

Chemical Composition of the Essential Oil from *Hancornia speciosa* var. *pubescens* (Nees & C. Mart.) Müll. Arg. (Apocynaceae) Leaves and Its Soil Characterization

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Abstract: Essential oils are secondary metabolites produced by plants, can be extracted from any organ such as: leaves, branches, roots, rhizomes, flowers, fruits, seeds, wood and stem bark. The present study aimed to analyze the compounds found in the essential oil of leaf *Hancornia speciosa* var. *pubescens* (C. Nees & Mart.) Müll. Arg. (Apocynaceae), popularly known as mangaba, and perform the soil chemical analysis of the occurrence of the same species. The oil was obtained by hydrodistillation in Clevenger from crushed leaves, their analysis was performed using the Shimadzu gas chromatograph model 2010 GC Ultra coupled to a mass spectrometer. The apofarnesol (48.45%), naphthalene (4.84%), α -bisabolene (4.12%), trans- β -heptanone (2.34%), spathulenol (1.48%), cypermethrin were identified (1.35%) and malonic acid (1.34%), which according to literature all these compounds have great insecticidal characteristics. Soil testing was performed according to the protocols of the S.L. Goiânia/GO, which was found a soil poor in nutrient with acidic pH, these predominant features of the Cerrado's soils, which can influence the biosynthesis of secondary metabolites. Concluding that *Hancornia speciosa* variety *pubescens* may have insecticidal activities.

Key words: Mangaba, *Hancornia speciosa*, essential oil, soil.

1. Introduction

Brazil's Cerrado possesses a flora with great diversity of species, approximately 11,627 native plants encloses this Brazilian biome, with more than 220 species with medicinal use and more than 20 types of eatable fruits that are known by local citizens and also sailed in urban centers [1].

Hancornia speciosa Gomes or "mangaba" belongs to *Hancornia* genus. It's constituted of just one specie. Thus for mangaba its species is *Hancornia speciosa* Gomes, which has six varieties that had been identified as: *H. speciosa* to var. *speciosa*, *H. speciosa* to var. *maximiliani*, *H. speciosa* to var. *cuyabensis*, *H. speciosa* to var. *lundii*, *H. speciosa* to var. *gardneri* e *H. speciosa* to var. *pubescens* [2]. Leaves from this specie are used in folk medicine as tea for menstrual cramps [1]. A decoction mix with mangaba's roots and *Manioht tripartita* is useful for dislocation and

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hypertension [3].

In the present study, the authors sought to investigate the chemical variability of the essential oil from *Hancornia speciosa* var. *pubescens* (Nees & C. Mart.) Müll. Arg. leaves and soil characterization of this specie.

2. Materials and Methods

Plant material and EO isolation—Plant material (leaves) of the specie *Hancornia speciosa* var. *pubescens* (Nees & C. Mart.) Müll. Arg. (Apocynaceae) was collected in December 2014 at the city of Goiânia—Goiás, in the Escola de Agronomia da Universidade Federal de Goiás (UFG) and authenticated by Dr. Lázaro José Chaves. The leaves of *H. speciosa* var. *pubescens* were triturated (120 g) and hydrodistilled by Clevenger-type apparatus. After 3 h and a half distillation, the EO was collected using hexane HPLC grade in order to solubilize it. The samples were sealed and kept in dark glass vials in the refrigerator at -20 °C for further analysis.

2.1 Chemical Composition

GCMS—EO analysis were performed by gas chromatography (GC 2010 Ultra model, Shimadzu) equipped with a mass selective spector. Compounds were separated on a RT-5MS capillary column (30 m × 0.25 mm). A 1.0 µL sample was injected in the split mode. Helium was used as carrier gas with a flow rate of 1 mL/min. Injector temperature was set at 200 °C. Column oven temperature was programmed from 60 °C to 280 °C. Initial temperature was held for 2 min, and then increased at a rate of 3 °C/min till achieve 240 °C. After that, at a rate of 10 °C/min, final temperature was held for 10 min. Most constituents were identified by comparison with their GC retention indices with those of the literature. Retention indices were determined in relation to homologues series of n-alkanes (C8-C24) under the same operating conditions [4]. Further comparisons were made using their mass spectra with those stored in NIST11/2011/EPA/NIH data base.

2.2 Attainment of the Ground Sample

The ground sample was collected at 10 am (February, 2014) in the Escola de Agronomia da Universidade Federal de Goiás (UFG), where was located mangaba's tree, which its leaves were collected for their EO analysis. The samples had been collected according to established protocols of analysis.

2.3 Chemical Composition Analysis of the Ground

The chemical composition of the ground was performed by S.L. Goiânia/GO. The sample was taken for analysis two hours after its collection, which had been kept in plastic bag at room temperature.

3. Results and Discussion

The EO of *Hancornia speciosa* var. *pubescens* leaves was obtained in a yield of 0.56% (w/w) fresh weight. The results of GC-MS analysis of the oil identified twenty compounds. Seven of them were considered major and most important in terms of pharmacological properties, as shown in the table below:

One of the first studies realized for chemical composition elucidation of the volatile oils from *H. speciosa* leaves belonged to Santos et al. [5], which objective was to verify alterations between EO major components from fresh leaves and after 10 days. of drying submission. A decrease in the percentages of the alcohol was observed as (E)-3-hexenol from 68.6% to 13.3%, on the other hand it had a significant increase

Table 1 Major constituents of the EO from *Hancornia speciosa* var. *pubescens* leaves

N ^o	IR*	Compounds	Index (%)
1	2802	Malonic acid	1.34
2	3036	Cypermethrin	1.35
3	1536	Spathunelol	1.48
4	1479	Trans-β-heptanone	2.34
5	1518	α-bisabolene	4.12
6	1430	Naphthalene	4.84
7	1572	Apofarnesol	48.45
8	---	Others	36.08

*retention index

in the percentage of the oxygenated monoterpenes as geraniol from 2.4% to 54.7%, linalol modified from 4.3% to 9.0% and eugenol that was presented by 2.3% after 5 days of drying.

Apofarnesol (48.45%) constitutes one of the derivatives of the farneseno with promising insecticidal activity. Ribeiro [6], in its phytochemical study of the biological activities from *Jatropha curcas* L. against Leishmania forms it was attributed to apofarnesol, the responsibility of the insecticidal activity performed in his work. In another study, farnesol derivatives [7] had been important in the increase of the susceptibility of *Staphylococcus aureus* and *Candida albicans* cultures of *Staphylococcus albicans*.

Thus, in the analysis of the composition of the essential oil from leaves of *H. speciosa* to var. *pubescens*, the majority components apofarnesol, naftaleno and α -bisaboleno differs from those presented by Santos et al. [5], in the analysis of the essential oil of *H. speciosa* whose majority composites had been monoterpenes, geraniol, linalol, fenilpropanóide and eugenol. This chemical variability between these species varieties is sufficiently acceptable.

Therefore, the genetic variability of the plants, which is closely related with the volatile oils quality, is expressed by chemotypes [8]. Chemical variation also occurs in different volatile oils gotten from one same species collected in different places, what it is frequent

due to their high chemical complexity [9].

The chemical composition of the ground where were collected the leaves from *Hancornia speciosa* var. *pubescens* is demonstrated in the table below:

It is possible to observe that pH of this ground is very acid (pH = 4.3), with dystrophic characteristics, this last one must to the inferior values 50% of saturation the exchangeable bases, which determine low saturation [5], also characterized with low capacity of cationic exchanges, having predominantly aluminum, calcium and zinc in the complex of exchanges of the ground, it presents medium saturation for aluminum (19.53%) and low concentration of nutrients. The organic material presented 35.0 g/dm³ that is considered average.

According to Cremon et al. [10], the values of aluminum saturation (m%) had oscillated around 30.9-57.9% in Cerrado's environments of Paranatinga-MT region. The levels are lower than those considered acceptable for development of the commercial cultures. Values variations from 35% to 50% are considered harmful and higher than 50% are very harmful. The aluminum saturation index of 19.53% found in this present study can be considered acceptable.

Cerrado's ground is characterized by presenting low natural fertility, acid, deep and arenaceous texture [1, 12]. Replacement or adequacy of the nutrients presenting in this ground is vital for plants growth and

Table 2 Chemical composition of the ground where were collected the leaves from *Hancornia speciosa* var. *pubescens*.

Compounds	Value	Compounds	Value
Zinc (mg/dm ³)	1.5	CEC	8.96
O. M. (g/dm ³)	35.0	m (%)	19.53
pH (CaCl ₂)	4.3	V (%)	22.99
Ca (cmolc/dm ³)	1.5	Ca/Mg	3.00
Mg (cmolc/dm ³)	0.5	Ca/CTC (%)	16.74
Al (cmolc/dm ³)	0.5	Mg/CTC (%)	5.58
K (mg/dm ³)	0.06	K/CTC(%)	0.67
H + Al (cmolc/dm ³)	6.9	H + Al/CTC(%)	77.01
Ca + Mg	2.0	C (g/dm ³)	20.30

H + Al—Hydrogen + Aluminum (Acid potential); CEC—cation-exchange capacity; O. M.—organic material, V—base saturation index; m—Aluminum saturation index.

vegetative development. The lack of those nutrients promote negative consequences in productivity, quality of the fruits, orchard health and longevity.

In its study about “mangabeira’s” response after ground’s fertilization with NPK and micronutrients, showed solo’s profile before treatment: pH in water = 5.8 (average acidity); available P = 7.8 mg/dm³; available K⁺ = 0.01 cmolc/dm³; Ca²⁺ + Mg²⁺ exchangeable = 1.1 cmolc/dm³ (low); Exchangeable Al³⁺ = 0.9 cmolc/dm³ (high) and organic substance = 22 g/dm³. After fertilization, results revealed a significant effect ($P < 0.01$) in the weight of the fruits but they weren’t capable to verify some influence in mangabeira’s productivity [12].

The results gotten in this work had evidenced, as shown in the literature, insecticidal activities in the identified composites, whose majority found had been the apofarnesol (48.45%), naftalene (4.84%) and the α -bisabolene (4.12%), having also found the Trans- β -heptanone (2.34%), spathulenol (1.48%), cypermethrin (1.35%) and malonic acid (1.34%). Compounds that possess insecticidal characteristics already have herbicidal and antibacterial characteristics.

In relation to the analysis of the ground, it was possible to identify that it is poor in nutrients and an acid pH. This last characteristic is predominant in Cerrado’s ground and can excessively influence biosynthesis of the secondary metabolites and in the intra and interspecies variability, mainly with respect to essential oils.

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