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PHYSICO-CHEMICAL COMPOSITION AND ACTIVE PRINCIPLES OF LEAVES AND FRUITS OF PSEUDOACASIA ROBINIA OF UPPER KATANGA IN THE DEMOCRATIC REPUBLIC OF CONGO

[COMPOSITION PHISICO-CHIMIQUE ET PRINCIPES ACTIFS DES FEUILLES ET FRUITS DU PSEUDOACASIA ROBINIA DU KATANGA/ R.D. CONGO]

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Resumé

Il existe une variété de la plante sauvage d'acasia dans le Haut-Katanga/RDC. Il s'agit d'un pseudo acasia Robinia, mais qui ne donne pas de fleurs et ne dégage aucun parfum.
Au terme de notre recherche, les résultats obtenus révèlent que la plante de pseudo acasia Robinia poussant à Lubumbashi et dans ses environs est dotée des propriétés anti oxydantes, antiseptiques, anti venimeuses suite à la présence des tanins dans les feuilles et les fruits ;
Cette richesse en tanins pourrait être valorisée en œnologie par la vinification des fruits tropicaux sauvages, généralement pauvres en tanins.
La domestication et la protection en son milieu naturel de cette plante s'avèrent impératives.

Mots Clés : Acasia, tanins, œnologie, fruits

Abstract

There is a variety of the wild acacia plant in Upper Katanga / DRC. It is a pseudo acasia Robinia, but which does not give flowers and does not release any parfum.
At the end of our research, the results show that the pseudo acasia plant Robinia growing in Lubumbashi and its surroundings is endowed with antioxidant, antiseptic and anti-venomous properties due to the presence of tannins in the leaves and fruits;
This richness in tannins could be enhanced in oenology by the vinification of wild tropical fruits, generally poor in tannins.
Domestication and protection in its natural environment of this plant are imperative.

Mots-clés en anglais: Acasia, tannins, oenology, fruits

1. INTRODUCTION

The literature reports a wide variety of wild-type Acacia plant scattered throughout the world. The latter is from the family of leguminous plants with deciduous or persistent leaves, often of oval shape. Most acasia have thorns and flowers [1].
F.Rasool et al [2] established the chemical composition and defined the ethnobotanical uses of the acasia plant Jacquemontii in Pakistan and reported the results below for the leaves and seeds of gasoline at 22 and 33, respectively. % crude protein, 49 and 15% crude fiber, 17 and 28% fat.

The leaves contain 0.1% P; 0.6% K; 1.2% Ca; 0.1% Na and 0.6% Mg; 246 ppm iron; 29.2 ppm Mn; 27.9 ppm Zn and 14.4 ppm copper. The active ingredient contents expressed in ppm, in particular the alkaloids, flavonoids, saponins, tannins and total phenolic compounds in the leaves, are 5.8; 168; 196; 124; and 137respectively [2]
The encyclopedia of medicinal plants refers to the acacia plants (A. borrida, A. arabica) found in Mediterranean and African regions and whose flowers, in clusters, are very fragrant and sought after by bees. Leaves, flowers, bark and gum arabic powder are used to treat conditions such as intestinal disorders and burns ([3],[4]). In Africa, research on acasia dates back several centuries and concerns the part of the French colonies for the gum arabic trade ([5],[6]).

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In the DRC, research on this plant is mainly carried out in the framework of the project for the protection of the environment and the fight against climate change in Bikoro territory [7] and for the production of acasia auriculiformis in the agroforestry system of Mampu on the Batéké plateau [8]. Thus, in the province of Haut-Katanga, the AFODER project is active in the agroforestry plantation of acasia auriculiformis which is an exotic species [9].

The inventory and description of wild edible [10] and toxic Katanga [11] plants do not allude to the acasia known to the natives for its so-called "manjerés".

It is important to note that the variety of acasia encountered in Haut-Katanga does not give flowers and does not give off any perfume. However, it produces berries often eaten by children and pregnant women. It is also used to treat tooth decay and wound treatment. Its dry branches are hosts of edible fungi at the beginning of the rainy season.

That being so, and taking into account the eco-climatic realities specific to the environment (soil, climate, intensity of the light, season, stage of development of the plant) which can condition its composition in active principles [11], we propose to carry out the analysis and chemical screening of leaves and fruits of PSEUDOACASIA ROBINIA for their use in winemaking in case they are rich in tannins exploitable for their astringency and bitterness.

Indeed, for millennia, man exploits the properties of tannins of certain plants in very different fields of application ([12], [13], [14], [15], [16]).

Tannins are polymers of polyphenols present in significant amounts in red wine and responsible for astringency and bitterness ([17],[18],[19]). It should be noted, however, that the condensed tannins with which most nutritional studies are conducted are those of quebrache, acasia smallissima, sorghum or grapes ([18],[19], [20], [21],[22]).

2. MATERIAL AND METHOD

2. 1. EQUIPMENT

2.1.1. Plant material

The study materials are the leaves and fruits of pseudo acasia robinia. This plant grows wildly in the province of Upper Katanga particularly in the city of Lubumbashi and its outskirts. The photographs taken in December 2018 in the Kamatete district and shown in Figures 1, 2 and 3 show the plant, leave and fruit.

Fig.1 Acasia of plant

Fig. 2 leaves of acasia

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Fig.3 Acacia of fruit

The acacia plant of Figure 1 easily reaches 8 - 10 meters in height and 20 centimeters in diameter. The green leaves are oval in shape, alternately placed on an elongated petiole of 8 to 12 pieces; it is a thorny plant whose green fruits, of ± 3mm in diameter, turn purple / purple at maturity.

2.1.2. Other analysis equipment

For the analyzes, we used these few materials:

- HERAEUS
- oven
- Brand
- ICP 8300 prolabo
- brand muffle furnace
- Sieve
- Soxhlet
- Salvis bath brand

2.2. METHOD

2.2.1. Sampling method

We manually picked the leaves and ripe fruit from the plant in the morning and dried in an oven and ground with a porcelain mortar; then screened using a sieve with a mesh size of 315 µm in order to obtain the fine powders which were stored at room temperature in clean and dry jars, well closed and on which the various analyzes were carried out.

2.2.2. Analytical method

1 ° Determination of the macroelement composition of acacia leaves and fruits

Moisture determination was made by drying the samples in an oven set at 105 ° C to constant weight [23]; Total ash was determined by calcination at 550 ° C for 8 hours in a muffle furnace (method 923.03, AOAC 1990), [24]. To quantify the mineral elements, we used ICP 8300; crude protein was made by total nitrogen determination using the Kjeldhal method. [24] The crude protein content was determined using the following relationship:% PB =% N x 6.25 where% PB = grade in crude protein,% N = total nitrogen content of the sample and 6.25 = conversion factor of nitrogen content in protein.

The lipids were extracted by soxhlet according to the Weiball method as reported by BUKATUKA. [25] The determination of total carbohydrates was made according to

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Dubois et al [26] and calculated using the following relationship: IQ = OD x 160 / 0.0072 x 1000 where QI = quantity of sugars in the sample in g / 100 g, OD = the optical density of the sample (evaluated at 390 nm).

2 ° Identification of the active chemical substances in the leaves and fruits of the acasia plant

The methods used are based on the formation of a precipitate, the change of coloration or the formation of foam as described by Aebisch et al. [27], Wagner [28], Lumbu [29], Bruneton [30] who use the six reagents including Bragendorff, Hager, Mayer, Sunnenshein, Wagner and Bertrand. [27] The desired phytochemical groups are alkaloids, flavonoids, anthocyanins, quinones, steroids, terpenoids, saponins and tannins. The aqueous flavonoid extract gives, in the presence of concentrated acid and magnesium chips, a pink-orange and purplish red coloration in the supernatant layer of isoamyl alcohol. After heating in a water bath, without adding magnesium, the appearance of a red color indicates the presence of leuco anthocyanins.

Yellow picrosodium paper turns orange or red depending on the concentration of free hydrochloric acid in the aqueous vapor during the hot treatment of the drug. The quinones contained in an extract are detected by the color change of the extract passing red in the presence of the base (NaOH) [27]; the detection of saponins is based on their foaming power: For non-persistent foam, the filtrate is tested with a mixture of equal volume of 1N sulfuric acid and green-dirty coloration or violet turning red. [27]. The ethereal organic extract containing the steroids gives the green yellow stains in the presence of anhydrous acetic acid. By adding the HIRSHNON reagent (trichloroacetic acid), the yellow color turning red indicates the presence of terpenes. [27]

In the presence of 1% ferric chloride, the aqueous extracts containing the tannins give various colors: blue-green, dark-blue or green or form precipitates .[27]

3. PRESENTATION AND DISCUSSION OF THE RESULTS

The analyzes of the leaves and fruits of PSEUDOACASIA ROBINIA studied gave the results recorded in the tables n ° 1,2 and 3 respectively for the composition in macro elements, the composition in mineral elements and the tests of the active chemical substances.

Table1. Main nutrient composition of acasia leaves and fruits

	Humidity (%)	Protein (%)	Fat (%)	carbohydrates (%)	Ash (%)
Leaves	12,8	16,75	4,0	Trace	5 ,6
Fruit	82,7	4,37	0,4	20	6

Compared with other exotic varieties, case of acasia jacquemontü; pseudoacasia robinia from the outskirts of Lubumbashi is quite poor in protein and fat. This could be

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explained by the differences in the environmental conditions in which it grows and / or by the difference of the families, species or varieties concerned.

Table2. Mineral composition of leaves and fruits of acasia

Items analyzed in mg / kg	Leaves	Fruit
A1	762,0	149,0
As	20,16	165,2
Ca	15940	2319
Cd	-1,784	-6,178
Co	41,00	-7,241
Cr	64,35	-0,778
Cu	13,60	11,00
Fe	528,9	87,04
K	4688	11890
Mg	8052	2243
Mn	523,4	47,56
Na	217,3	136,1
Ni	-31,90	-35,18
Pb	211,1	167,4
Se	-2522	6075
Zn	83,90	20,78

Interpretation:

Taking into account the results of the mineral elements of Table 2 and the results of acasia jacquemontü found by F.Rasool et al [2]; it reveals the following: apart from the copper content, we observe variations in the contents between the elements analyzed, differences due, among other things, to the fact that it is not the same species and that the two plants do not grow. Or have not benefited from the same eco-climatic conditions.

From a nutritional point of view, it can be noted that the ratio K / Na is very favorable and that acasia fruits commonly called "manjeres" would be a significant source of potassium (11890mg / kg of dried fruits). We also observe that there is more iron and calcium in the leaves than in fruits (why)

Table3. Identification of active chemical principles in the leaves and fruits of acasia

	Leave	Fruit
Alkaloides	++	++
Tannis	+++	+++
Flavonoids	–	+
Saponins	++	–
Quinones	+	–

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Terpenoids	+	+
Leucoanthocyanins	+	−
Stéroides	−	−
H C N	−	−

Legend: − : absence
+: presence
++: Strong presence
+++: Very strong presence

The identification tests of the active chemical principles reveal the presence of leucoanthocyanes, terpenoids, quinones as well as a strong presence of saponins and a very strong presence of tannins in the leaves and fruits of acasia. This would confer on the plant some therapeutic virtues ([3], [12],[15]), including anti venoms, anti-hemorrhoids , antiseptics, anti-diarrheal, anti-oxidants and bactericidal following the strong presence of tannins.

It is important to point out that the Acacia plant is known to be rich in active chemical substances; case of:

- Acasia jacquemontü Benth which contains in the leaves levels in ppm of 5.8; 168; 196; 124 and 137, respectively, alkaloids, flavonoids, saponins, tannins and total phenol compounds [2];
- Acasia nilotica and acasia brevispica respectively 49.1 and 12.0% of the dry matter of the leaf .[16]

The condensed tannins with which most nutritional studies are conducted are those of quebrache, acasia (acasia smallissima), sorghum or grapes. [17]

The tannin richness of pseudoacasia robinia growing in Lubumbashi could be enhanced in oenology by the vinification of wild tropical fruits, generally poor in tannins, Case of Strychnos Cocculoids. [31]

CONCLUSION

At the end of our research, the results obtained reveal that the pseudo acasia robinia plant grown in Lubumbashi and its surroundings is endowed with antioxidant, antiseptic and antivenom properties due to the presence of tannins in the leaves and fruits;

This richness in tannins could be enhanced in oenology by the vinification of wild tropical fruits, generally poor in tannins. This would improve the organoleptic characteristics of these wines of local production compared to the reference products in this case the red wines made from grapes. Domestication and protection in its natural environment of this plant are imperative. Note that it differs from certain other varieties ([5], [6]s) by the fact that it does not produce flowers and therefore does not release any aroma.

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