (2010) pruning means a cultural treatment, as well as control of pests and diseases. This type of treatment may be beneficial to the trees, however, the practice of pruning can become dangerous if performed by unskilled people. This fact tends to be more common as we notice the increasing neglect in policy control and plant treatment, often resulting in an desperate and inadequate attitude of residents and public officials with little information and education on urban afforestation. There were few occasions when pruning contributed to the development of the plant, as in cases of removal of diseased, dead and/or deformed branches.

Figure 3. In Picture A, we note insects, popularly known as aphids, mealybugs (order Homoptera) in a sample of Bauhinia sp., in Manoel André square. In B, there is a detail of damaged trunk, also in Manoel André Square.
Figure 4. In Picture A, we find a trunk of *Terminalia catappa* L. with a wooden board affixed, used by mototaxi drivers working in the Luiz Pereira Lima square. In B, there is the trunk of a *Pachira aquatica* Aubl. with an electrical wiring system and traces of whitewash in the Deputado Marques da Silva Square.

**FINAL REMARKS**

The results of this study allowed to conclude that problems in afforestation in the three squares studied show the absence of planning and management of public policy. It is not known, in Arapiraca, of laws and/or specific codes for this purpose, as well as of the implementation of a Master Plan for Urban Afforestation. Reflecting this situation, homogeneous trees planted in the squares showed several phytopathogens, mechanical injuries, conflicts with urban facilities, inadequate practices of pruning and whitewashing of the tree trunks. As for the quantitative analysis of the trees, we observed a limited number of tree specimens in the three squares. However, afforestation of these sites has purposes and meanings distinct from other public spaces in the city. Regarding the identification of species, four species were considered native to northeastern Brazil, which meant an important fact for afforestation. We hope this study contributes to the planning and management of afforestation of squares in the city of Arapiraca and in other cities with similar problems. Afforesting a particular area is not just planting trees, because it requires periodic investments in caring for these living organisms that result in benefits and improvements, as a result, to the sense of artificiality of the environment. Actions that ensure tree health conditions, regular distribution of the species and its diversity should be prioritized. It is also recommended the creation and implementation of a Management and Monitoring Plan for Afforestation, among other measures aimed at upgrading and expanding the number of trees and their potential in the city of Arapiraca.

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REFERENCES


CARACTERIZAÇÃO E ANÁLISE QUALI-QUANTITATIVA...


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