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Introduction

According to Ritch (1987), Clement (1988), Ghavami (2002), Ashby (2004) and West (2011) the palm tree is considered as one of the most promising species in the tropical region of Latin America. However, despite its importance and potential, there are few studies related on how to make a good assessment of this resource. The present project compiles and summarizes the available studies about usage and characteristics of one particular palm tree, known as peach palm, a species common throughout the region but utilized up to now only for fruit production. The utilization of the trunk as a potential construction material, creates a more sustainable cropping practice.

Peach palm has been grown since pre-Columbian era by natives from Nicaragua to Brazil in tropical areas up to 1300 meters above the sea level. The cultivated crop benefits other crops as it shades for example coffee, cocoa, and citrus fruits. Peach palm is known under different common names in the Latin American region e.g., in Brazil it is known as “Pupunha”, while in the Andes area it is called “Cachipay”, in Venezuela "Pijiguao" or "Pichiguao and in Costa Rica "Pejibayes". In Peru and Colombia it is abundant in the lowlands of the Amazon and known as "Pijuayo" in Peru, while in Colombia it is called "Chontaduro". It is one of the most popular fruits of the pacific region of the country. Many other countries such the United States, for instance, identify the palm and its fruit with the name “Peach Palm”. The peach palm heart or palmetto is commercialized in the international market.

In ancient times, peach palm was also an important crop for the development of indigenous peoples, being cultivated not only for food, but to make weapons and build houses and fences out of timber and leaves (Tamayo, 2010).

In contrast nowadays, Latin America has created modern building systems that do not include the use of Peach Palm to be consistent with the reality of their environment. There are so many species of palms, which could constitute a

renewable natural resource for a variety of utilizations in the construction sector but are not taken into an account nor paid attention to the advantages for housing.

Peach palm consists of fiber composite material similar to bamboo which could be useful to structural engineering. According to Ghavami (2002), in order to use non-conventional materials as construction materials in large scale it is necessary to perform systematic scientific studies that could give insights on culture, techniques, collecting, curing and post-treatments, as well as complete physical, chemical, mechanical and dynamic analyses along with the evaluation of their performance over time. For this reason, it is necessary to initiate scientific research that may revolutionize the regional engineering by the use of peach palm as a structural material, integrating farming methods and sustainable economy.

The present study is part of the research program on non-conventional materials used in civil construction, which has been initiated in 1979 in the Department of Civil Engineering at the Pontificia Universidade Catolica of Rio de Janeiro (PUC-Rio), under the direction of Professor Khosrow Ghavami.

1.1. Objectives and Contents

Results on “micro-structure”, "meso-structure" and "macro-structure" of two palm wood ages of *Bactris gasipaes Kunth* commonly known "Peach Palm or Pupunha" are presented. A Digital Optical Microscopy was performed for the micro-structural analysis. Digital Image Processing was used to characterize the macrostructure and to establish the volume fraction of the cellulose fibers through the cross section of the Peach Palm. The methodology was successfully applied to study the variation of fiber volume fraction in two different ages of palm species *Bactris gasipaes Kunth* and classified as functionally graded material. Further, experimental research was conducted to determine basic physical properties (moisture and specific weight) and mechanical properties in tension, bending and torsion, generating as a result the maximum tensile strength (TS), the tensile modulus of elasticity (TMOE), bending modulus of elasticity (BMOE) and

modulus of rigidity (MOR) adjusting results with statistical methods to ensure the test accuracy.

This study consists of five chapters. Chapter two contains the literature review of the palm trees, specifically the peach palm, along with its background as a building material and the current regulations. Chapter three describes the materials and methods used for the micro-structure, meso-structure, and macrostructure identification, including physical and mechanical properties of two ages of peach palm stems. Chapter four presents the results and a comparison to similar materials such as Bamboo. Chapter five contains the research conclusions and suggestions for future research.