INTRODUCTION

West African people make recourse to the traditional medicine at the rate of more than 80% for curing human and animal diseases[1]. A diversity of medicinal plants is usually requested for this purpose [2, 3]. Among these plants, the genus Acacia of Leguminoseae- Mimosoideae family, commonly called “thorn tree” in Africa, constitutes a significant economic plant as a source of tannins, gums, timber, fuel, fodder and medicine [4]. *Acacia nilotica* and *Faidherbia albida* (syn.: *Acacia albida*) are two plants of the same genus having multiple pharmacological properties for which they are used in traditional medicine. In human health, *Acacia nilotica* is used to treat many health problems such as bronchitis, thoracic pains, cold, diarrhea, dysentery, fever, the hemorrhages, leprosy, ocular disorders, tooth rage and pneumonia [5]. Syphilis, oral candida, fungus infections of the skin, malaria and the tooth rage are also some diseases managed by the plant [6-10]. Other properties as antiviral [11-14], antibacterial [7, 15] and pesticides [16, 17] have been noted of the plant in recent studies. *Faidherbia albida* species is used in traditional medicine for its medicinal virtues [18]. Antimalarial, antimicrobial antipyretic, anti-inflammatory and anti-diarrhea activities of the stem bark of *Faidherbia albida* were observed [20-22]. Moreover, anti-trypanosoma activities of aqueous extract of *Faidherbia albida* stem bark against...
Trypanosoma brucei was reported [23]. Faidherbia albida is also promoted in animal feeding regarding its nutritive properties [24]. In spite of the multiple requests of these two species in human health, little or rare studies was carried out on their uses to cure animal diseases in West Africa. These two plants were selected in an ethnobotanical study on the use of these species to cure liver moat on sheep in Niger and Togo [25]. In a process of reverse pharmacology, the present preliminary studies on phytochemistry and toxicology (on shrimp larvae) have been carried out.

**Experimental Section**

Preparation of the extracts of *Acacia nilotica* and *Faidherbia albida*

**Test sample collection**

The fruits (Fr) of *Acacia nilotica* (AN) were bought on Akodesséwa mixed market of plant at Lome (Togo). The leaf (Le), fruits (Fr) and stem bark (SB) of *Faidherbia albida* (FA) were collected in a farm at Dapaong, a Health District in north of Togo. These parts collected were dried and reduce in powder to pursue the study [26]. Samples of each plant were deposited in Herbarium of the University of Lome, after botanical and ethnobotanical identifications respectively by the team of Professors Messanvi GBEASSOR, Koffi AKPAGANA and Koffi KOUDOVOU.

**Preparation of the aqueous and hydro-ethanolic extracts**

The powders of plant parts collected were used to obtain according to the methods of Koudouvo [26] and Dougnon et al. [27], aqueous extracts (by decoction) and hydro-ethanolic extract (by maceration) of Fr of AN, and Le, Fr, SB of FA. For the decoction, 100g of powder of the various samples were mixed separately with 1000 ml of distilled water and heated until boiling during 15mn, then filtered on Wathman N°1’s paper and evaporated by vacuum with Rotavapor BUCHI at 50°C. The crude extract obtained for each part of the plant named ‘aqueous extract’ were conserved at -4°C.

The maceration was realized by dissolving in 1000 ml of mixture water-ethanol 1V/1W (water 50% and alcohol 50%), 100g of powder of each sample of AN and FA. After 72h, the mixture was filtered on Wathman N°1’s paper and evaporated by vacuum with Rotavapor BUCHI at 50°C. The crude extract obtained for each part of the plant named ‘hydro-alcoholic extract’ were conserved at -4°C.

**Screening of chemical compound in Acacia nilotica and Faidherbia albida**

The identification of the chemical groups present in AN and FA was done according to the method described by Houghton and Raman [28] and used by Houngbeme et al. [29] and Ahossi et al. [30]. The powders obtained from the 4 samples plants was used for this study for the search of alkaloids, reducing sugars, glycosides, triterpenoids, steroids, saponins, flavonoids, tannins, free cyanogenic derived, free anthraquinones.

**Evaluation of the toxicity of Acacia nilotica and Faidherbia albida**

The method developed by Michael et al. [31], taken again by Vanhaecke et al. [32], then by Sleet and Brendel [33] and used by Houngbeme et al. [29] was used to study the toxicity of AN and FA. This method is based on the rate of survival of shrimp larvae (*Atemia salina*) in sea water, in the presence of the plant extract’s solutions. There is a correlation between shrimp larvae toxicity with human cells 9PS and 9KB (human carcinoma nasoparyngien) cytotoxicity [34], with cells A-549 of pulmonary carcinoma and cells HT-29 of colon carcinoma [35].

Eggs of *Artemia salina* (ARTEMIO JBL GmbH D-67141 Neuhofen) were incubated during 48 hours in sea water until blossoming of young larvae. A series of extracts solutions of AN and FA to be tested with variable and progressive concentrations were prepared. A total of eight aqueous and hydro-éthanolique extracts (two extracts for each part of the plants) were tested. 200 mg of each extract were taken and dissolved in 4 ml of distilled water to obtain a mother solution of 50 mg/ml concentration. Ten (10) successive dilutions with the half (1/2) of the mother solution with sea water in numbered test tubes (T1 to T10) and containing respectively 50/2, 50/4, 50/8, 50/16, 50/32, 50/64, 50/128, 50/256, 50/512 and 50/1024mg/ml of the extract to test, were prepared. A control tube without extract, containing 4ml of sea water was constituted for each extract. In the solutions of each of the 11 tubes, 16 larvae were introduced. The tubes were left under agitation during 24 hours. Counting under microscope of the number of surviving larvae in each solution, enabled us to evaluate the toxicity of each solution. If deaths were noted in the control tube, data are corrected by the formula of Abbott: % death = [(test - control) / control] x 100. Values recorded were transformed by logarithm and the lethal concentration (LC50) of the various extracts tested were determined by a linear regression [29].

**RESULTS AND DISCUSSION**

- *Acacia nilotica* and *Faidherbia albida* extracts yield

The yield obtained for the aqueous and hydro-ethanolic extracts of AN (EAqAN and EHEAN) and the aqueous and hydroethanolic extracts of FA (EAnFA and EHFA) were presented as follow:

For the fruit of AN, EAqAN and EHEAN revealed the respective yield of 24% and 18%. Gupta et al. [36] reported the yield of 23.92% for the aqueous extract of the pods of AN, that’s is similar to our result. Dikti Vildina et al. [37] having found a yield of 35.65% for the hydro-ethanolic extract of the fruits of AN with a proportion ethanol: water at 60:40; this difference may be explain by the rate of alcohol, this present study having used ethanol-water at 50:50.

For FA, 4% (Fr), 9% (Le) and 15% (SB) of aqueous extracts and 17% (Fr), 16% (Le) and 17% (SB) of hydroethanolic extract were the yield recorded. It arises from this result that the use of mixed solvent (water and alcohol at same volume) allow to extract a significant quantity of crude extract than the water only. This could have significant effects on pharmacological activities of the plant extracts.
**Phytochemical compound of Acacia nilotica and Faidherbia albida**

**Chemical groups of plant parts tested**

Table 1 below shows the presence or not of various chemical compounds in the powders of the various parts of AN and FA tested.

**Table 1 Phytochemical group present in A. nilotica and F. albida**

<table>
<thead>
<tr>
<th>Parts of plants</th>
<th>Chemical compound</th>
<th>Fa</th>
<th>AN</th>
<th>Le</th>
<th>Fr</th>
<th>SB</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td>+</td>
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</tbody>
</table>

The qualitative phytochemical analysis revealed the presence of AN, the presence of alkaloids, gallic tannins, flavonoids, quinone’s and free heterosides. Raheel et al. [38] reported that saponins, tannins, alkaloids, terpenoids and the polyphenols are contained in AN. In the same way, Ndiaye [39] revealed the presence of saponins in the fruits of AN. Moreover, the presence of phenolic compounds in seeds of AN like phenolic acids [40]; flavonoids as flavone’s [41], flavonols [42], flavanols [41] have been signalized.

For the fruit of FA, compounds such as alkaloids, gallic tannins, leucoanthocyanes, saponins, mucilage’s and coumarins were identified. In the leaves, metabolites like gallic tannins, alkaloids, anthocyanins, leucoanthocyanes, saponins, terpenoids, mucilages and coumarins were identified. The stem bark of FA revealed eight chemical compounds: flavonoids, gallic tannins, anthocyanins, leucoanthocyanes, saponins, mucilage’s, coumarins and the reducing compounds. The complete phytochemical study of FA by Karoune et al. [43] revealed the presence of phenolic compounds (phenolic acids and flavonoid) in the leaves, fruits and stem bark. The results obtained by Evans et al. [44] show the presence of alkaloids in seeds of FA.

**Phytochemistry of Faidherbia albida and biodiversity conservation**

Comparative phytochemical results of leaves, fruits and stem bark of FA revealed five common chemicals groups for the three parts of the plant: coumarins, gallic tannins, leucoanthocyanes, mucilage and saponins. Anthocyanins were only identified in the leaves and stem bark of FA. It’s come out from this result, substitution possibilities of stem bark of FA by the leaves and fruits of this plant if the pharmacological activities could be due to these phytochemical groups. Flavonoids and reducing compound present in the stem bark of FA were absent in the leaves and fruits. Consequently, the stem bark couldn’t be substituted by the leaves and fruits for medicinal usage. Intensive usage of the stem bark of FA in traditional medicine reported by Tijani et al. [20], Oluwakanyinsola et al. [21], Usman et al. [22] and Alhaji et al. [23] could found a solution way for the biodiversity conservation through substitution possibilities of stem bark by the fruit or leaves, showed in this present study. This will preserve from anthropic pressure, source of biodiversity menace.

**Toxicity of Acacia nilotica and Faidherbia albida**

Lethality test of Artemia salina larvae is a biological test which is used to determine among other, toxicity of plants extracts [45]. The analysis of data recorded through the regression equation allowed the determination of the various lethal concentrations (LC50) presented in table 2.

**Table 2 LC50 of A. nilotica and F. albida on shrimp larvae (Artemia salina)**

<table>
<thead>
<tr>
<th>Extracts</th>
<th>Coefficient of regression (r²)</th>
<th>Lethal Concentration (LC50) in mg/ml</th>
<th>Extract nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqueous extract of AN fruits</td>
<td>0,9097</td>
<td>0,5473427</td>
<td>Nontoxic</td>
</tr>
<tr>
<td>Hydro-ethanolic extract of AN fruits</td>
<td>0,9491</td>
<td>1,05354399</td>
<td>Nontoxic</td>
</tr>
<tr>
<td>Aqueous extract of FA fruits</td>
<td>0,9557</td>
<td>1,25910638</td>
<td>Nontoxic</td>
</tr>
<tr>
<td>Hydro-ethanolic extract of FA fruits</td>
<td>0,9566</td>
<td>1,31883786</td>
<td>Nontoxic</td>
</tr>
<tr>
<td>Aqueous extract of the stem bark of FA</td>
<td>0,9033</td>
<td>0,3455227</td>
<td>Nontoxic</td>
</tr>
<tr>
<td>Hydro-ethanolic extract of the stem bark of FA</td>
<td>0,9433</td>
<td>0,43077516</td>
<td>Nontoxic</td>
</tr>
<tr>
<td>Hydro-ethanolic extract of the stem bark of FA</td>
<td>0,9027</td>
<td>0,39339318</td>
<td>Nontoxic</td>
</tr>
<tr>
<td>Hydro-ethanolic extract of the stem bark of FA</td>
<td>0,971</td>
<td>1,0281908</td>
<td>Nontoxic</td>
</tr>
</tbody>
</table>

The results obtained have been interpreted by relating to the grid of correlation associated to toxicity degree with LC50 proposed by Moshiri et al. [46]: LC50 ≥ 0.1 mg/ml (nontoxic extract); 0.1 mg/ml > LC50 ≥ 0.05 mg/ml (slightly toxic extract), 0.05 mg/ml> LC50 ≥ 0.01 mg/ml (extract fairly toxic), LC50< 0.01 mg/ml (extract highly toxic). The recorded LC50 for the aqueous and hydro-ethanolic extracts of the fruits of AN are respectively 0.54 mg/ml and 1.03 mg/ml. For FA, the LC50 for the aqueous extract of Fr, Le and SB are respectively 1.25 mg/ml, 0.34 mg/ml and 0.39 mg/ml. The recorded LC50 values for EHEFA are respectively 1.31 mg/ml, 0.43 mg/ml and 1.02 mg/ml for Fr, Le and SB. In the literature, similar studies of toxicities on the same experimental model have not identified any toxicity on AN fruits. It is the same for the Le, Fr and SB of FA. Only the works of Okoro et al. [47] reported respective LC50 of 253.27μg/ml, 312μg/ml and 123.86μg/ml for ethanolic extracts of the leaves, stem bark and roots of AN. Thus, these authors claim that extracts of AN do not constitute a danger for humans since the recommended limit for the detection of cytotoxic activity using the larval lethality test is 20 μg/ml [48, 49]. For FA, from toxicity studies conducted on the ethanolic extract of the stem bark in the Rat [18], it found an LC50 greater than 5000 mg of extract /kg of body weight, which describing the safety of the extract tested according to OECD Guideline 425.

**CONCLUSION**

The present study shows that fruits of Acacia nilotica as well as leaves, fruits and stem bark of Faidherbia albida contain a variety of chemical compounds that justify their use in animal Ethnomedicine. Renewable parts such as fruits and leaves of Faidherbia albida contain the same chemical compounds as the stem bark, which could then allow a substitution of the stem bark by the leaves or fruits when the active principles could
reveal biological and identical pharmacological properties, for the conservation of biodiversity. The aqueous and hydroethanolic extracts of the various parts (fruits, leaves and stem bark) of *Acacia nilotica* and *Faidherbia albida* does not show any toxicity on *Artemiasalina* larvae. Thorough biological, pharmacological and phytochemical studies as well as toxicological screening work on other laboratory models will be realized to confirm for valorization, the use of these two plants in animal Ethnomedicine.

**Acknowledgment**

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**Conflict of Interest**

Authors declare that there is no any conflict about this research

**References**


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