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Research Article

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An easy method to classify plant parts in order to investigate them for bioactive compounds: application to *Commiphora africana* originated from Mauritania

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ABSTRACT

An easy ethnomedicinal method, applicable to classify plant parts and healed symptoms have been developed. It may allow a rational choice of the most promising parts and efficiently adequate biotests. Since Commiphora africana is insufficiently investigated and Mauritanian ethnotherapy uses it to heal several symptoms, we applied this method to classify its parts and to adopt pertinent biotest. Our results highlight oleoresin, leaf and bark as the most promising parts and, at the same time, bacteriological biotest as the fitting bioassay. Importance of Commiphora africana oleoresin in Mauritania (28.6 %) reminds the esteem which is reserved to it in North Africa [11], whereas important use of leafs, roots and bark (≈ 18.4 %) is comparable to use generalized to other plants in neighboring Mali and Senegal [7, 13]. These results may be explained by geographical position of Mauritania being culturally and demographically a transition between North and Sub Saharan Africa.

Keywords: Ethno-medicine, *Commiphora africana*, Plant parts, Biotest.

INTRODUCTION

The folk-medicine based on the use of plants is a recognized knowledge source which accumulated during a long period through several generations, and elaboration of efficient ethnomedicinal method may be used to rationalize research of bioactive compounds, justifying folk-medicinal use [1-4]. In order to investigate a poorly studied plant-like the majority of plant species in Mauritania-there is a need for a rationalized method based on ethnomedicinal information [3, 5]. This study is aimed at elaborating a method applicable to prioritizing of different parts according to the intensity of folk-medicinal use. Also at the same time, it must permit to classify healed symptoms and list corresponding potential scientific causes in order to choose the most promising part and efficient biotests. Geographical position of Mauritania as a transitional link between North and Sub-Saharan Africa regions predicts a doubly rich folk-medicinal use of plants based on both regions culture and traditions [6]. However, there is an insufficient investigations directed at elucidating active principles justifying this rich folk-medicine culture [3,8]. For example plant like *Commiphora africana* originated from Mauritania is not investigated at all, in spite of intensive use of all its parts.

EXPERIMENTAL SECTION

1.1 Ethnomedicinal method

First information from traditional medicinal media must be collected and treated adequately to give a clear picture of the use of different parts and healed symptoms.

1.1.1Elaboration of ethnomedicinal survey sheet

The first step consists of elaborating an adequate sheet to collect information on use of different plant parts and healed symptoms and, then after, it must be translated into local languages of surveyed traditional therapists (Arab for example).The following survey model can be used for collecting ethnomedicinal information(table 1).

Table 1: Survey sheet model

Place and date of surveying: superviser identity:

Healer identity Contact	adress age	sexe	main profession	ethnic group
	□ region □ locality	□F □M	□ healer □ farmer □ breeder □ trader □ others	

Medicinal use of Commiphora africana

Parameter / Part	healed symptom	harvesting method	state of use	method of use	toxicity □ yes □ no
leafs					□ yes □ no
seeds					□ yes □ no
flower					□ yes □ no
root					□ yes □ no
branches					□ yes □ no
bark					□ yes □ no

1.1.2 Operative surveying sheet

Results from validated surveying sheets must be transformed into elaborated operative ones which will have double entry: line with plant parts, numerated j= 1 to J and column corresponding to healed symptoms, numerated l = 1 to L. Responses from traditional therapeutists will be valued 1 if there is a plant part use corresponding to given symptom (part j healing symptom l), otherwise it will be valued 0.After validation sheets will be numerated with the index i from 1 to N. Every validated sheet i will have value corresponding to plant parts j and healed symptoms l. This value will be noted K_{ijl}. Frequency of part use PF_j will be calculated summing all values K_{ijl} over all symptoms (l=1 to L) and all sheets (i= 1 to N), whereas occurrence of a fixed symptom SF_l is the sum of values of the line l across all parts (j= 1 to J) and summing this result over all sheets (i=1 to N). Total frequency over all (parts, symptoms and sheets) TF is the sum of entry values over all indexes i, l and j. Thus the following formula can be used for calculating part frequency of use PFj and symptom occurrence SF_l:

$$PF_j = \sum_{i=1}^{i=N} \sum_{\ell=1}^{\ell=L} PF_{i\ell}\,,\; SF_\ell = \sum_{i=1}^{i=N} \sum_{j=1}^{j=J} SF_{ij} \text{ and } TF = \sum_{i=1}^{i=N} \sum_{\ell=1}^{\ell=L} \sum_{j=1}^{j=J} SF_{i\ell j}$$

This formula can be expressed as percentage of all values:

$$PF_j\% = PF_j 100 \,/\, TF \;,\; SF_\ell\% = PF_\ell 100 \,/\, TF$$

1.1.3 Classification of parts and symptoms

Parameters PF_j and SF_ℓ can be used to classify plant parts and healed symptoms according to their frequency of use by traditional therapeutists. This classification will be used to rationally choose the most promising parts to be investigated and, by analyzing possible causes of given symptom, pertinent biotest to be adopted.

1.2Application to *Commiphora africana*

Commiphora africana is an important medicinal plant intensively used by Mauritanian folk medicine to heal numerous symptoms and all parts including oleoresin are of intensive use. However, there is no scientific investigations directed to elucidate bioactive compounds justifying this intensive use [3, 4, 8], that is why we applied above developed method (§1.1) to classify parts of this species according to frequency of ethnotherapeutic use (priorization of parts) and healed symptoms occurrence. The retained parts are leafs F, seeds G, flowers Fl, root R, bark Ec, branches Rm; and oleoresin Rs. Retained symptoms are : Coughing Tx ; migraine Migr ; sexual impotency ImpX; infected wounding Pl; dysentery/indigestion Dys-Am ; influenza Influ ; hyperacidity HyperAc; inactivity Inctiv; othodontite Orth and male sterility SterH.

RESULTS AND DISCUSSION

1.2.1 Classification of plant parts

Mauritanian traditional therapy uses all parts of *C africana* species, consequently we applied the method developed above (§1.1) to classify them according to their importance. Retained parts have been represented in function of increasing importance (figure 1). This figure shows that the most used parts are Oleoresin Rs; Leafs F; Bark Ec; Root R; branches Rm with using frequencies 28.6 %; 18.9 %; 18.6; 18.2 % and11.9 %, respectively. Oleoresin Rs, Leafs, Bark Ec and Root R are more frequently used, whereas flowers and seeds are of less use.

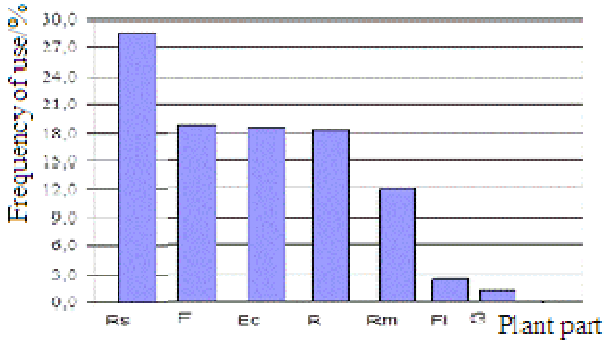

Figure 1: intensity of using *C africana* part (abreviations in §1.2)

To our best knowledge, there is no investigation which quantifies traditional therapeutic use of parts from commiphora genus originated from Africa. However several authors have underlined the importance of its folk-medicinal use in the continent [7, 9-12]. According to a relatively recent study carried out on 73 medicinal plants including *C africana* from Mali (West-Africa), the most frequently used parts are roots, leafs and bark (24% ; 22% and 12%, respectively [13].In one hand our results (≈18.4 %) are close to these values which are generalized at tens medicinal plants including *C africana* species, on the other hand importance of *C africana* oleoresin in Mauritania (28.6 %) remindsthe esteem, reserved to it in North Africa [11].This observation is probably a consequence of geographical position of Mauritania being culturally and demographically a transition between Maghreb and West Africa. Also this is an indication of richness of Mauritanian folk-medicine integrating traditions from North and West Africa.

1.2.2Classification of healed symptoms

Our preliminary investigation revealed an important number of symptoms treated by Mauritanian folk-medicine using *C africana* parts. However, we retained the seemingly most important symptoms as listed above (§1.2). The frequency of symptoms occurrence may be a valuable indicator of their folk-medicinal importance. That is why we represented symptoms in function of decreasing frequency (figure 2). This figure shows that the most important symptoms are infected wound; indigestion; dysentery whose occurrence percentages are 19.2%, 16.7%, 15.3 %, respectively. As figure 2 shows the predominant symptoms are infected wounds; indigestion and dysentery, whereas the others correspond to the lesser importance (< 4.5 %).

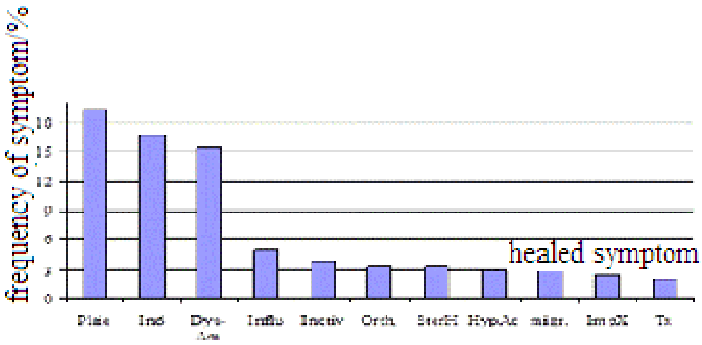

Figure 2: Occurrence of symptôms healed by *C africana* species (abreviations in §1.2)

Importance of wounds and digestive disease (figure 2) is comparable to the level of these same symptoms (intestine illnesses and wounds) in North Africa where they are treated with Leafs, bark and Oleoresin [11]. However this author has underlined the importance of respiratory diseases which are absent in Mauritanian use of *C africana* (Figure 2). Even though there is no investigation restricted to C africana folk-medicinal use in Sub-Saharan Africa, we can compare our results to that generalized at several species. Indeed in sub-sahran Africa as in Mauritania (figure 1) wounds and digestive illnesses are frequently treated with leafs, roots and bark [13, 14]. However other diseases like malaria and taenia treated with these parts in Africa seem to be of less importantly treated with *C africana* in Mauritania. Thus the predominance of healed symptoms linked to infected wounds and digestive troubles as for *C africana* reminds folk-medicinal receipts in North and Sub-Saharan Africa.

1.2.3 Priority parts and symptoms

Classification of plant parts according to their ethnotherapeutic importance may allow to rationally choosing priority part, candidate for phytochemical and physicochemical studies. This study shows that oleoresin, leafs, bark and roots are the most priority parts of *C Africa* originated from Mauritania tobe investigated. Also efficiently adequate biotests associated to the most important symptoms (infected wounds and digestive illnesses) must be chosen.

1.2.4Biotest choice

The investigation above (§1.2.3) shows that infected wounds and symptoms linked to digestive illnesses correspondent to priority factors and thus may be the clue to choose biotest. Application of the above developed method has suggested potential presence of antibacterial compounds eventually justifying ethnotherapeutic use (infected wounds and digestive illnesses). However, it indicates a numerous varieties of bacterial strains possibly linked to these symptoms (table 2).

Tableau 2: Strains potentially linked to healed symptoms (wounds and digestive trouble)

Symptom	possibles causes	Microbes
infected wounds	microbial infection	*Clostrodium perfringens, C. Novyi, C. Septicum, C. tetani, C. tétanos, S aureus*
Diarrhea	microbial source	*Escherichia Coli, TeaniaSchigellose, EntHistolytica, Klebsiella Lactobacilli*

CONCLUSION

An easy ethnotherapeutic method intended to be applied to classify plant parts and healed symptoms according to the frequency of folk-medicinal use has been developed. It may allow choosing rationally the most promising parts and efficiently adequate biotests. Application of this method to *Commiphora africana* originated from Mauritania showed that oleoresin, leafs, bark and roots arethe most promising parts and at the same time the fitness of bacteriological biotest. A set of bacterial strains potentially linked to the most prominent symptoms (infected wounds and digestive trouble) is listed out. In one hand Mauritanian ethnomedicinal use of *C africana*leafs, bark and roots (≈18.4 %) is comparable to neighboring Sub-Saharan Africa which predominantly uses leafs, bark and roots, in other hand intensive use of oleoresin (≈28%) can be compared to North Africa. Probably this is a consequence of geographical position of Mauritania being culturally and demographically a transition between Maghreb and West Africa.

In immediate future we will investigate one of the most promising parts with bioguided phytochemical analysis in order to elucidate bioactive compounds behind its intensive use by Mauritanian folk-medicine.

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