

## Iriarte Deltoidea and Socratea Exorrhiza: Sustainable Production Alternatives for Integrated Biosystems

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### Abstract

The objective of the present research is to analyze the structure, behavior and applicability of the integrated biosystems, through the study of the ancestral, current and potential uses of the sucker palms - Socratea Exorrhiza and chonta - Iriarte Deltoidea; And how its ecosystem functioning provides us with environmental goods and services; Which until now have not been thoroughly reviewed and therefore many of its properties are unknown. It is for this reason that this research tries to demonstrate that there are tools that make it possible to formulate plans, programs or projects of sustainable use that allow the biosystem to maintain itself as the ecosystem.

It is understood by integrated biosystems such as those that link two or more biological systems to transform organic waste into value-added products, through the use of processes involving microorganisms, major organisms, animals and plants. One of the processes becomes the raw material for the start of the next or the following processes (Rodríguez, et al.). "Biosystems are semi-open chemical chemosystems (or chemical reactors), which take from their surroundings the matter and energy they employ, which synthesizes all their other components and reproduce" (Bunge). They are made up of elements among which are living beings organized at different hierarchical levels. For example, genetic systems, organ systems, parasite systems, plant systems, among others, where intermediate levels can be observed between individual systems and population systems or communities (Jaramillo). These constitutive elements play a fundamental role in the functioning of systems and therefore of biosystems, such as: Inorganic substances, organic compounds, climatic elements, producers, consumers, disintegrators. The study will be carried out through seven stages: The first one refers to the bioconstruction and use of wood, the second to the use of biomass, the third, the fauna refuge, the fourth, the entomological analysis of species found in Cellulose; The fifth, to edible and medicinal uses, the sixth to the interaction of microorganisms in the soil; And the seventh and last to the proposal of normative tools and recommended uses.

**Keywords:** Chuapo; Chonta; Guadua; Integrated biosystems; Bioconstruction biomass; Entomological analysis; Orinoquia; Amazonia

### Introduction

Iriarte deltoidea of common name CHONTA and the Socratea exorrhiza commonly recognized in the region of the Amazonia and Colombian Orinoquia like CHUAPO. Are tropical palm species [1,2] found in humid forest ecosystems, and have traditionally been used by the inhabitants of the Central American countries to Bolivia and Brazil, in these regions where they grow they are mainly used by the Indigenous and peasants for the elaboration of different products of daily use as furniture and handicrafts, that is to say that in Colombia it is common, traditional and widely used by communities of low economic resources, but its scientific study is scarce and surely with more investigation both Iriarte Like the Socratea could become an important source of income with diverse applications.

This study seeks to execute seven investigative stages and to execute it was divided into two parts beginning by taking one of the species, in this case the chonta, applying the respective phases of investigation and in parallel, to perform the same procedure with the chuapo.

Stages 1 and 2 of the process will be performed comparing the two specimens proposed with Guadua angustifolia, taking the latter as a reference, and providing qualitative and quantitative information on the research of each of the palms; Oriented to understand and consolidate the way in which it should be given the sustainable use or if possible a sustainable productive chain, based on the functioning of an integrated biosystem that allows to offer social, economic and environmental opportunities to the communities that currently work

With the chonta; And to those who could benefit from the correct use of the slur. As a result of the investigative procedure, environmental normative tools will be proposed to allow the correct use of these species; As well as the inclusion in the standard resistant earthquake that facilitates to dynamize the agroforestry structure of the region as already has been done in other places of the country with the guadua.

### Experiment Materials and Methodology

The development of the investigation has begun with the palm chonta executing stages one and two in the following way:

#### Stage 1

A supplier of the certified material was located in the city of Mocoa in the department of Putumayo, which has been marketing "Chonta" for a long time (30 years approximately).

In parallel, mechanical tests were carried out in the laboratory,

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corresponding to 15 test tubes for the penetration resistance tests (Pilodyn) and 15 test specimens for Perpendicular Compression tests.

The material was physically tested by installing a 12-square-meter weather deck with 7-cm-wide, 3-meter-long and 1.5-centimeter-thick boards with 1-cm slats dilating for the purpose to measure environmental degradation processes.

## Stage 2

To explore the possible uses that can be given to biomass, the following parameters will be evaluated, preliminarily [3]:

**Meteorological conditions:** The experimentation will be carried out in close proximity to the avant-garde road very close to the weather station of the avant-garde airport of the city of Villavicencio, capital of the department of Meta (Colombia), taking into account the following atmospheric conditions: relative humidity, Altitude and geographical coordinates.

**Conditioning of the material [4]:** Milling of a certain amount of palm was carried out until passing through a sieve of a certain diameter.

**Determination of apparent density of the sample [5]:** Three different tests will be performed by the traditional method of gravimetry, using analytical balance and a pycnometer to calculate the weight of the dust sample from the difference of the filled and unoccupied pycnometer, and the chonta (palace) Bibliographical source) and for the "chuapo" in the department of Meta in the Orinoquía region. In the cuts made it was possible to observe the differences and similarities between one species and the other in terms of fibers, texture, morphology, among other characteristics. The density is determined by the equation  $d=m/V$

**Determination of the hygroscopic moisture of the sample [6]:** In the same way, 3 tests will be performed using the gravimetric method.

**Determination of ashes [7]:** Two tests will be carried out where the samples will be weighed, incinerated in the kiln, subsequently weighed and the difference in the masses calculated.

**Determination of lignin [8]:** Alkaline hydrolysis treatment at a temperature of 30°C, of 5 grams of sample, weighed in the analytical balance with an accuracy of 0.001g, the first experiment was one hour with sodium hydroxide and sodium sulfate.

**Determination of hemicellulose [9]:** Catalytic acid hydrolysis treatment of the sample previously treated by hydrolysis was performed.

## Results

As is noted from the Figures 1 and 2, the different sites were searched to locate the specimens, for the Chonta in the department of Putumayo in the Amazon region (of which there is no photographic record, but was taken from a video of differences and similarities between one species and the other in terms of fibers, texture, morphology, among other characteristics.

For the process of construction of the prototype (DECK) the wood of the treated and legally marketed chonta was purchased, which will be exposed to the elements in the season of high and low rainfall. It will also be monitored for two years to see the evolution and behavior of the material and its probabilities of being classified as an element suitable for bioconstruction activities (Figure 3).

During the field work performed for the elaboration of the necessary cuts for laboratory tests, the presence of different Coleoptera



Figure 1: Material cut in the municipality of Restrepo, Meta, Orinoquía, Colombia. For the accomplishment of laboratory tests, wood of the plucking. Photography Francisco Quiñonez.

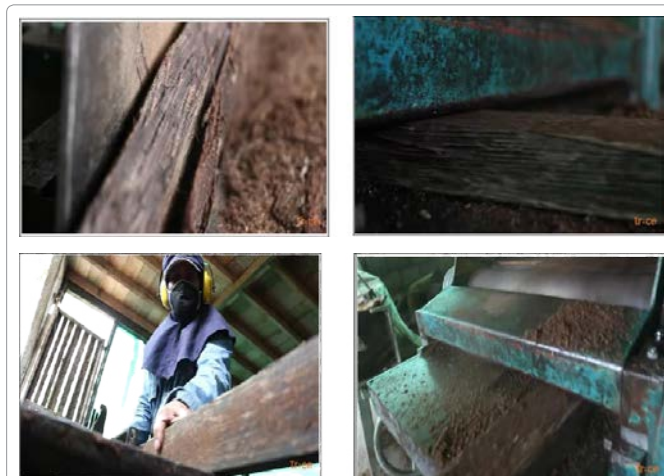


Figure 2: Material extracted and treated wood Iriarteia deltoidea in the municipality of Mocoa, Putumayo, Amazonia, Colombia.



Figure 3: Wood of chonta, used in the construction of deck as experimental prototype, designed and constructed by the architect Francisco Quiñonez. Photography Francisco Quiñonez.

Figure 4 was found, which may be present in the specimens, possibly due to the existing symbiotic activity.

Through the secondary information consulted a very valuable revelation was found regarding the chuapo palm and its relation with the parrot orejamarillo: With characteristics of life very different to the one that the country knew, was discovered in 2009 a population of Orejamarillo parrot in the upper part of Cubarral (Meta), Orinoquía, which today reaches the 80 individuals in the reproduction stage.



**Figure 4:** Finding coleoptera in the cellulose and trunk of the palms. Photography Francisco Quiñonez.

Since then, environmental authorities together with different entities are committed to its conservation with a project built on the basis of effort and dedication. But the struggle is not only to preserve the parrot but its 'home', that is why a study of the population dynamics of the Chuapo palm has been done since 2015, and in a recent phase the measurement of the rates of Mortality and growth in each. This impinges on the importance of analyzing the environmental services offered by the *Socratea* as a wildlife refuge.

## Discussions

The use of biomass from both palms, such as roots, leaves, stems, fruits, leaf litter, will undergo different laboratory tests to experience the likelihood of obtaining liquid or gaseous fuels that contribute as energy to more efficient and cleaner mechanisms. That the gases produced in the combustion would have a much lower proportion of sulfur compounds than those coming from the processes of combustion of carbon.

The analysis will begin by making the parallel between the CHONTA and the GUADUA which is composed mainly of hemicellulose and lignin [10] 61-71% and 20-30% respectively, it is expected similarly a similar composition of the chonta due to that its morphology is similar, since the density and hardness of the tissue of the stem of the palms in general increase from the center to the periphery and are greater towards the base [10], the guadua instead presents a hollow structure in the center and that is populated and making it harder and denser towards the crust [10]. Due to its similarity in hardness and density in the stem, it is desired to verify the high lignin content in the chonta palm, since, if its chemical structure were similar, it could be used as the guadua in the construction of houses, as material Reinforcement and attractive color as landscaping element, it is known that the mechanical properties of lignin make it special, even today is the raw material of carbon fibers useful for the materials industry.

## Conclusions

These palm varieties are extremely resistant and have been used ancestrally by the natives for their constructions, compared to the *Guadua angustifolia*, which is a very ductile fiber, easy to work and abundant in the tropical regions, but which in turn is very delicate to the processes of deterioration. On the other hand, the chuapo and

the chonta are today characterized by contemporary constructors as a "very hard material that wears and damages the cutting tools"

The behavior of the chonta wood during the construction of the prototype, was classified as excellent, since it is a material of great hardness and resistance that in turn counts on a degree of flexibility that allows to work it and to mold it according to the design. It is analyzed as a solid material, stable and beautiful finishes.

It is necessary to perform the entomological study, due to the coleopteran species found at the time of cutting the palms for laboratory tests, due to their variety and importance it is necessary to evaluate their biological and ecological function within the biosystem.

As the research stages are carried out, we confirm that the best way to propose a sustainable productive system or sustainable production project is to propose its exploration and evaluation under the theory of integrated biosystems, and it works understanding the hierarchy, interactions and interrelations of the System in general to understand ecosystems in an integral way, and in this way to interpret and use in a sustainable way the environmental goods and services of which we are kindly surrounded. The recognition, interpretation and encompassing of a strategic ecosystem as an integrated biosystem is the key to achieving sustainable development.

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