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Pau rosa (Aniba rosaeodora): An extractivist potential

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Lucas Eduardo Lopes Farias
Agricultural Engineer
E-mail: lucasfarias0102@gmail.com

Breno Jorge Zeferino Monteiro
Agricultural Engineer
E-mail: bzeferino@hotmail.com

Joseph Pina Bonfim Ferreira
Agricultural Engineer
E-mail: josephbonfim10@gmail.com

Breno Porto de Oliveira Cunha
Agricultural Engineer
E-mail: brenocunha.ufra@gmail.com

Ana Vitória Pinheiro Serra
Agricultural Engineer
E-mail: anavitria.vitria75@gmail.com

João Paulo Amaral da Silva
Graduating in Agronomy
E-mail: jpamaral23@gmail.com

Luana Cristhiny Silva da Costa
Graduating in Agronomy
E-mail: luanacscosta07@gmail.com

Eberth Gonçalves Rocha de Oliveira
Graduating in Agronomy
E-mail: oliveiraeberth368@gmail.com

Rogério Tavares da Silva
Graduating in Agronomy
E-mail: rogeriotavaresilva@gmail.com

Diana Brandão Baía
Graduating in Agronomy
E-mail: dianabbaia@gmail.com

Gertrudes Namias Tocantins de Souza
Graduating in Agronomy
E-mail: gntocantins@gmail.com

Vivian Carolina Nascimento de Albuquerque
Graduating in Agronomy
E-mail: vivian.albuquerque.1996@gmail.com

ABSTRACT
Pau-Rosa (Aniba rosaeodora), which belongs to the lauraceae family, is a species with high added economic value. Its value is based on the extraction of its essential oil, which is highly prized by the chemical, cosmetic and food industries. Its exploitation began in 1882 in French Guiana, when the extraction of its oil generated interest in the perfumery industry because it has a sweet, woody smell. The great interest shown by the industries in the essential oil has motivated producers to plant the species. However, there is a limited supply of seedlings for sale, as its exploitation was unsustainable, so most of the trees were felled to produce the oil in distillation plants. Essential oils are complex mixtures of volatile substances that dissolve in fat, propagate an aroma, are liquid and are normally obtained by hydrodistillation and steam distillation, where steam distillation is the most widely used in industry. During the essential oil extraction process, the water that drags the volatile constituents becomes aromatized, which is called hydrolate.

Keywords: Essential oil, Industry, Extractivism, Amazonia.

1 INTRODUCTION

Aniba rosaeodora Ducke, popularly known as Pau-Rosa, is a tree in the Lauraceae family that occurs throughout the Legal Amazon, including Brazil, French Guiana, Suriname, Guyana, Venezuela, Peru, Colombia and Ecuador (KUBTZKI & RENNER, 1982).

Its main characteristics are that it is a large tree, reaching up to 30 meters in height by 2 meters

in diameter, with a straight and cylindrical trunk and the presence of a brown-yellowish or reddish house that detaches in large plates; its crown is narrow or oval, occupying the middle or upper canopy of flowers (DUCKE (1938) AND KUBITZKI & RENNER (1982)).

Its exploitation began in 1882 in French Guina with the main objective linked to the extraction of oil, which has an odor characterized as sweet and woody, thus having good eyes directed to the perfumery industry (VIAL-DEBAS, 1996).

In Brazil, its commercialization had as its main economic focus in the years 1940 to 1970, where at the time its export had a gigantic leap, where it was considered the third main product of economic value in the trade balance of Amazonas (MAY and BARATA., 2004).

Its oil, in addition to having a great commercial factor directed to perfumeries, also provides a high added value, being well known for having biological activities and application in the chemical, cosmetic and food industries (AGUIAR et al., 2017).

Among the components present in the oil, Linalool is the one that is present in the largest quantity, being a secondary metabolite, component of aromatic essential oils of vegetable origin, being one of the most important substances in the pharmaceutical industry; is used as

fragrance fixer, but also by folk medicine for anti-inflammatory, analgesic, hypotensive, vasorelaxant, antinociceptive and antimicrobial activity, in addition to these properties, have hypnotic, hypothermic and sedative actions (CAMARGO and VASCONCELOS., 2014)).

The oils of essence origin are considered complex mixtures of volatile substances that during the extraction process have as a co-product the water that drags the volatile constituents, which finally becomes flavored being called hydrolate, thus there are biological activities already described for the rosewood hydrolate. larvicide (AGUIAR et al., 2017).

2 BOTANY AND SYSTEMATICS

Kingdom: Plantae

Filo: Magnoliophyta **Class:** Magnoliopsida Ordem**:** Laurales

Botanical family: Lauraceae

Genus: Aniba

Scientific name: *Aniba rosaedora* Ducke

Common names: pau-rosa, pau-rosa-mulatinho, pau-rosa-itaúba (Brazil) and pau-rosa-imbaúba, rosewood (Guyana), bois de rose, bois de rose felelle (French Guiana), enclit rosenhout (Suriname). (BORGES, 2012)

Botanical synonyms: *Aniba rosaeodora* Ducke var. Amazonian Ducke and *duckei* Kostermans.

- **Trees:** large size, reaching up to 30 cm in height and 2m in diameter.

- **Leaf:** simple, alternate, obovate, elliptical or obovate-lanceolate, wide range in size, averaging 14 (6-25) cm long by 5 (2.5-8) cm wide. (BORGES, 2012).

Source: Christma chota Mendoza

- **Flower:** rusty-yellow, hermaphrodite and diminutive.
- **Seed:** according to Borges: "the seed of the rosewood is ovoid, a slender, smooth and opaque integument; light brown in color with dark brown longitudinal streaks and 2.6 cm long and 1.5 cm in diameter.". (2012)

Source: Sampaio (2003)

3 NATURAL GEOGRAPHICAL DISTRIBUTION

According to Leite et al (1999), the first survey of the geographical distribution of Rosewood (*A. rosaeodora*) was carried out in 1930 by Ducke, and later in 1938, and indicates the development of the species in the regions of rain forests in the interior of French Guiana and neighboring parts of Brazil (Oiapoque and Amapá) and Suriname. Still, the author considered the Amazon River as a zone of occurrence, but as a small strip of tens of kilometers to the north and south, reaching the border limits of the states of Pará and Amazonas. In Brazil, more specifically, the species occurred widely

along the Amazon River and in the Amapá region.

Currently, the geographical distribution of Rosewood emphasizes the western Amazon as the main region of incidence and exploitation of the species. In Pará and Amapá, only individuals belonging to the ancient populations exploited in the past remained. Thus, the exploitation of the species is restricted to the western portion of the Amazon, specifically in the municipalities of Nhamundá, Borba, Parintins, São Sebastião do Uatumã, Maués and Nova Olinda do Norte. In general, Borges (2012) mentions the occurrence of the species found in areas between the 10th and 2nd parallels of south and north latitude, respectively, and the 56th and 72nd meridians of longitude.

The distribution of the species is also due to the conditions, mainly, of climate and soil found in the regions of exploration. Thus, A. rosaeodora is distributed in climate zones classified as Am (tropical monsoon climate - characterized by a short dry season and abundant and prolonged rainfall, in addition to temperatures above 26°C constant) and Aw (tropical climate with rainfall in summer - identified by the good definition of dry and rainy seasons), according to the Köppen classification. with high rainfall (Leite et al, 1999).

Pau-Rosa preferentially inhabits high rain forests, although it can be found in low white sand forests (Rio Negro) and igapó areas in Pará (Rio Mapuera). In the forests, Rosewood occurs in groups of five to eight plants spaced 50 to 100 meters apart and its groups, in turn, spaced 300 to 400 meters apart. Also, due to the extremely predatory exploitation system that occurred, the high natural incidence of adult plants (> 3 meters) is a rare condition, being common to location of isolated and well-dispersed specimens. According to studies, the grouping tendency of the species should be strongly related to the light conditions of the place, although the Rosewood can develop in shade places, a necessary capacity for the regeneration of the species.

4 APPLICATION

The most well-known and economically relevant use extracted from rosewood trees (Aniba rosaedora) is in the development of the oil that is removed from the tree, which is extracted from linalool, where it is widely applied in the perfume industry being appreciated both in the national and international markets. Traditionally, the production process of rosewood oil consists of felling the trees in the forest, which are cut into small chips and crushed for distillation in mobile mills near the exploited area. It is known that one ton of wood produces only 9 kg of oil, and 20 tons of chips are needed to produce a 180 kg barrel of oil (SAMPAIO et al., 2005)

Also according to Sampaio et al., (2005), obtaining oil extract from rosewood leaves in recent years has become increasingly difficult to find this raw material because this tree is becoming rare in the Amazon due to the factor of deforestation and constant collection of its wood. However, this natural resource, which is of great value, needs urgent effective management so that the total disappearance of

the species does not occur. Soon the option for the method of pruning the crown of these rosewood trees in some plantations of the Ducke reserve in Manaus has seen the ability of some adult trees to regrow, the productivity of oil taking place from branches.

The use of rosewood oil for industrial purposes in the Amazon began around 1926, due to the depletion of the reserves that were located in French Guiana, and with the implementation of the first plant in Juruti Velha, which is located in the city of Taparapu in Pará. In the year it started operating, it was an exporter of around 16 tons of rosewood essence oil. Rosewood processing was the first flora-chemical agroindustry to be implemented in the Amazon (HOMMA, 2003).

The use of rosewood essence was first used by the soap and perfume industries as fixers of the essence. It is possible to highlight the perfumery Phebo Ltda, which was founded in 1932, in Belém do Pará, which manufactured Phebo soap with more than two hundred types of perfume and among them was present the essence of the Oil of the Tree of the Stick (HOMMA, 2003).

Essential oils are complex mixtures of volatile, lipophilic, odorous and liquid substances and are usually obtained by hydrodistillation and steam dragging, which water vapor dragging is the most used in industries (CHAAR, 2000). During this processing that the essential oil is extracted, the water that drags the volatile constituents becomes flavored, which is called hydrolate (AGUIAR et al., 2016).

5 PROPAGATION

Currently, IBAMA, through Ordinance No. 01 of 05/13/98, seeks to reduce/minimize the exploitation of rosewood in the Amazon, requesting the exploiters of the raw material to carry out the replacement process equivalent to the extracted raw material and thus causing the use of a management that results in the regrowth of adult trees, such as cutting the trunks above 50 cm from the ground or pruning the crown of the trees. In addition, more recent studies, such as those by Chaar (2000) and Oashi et al. (1997), also indicate that thin leaves and branches produce more oil than wood and point out that the oil yield in the Manaus region is higher in the dry season.

The pruning method, which was implemented in 1997, resulted in a high number of shoots that later generated higher weight of leaves and branches in the May 2000 evaluation. The regrowth process and greater efficacy in relation to the oil productivity of the branches in relation to the wood of the rosewood trees (OHASHI et al., 1997), show that the conduction of the plantations of this species through the pruning of the canopy has great chances of being the most viable way to exploit and manage this species (SAMPAIO et al., 2005).

In addition, this management through the pruning of the canopies was observed as a means of renewable source of biomass and with this it was realized that this

This process results in a decrease in the costs of preparing the area and installing the plantations, making resources available for soil fertilization, contributing to greater biomass production in a shorter

period of time (SAMPAIO et al., 2005).

Research has been carried out on vegetative propagation and the results are so encouraging that it can be concluded that rosewood propagates by means of cuttings. Obtaining seedlings by this process, even without any previous treatment, but under natural conditions, results in beneficial prospects for the silviculture of this forest essence, but it needs to receive greater attention from the organizations responsible for forestry research in the Amazon (VIEIRA, 2005).

According to Jardim et al., (2010), the use of asexual propagation techniques, as an example of micropropagation, can become an alternative to disseminate this species. Among the characteristics of micropropagation is the greater control of the different phases of explant growth in vitro. However, it is necessary to add growth regulators to the culture medium, organic compounds of which, in low concentrations, cause the inhibition or alteration of the development of the plant when cultivated in vitro (HARTMANN et al., 2002).

The implementation of phytohormones, or even other compounds that stimulate rooting, should be tested in clones from young and adult specimens, in both environments, both under controlled conditions and in the natural conditions of the rosewood tree. The tree has the characteristic of adapting to bare-root planting in the rainy season on stumps, seedlings with leaves and defoliated seedlings, and resisting against mortality and this generating a decrease in production costs when reforested (VIEIRA, 2005).

6 CULTIVATION

According to MILK; QUISEN; SAMPAIO (2001), in the seed collection stage, these "should be collected while still in the tree or when they fall to the ground. The color of the seeds is also a good indicator of the degree of maturation that benefits germination. Seeds with a dark violet color have a faster speed and a higher percentage of germination."

Seedling production: Seedlings can be obtained by seeds and cuttings.

By seeds: The substrate to be used in the production of paurosa seedlings should be a soil with good texture and structure, good fertility and amount of organic matter. This soil can be obtained in the upper layers of forest areas. In the preparation of the substrate, it is

Convenient to sift the soil in large sieves with mesh size of approximately 1cm. In order to prevent the formation of clods. If the soil used in the substrate does not present the required fertility, it is recommended to correct it with the addition of 50g of simple superphosphate and 50g of potassium chloride for each cubic meter of soil, and the correction of pH with the application of 2kg to 3kg of lime per cubic meter of soil, says LEITE; QUISEN; SAMPAIO (2001).

Sowing and germination The recommended seedling production for rosewood should be carried out by direct sowing of seeds in black polyethylene bags of 13cm x 18cm, well filled with

substrate, enchanted and well irrigated. Sowing should be done manually, placing one seed in each container, buried between 1cm and 2m from the soil, and, when sowing is finished, cover the seeds with a layer of 0.5cm of mulch (sieved soil, sceplet or rice husk), as a measure of protection at the initial stage of germination, both from high temperature and from the rapid drying of moisture. Flower beds should be covered with shade with at least 50% shading. Watering should be frequent with the aid of watering cans or sprinkler irrigation system, one being applied at the beginning and another at the end of the day. The seedlings must remain in the beds until they reach 20cm to 30cm in height, and then they are selected and taken for definitive planting in the field, says LEITE; QUISEN; SAMPAIO (2001)

Crop treatments: After the beginning of germination, it is recommended to apply a mixture of fungicide, such as Benlate at a dosage of 2g/l of water, and insecticide, such as Parathion methyl 60% (10.5 ml/15l of water), alternated with Orthene 750 BR (15g/15l of water). This mixture, plus an adhesive spreader, should be applied weekly until the seedling reaches 3cm to 4cm in height, and then be applied fortnightly, says LEITE; QUISEN; SAMPAIO (2001).

Fertilization In the nursery phase, it is recommended to fertilize with NPK solution, in the proportion of 50ml/plant. Essential for the good development of healthy seedlings is the nutritional complementation of the plants, through the application of foliar fertilization, which should be done every fifteen days with NPK in a 1:2:1 ratio. MILK; QUISEN; SAMPAIO (2001).

Irrigation : Seedlings should be irrigated at least twice a day in summer. When transplanted to the field in the rainy season, they withstand the climate of the region well, so it is not necessary to irrigate during the planting phase. MILK; QUISEN; SAMPAIO (2001).

The ideal material for vegetative propagation of rosewood by cuttings are juvenile branches, obtained from the regrowth of adult trees or one-year-old seedlings. MILK; QUISEN; SAMPAIO (2001).

Planting Before planting, the following procedures should be carried out:

a) Selection of the area for planting The areas with good drainage are the most suitable, without the possibility of waterlogging. It is recommended to collect soil samples for analysis before planting. It is not advisable to cut down forest areas to establish planting, but to use abandoned or dusty areas previously used as pasture or for annual crops.

b) Cleaning of the area In dusty areas, the cleaning should deal with the removal of existing vegetation, and it may be decided to maintain trees that favor the shading of rosewood seedlings, depending on the type of planting to be adopted. After the vegetation is felled, there are harrowings that favor the incorporation and, consequently, the incorporation of the matter into the soil. Two other harrows are advisable, in addition to liming for soil correction, in case of very acidic soils. MILK; QUISEN; SAMPAIO (2001)

c) Opening pits: In areas with a slight slope, it is recommended to mark the pits following the level of the ground. The ideal dimensions are 40cm x 40cm x 40cm. MILK; QUISEN; SAMPAIO (2001)

d) Planting It should always be established at the beginning of the rainy season in the region, according to the procedure for most regional forest species, taking care that the plastic packaging is completely removed from the seedling and dispose of the roots in a natural way as they are in the container. MILK; QUISEN; SAMPAIO (2001).

Dense homogeneous planting Dense planting is recommended either for a sustained exploitation of short duration or, in particular, for the selection of more productive breeders. However, nothing is known yet about the possibility of pests and diseases. QUISEN; SAMPAIO (2001).

Intercropping is the most recommended for long-term exploitation of this species. It has the advantage of seeking to reproduce, roughly speaking, the environmental heterogeneity of the Amazon rainforest (the natural habitat of the species). In addition, it allows the decentralized economic return for only this species, that is, it allows the sustained exploitation of the other intercropped species. MILK; QUISEN; SAMPAIO (2001).

7 BENEFICIATION

The description of the production process of rosewood essence explores the ways of organizing and performing tasks in the stages of extraction, transport and transformation of wood logs into linalo oil (RODRIGUES 2016).

The production of rosewood essential oil depended exclusively on the extractive supply and the growth of the market requires the development of plantations on a rational basis, since there is an evident tension between the supply based on nature and the expansion of the market. In the 1950s, rosewood extraction exported 444 tons. This shows the potential that the development of this crop would represent for the Amazon, whose value could be estimated at 16 million dollars, not including 3 million dollars of the imported synthetic similar (HOMMA 2003).

Its cultivation could also be used for the recovery of deforested areas in the Amazon, in the generation of income and employment for the family farming segment, among other options, aiming at its verticalization in the region (HOMMA 2003).

The formation of new rosewood plantations in altered and/or degraded areas in the Amazon contributes not only to the recovery of these areas, but also to the restoration of the environmental services provided by forested areas (FERRAZ et al 2009).

8 PRODUCTS

The main product derived from rosewood is its essential oil. Extractivism has been going on

for many years, peaking between the 1960s and 1980s. This essential oil is mostly made up of linalool, a monoterpene that is used in fine perfumes such as Channel No. 5 and many other types of cosmetics in the industry. Prices are very high, exceeding 300 dollars per liter in the international market. (CONTIM AND CONTIM, 2018)

Therapeutic functionalities have also been discovered in linalool, with

anesthetic and antimicrobial activities, thus arousing the interest of the pharmaceutical industry. This great demand caused the decimation of the natural populations of rosewood, and this work of extractivism was carried out by riverside dwellers in the Amazon region with cheap labor. All of this has caused the species to enter the endangered list. (CONTIM AND CONTIM, 2018)

9 MARKETING

Essential oils are raw materials used by the perfumery industry, which occupies 14% of the market for cosmetics, cleaning products and the food industry. They are also used by the chemical and pharmaceutical industry. The volume of production and consumption of essential oils in Brazil is largely due to the strength of the Brazilian cosmetics industry (Leite et al., 1999).

In Brazil, rosewood stood out commercially between the 1940s and 1970s, becoming the third most important product in the trade balance of Amazonas (May & Barata, 2004). Due to the predatory exploitation of the oil produced in the mills from wood, the marketing value of the product suffered a great appreciation and went from USD 30.00 kg-1 in the early 1990s to approximately USD 320.00 kg-1 in 2019 (Brasil, 2019). In addition, it was observed that the exploitation of oil from leaves and branches is possible and of equal quality to the exploitation of the wood of the species, making the activity more sustainable and valued (Lara et al., 2018; May & Barata, 2004).

In a study carried out with traders and producers of Rosewood seeds and seedlings in Amazonas, Lara et al. (2021) identified that the sale price of seedlings of the species was the highest value among the available forest species, since the difficulty of adapting and regularizing producers and traders with the agencies in charge is difficult. The author identified NGOs and entrepreneurs as the main buyers of seedlings and seeds, which aim to establish commercial plantations for reforestation and sale of oil of the species, respectively. In addition, it was verified that the suppliers of seeds and seedlings of the evaluated enterprises were, for the most part, indigenous people and individual collectors, configuring the activity as informal.

10 CONCLUSION

Rosewood, in addition to having a high commercial value, also presents itself as A strong implement for social purposes, linked to its extractivism and production by small local farmers.

Its oil of high commercial purchasing power has been used in a very satisfactory way, mainly

by the perfumery industries, but its commercialization is not only based on this, it can also be used in the pharmaceutical and pharmaceutical sector.

It is necessary that, for a sustainable production of rosewood (Aniba rosaradora), its exploitation is not unbridled, with the risk of causing the extinction of the species. In this way, extracting the essential oil in a harmonious and sustainable way with the environment is essential for future production.

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