



## Ethnopharmacological Survey of Medicinal Plants Used to Treat Human Diseases in the Tivaouane Department, Senegal

Kady Diatta<sup>1\*</sup>, William Diatta<sup>1</sup>, Alioune Dior Fall<sup>1</sup>, Serigne Ibra Mbacké Dieng<sup>1</sup>,  
Amadou Ibrahima Mbaye<sup>1</sup>, Abdou Sarr<sup>1</sup> and Mamadou Bamba Seye<sup>1</sup>

<sup>1</sup>Laboratory of Pharmacognosy and Botany, Cheikh Anta Diop University of Dakar, ZC 5005, FMPO,  
UCAD, Dakar, Fann, Senegal.

### *Authors' contributions*

*This work was carried out in collaboration among all authors. Author KD designed the study, performed the statistical analysis, wrote the protocol and the first draft of the manuscript. Author WD managed the analyses of the study. Author ADF managed the analyses of the study. Authors SIMD, AIM, AS and MBS performed the statistical analysis. Author ADF managed the literature searches and approved the final corrections. All authors read and approved the final manuscript.*

### *Article Information*

DOI: 10.9734/EJMP/2019/v30i330178

#### Editor(s):

- (1) Dr. Ghalem Bachir Raho, Department of Biology, Mascara University, Algeria.  
(2) Dr. Paola Angelini, Department of Chemistry, Biology and Biotechnology, University of Perugia, Italy.  
(3) Marcello Iriti, Professor of Plant Biology and Pathology, Department of Agricultural and Environmental Sciences, Milan State University, Italy.

#### Reviewers:

- (1) Itodo, Sunday Ewaoche, Niger Delta University, Nigeria.  
(2) Byron Baron, University of Malta, Malta.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/53039>

**Original Research Article**

**Received 05 October 2019**  
**Accepted 11 December 2019**  
**Published 17 December 2019**

### **ABSTRACT**

**Background:** In Africa, particularly in Senegal, 70% of the population resort to traditional medicine.  
**Aim/Objective:** The aim of this study is to inventory the plants used to the the treatment of erectile dysfunction, hypertension, diabetes etc because the populations often resort to phytotherapy.  
**Methods:** Fifty traditional practitioners, fifty herbalists and fifty resources persons were conducted to identify the plants used in the management of affections in the Tivaouane department.  
**Results:** Ninety seven plants could be identified and divided into eighty nine genera and forty eight families. Thus, Fabaceae families with 18 species, Euphorbiaceae (8 species), Combretaceae (5 species), Malvaceae (4 species), Anacardiaceae, Annonaceae, Asteraceae, Meliaceae Myrtaceae and Poaceae each with 3 species and Asclepiadaceae, Liliaceae, Lythraceae, Loganaceae and

\*Corresponding author: E-mail: khadydiose@yahoo.fr;

Menispermaceae each with 2 species; Apocynaceae, Balanitaceae, Bignoniaceae, Capparidaceae, Caricaceae, Casuarinaceae, Celastraceae, Cochlospermaceae, Cucurbitaceae, Hypericaceae, Lamiaceae, Loraceae, Lauraceae, Loranthaceae, Moraceae, Moringaceae, Musaceae, Olacaceae, Polygalaceae, Rhamnaceae, Rosaceae, Rutaceae, Sapindaceae, Sapotaceae, Sphenocleaceae, Sterculiaceae, Tiliaceae, Verbenaceae and Zingiberaceae are represented by a single species. The most used plant for antipyretic herbal medicine is *Senna occidentalis* with a citation percentage of 31.72%, followed by *Khaya senegalensis* (17.18%) and *Citrus aurantifolia* (11.01%). The most used plant for antalgic herbal medicine is *Grewia bicolor* with a citation percentage of 19.48%, followed by *Acacia nilotica* (12.21%) and *Hibiscus sabdariffa* (9.59%). The most used plant for antihypertensive is *Zizyphus mauritiana* with a citation percentage of 16.83%, followed by *Combretum micranthum* (13.37%) and *Oxythenantera abyssinica* (11.88%). The most used plant for cicatrizing is *Acacia nilotica* with a citation percentage of 25.71%, followed by *Vernonia colorata* (12%) and *Leptadenia hastata* (10.29%). The most used plant for erectile dysfunction is *Flueggea virosa* with a citation percentage of 24.14%, followed by *Zingiber officinale* (18.96%) and *Cassia sieberiana* (12.07%). The leaves (51%) and barks (18%) are the organs used for the medicinal preparations. The decoction (44%) is the most use followed by maceration (29%) and powder (16%).

**Conclusion:** Further investigations are needed to explore the bioactive compounds of these herbal medicines. In this aspect, many plants are claimed to be effective in the treatment of many affections.

**Keywords:** *Ethnopharmacological survey; medicinal plants; human diseases; Tivaouane department; Senegal.*

## 1. INTRODUCTION

Medicinal plants have been prescribed and used widely for thousands of years to treat various disorders and ailments in traditional herbal medicine systems all over the world [1] and have considerable importance in international trade today [2]. There is an increasing demand for the utilization of medicinal plants for providing primary health care to populations, as they are extensively available and inexpensive [3]. In developing countries, approximately 80% of the native inhabitants still rely on traditional medicine, mainly based on phytotherapy, for their primary health care [4]. The use of plants as medicine is as old as the history of mankind [5, 6]. Nowadays, medicinal plants are not only used as regional and traditional treatments but also registered as official medicines that are verified with pharmacopoeias [7]. Medicinal plants play a major role in pharmacological research and drug development, not only when plant constituents are exploited directly as therapeutic agents, but also as starting materials for the synthesis of drugs or as models for pharmacologically active compounds [2,8]. In West Africa, populations are used to taking traditional medicine as a first aid against common health problems [9]. In this aspect, many plants are claimed to be effective in the treatment many affections.

In Senegal, it is clearly recognized that, in the absence of sufficient health coverage for

medicine, at least 76% of households use medicinal plants close to their homes (50%) or sold on urban markets (25%). This use is justified by factors such as health indicators: a high birth rate (48%), population growth (3%) and urbanization (40%), which contrast with a low budget, a lack of access to health care, and poor, the morbidity and the high mortality [10].

Senegalese flora, despite the climatic and human constraints that they suffer, can still offer Man a variety of medicinal plants. There are many products in the pharmacopoeia, herbalists in the markets, in the street, or at the source, namely in the villages of the interior of Senegal. Medicinal plants are used whole or in parts (leaf, stem, root, bark, fruit) in various galenic preparations.

The main aim of this study was to evaluate by surveys the plants used in the treatment of certain affections. We will focus on medicinal plants antipyretic, analgesic, antihypertensive, antidiabetic, healing and finally those used by the population to treat erectile disorders.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The survey was conducted in Tivaouane Department. The Tivaouane Department (Fig. 1) has an area of 3217 km<sup>2</sup>, lies at 14°51'00"N Latitude and 16°10'00"W Longitude. It has a

Sudano-Sahelian climate with maritime influence and a total annual rainfall of 600 mm/year ANSD, [11]. Fig. 1 shows the survey locality.

## 2.2 Vegetation Description [11]

The vegetation cover of the department of Tivaouane is complex ranging from dunes steppe to Savannah, characteristic of the Sudano-Sahelian domain. In the department of Tivaouane there are non-leached ferruginous "dior" soils and they are of different categories : Hydromorphic lowland soils (inter dunes) rich in calcium and clay, suitable for vegetable and fruit crops, clay sands favoring cereal crops and legumes and lateritic lands very difficult to cultivate.

## 2.3 Socio-economic Conditions [11]

The Tivaouane Department presents an economic—issue predominantly agricultural. However some peculiarities can be reported with industry, fishing and tourism. What makes it an attractive pole especially the presence of factory, surrounding populations thus accentuating the already existing unemployment As a result, the

living conditions are becoming more and more difficult and the rural exodus is very accentuated.

## 2.4 Study Design

This study was conducted using a pre established questionnaire. It covered the period from May 2013 to December 2013. The majority ethnicities encountered were Wolof, Peulh, Serer etc.

## 2.5 Population of the Study

The study population was composed of fifty traditional practitioners, fifty herbalists and fifty resources persons.

## 2.6 Collection, Identification and Classification

The unknown species of our interviews had been collected and identified in the laboratory of Botany of Cheikh Anta Diop University by Pr Diatta (Botany Specialist). The classification was made using and the new classification APG III [12], the books of Eklu-Natey [13] and Kerharho [14].

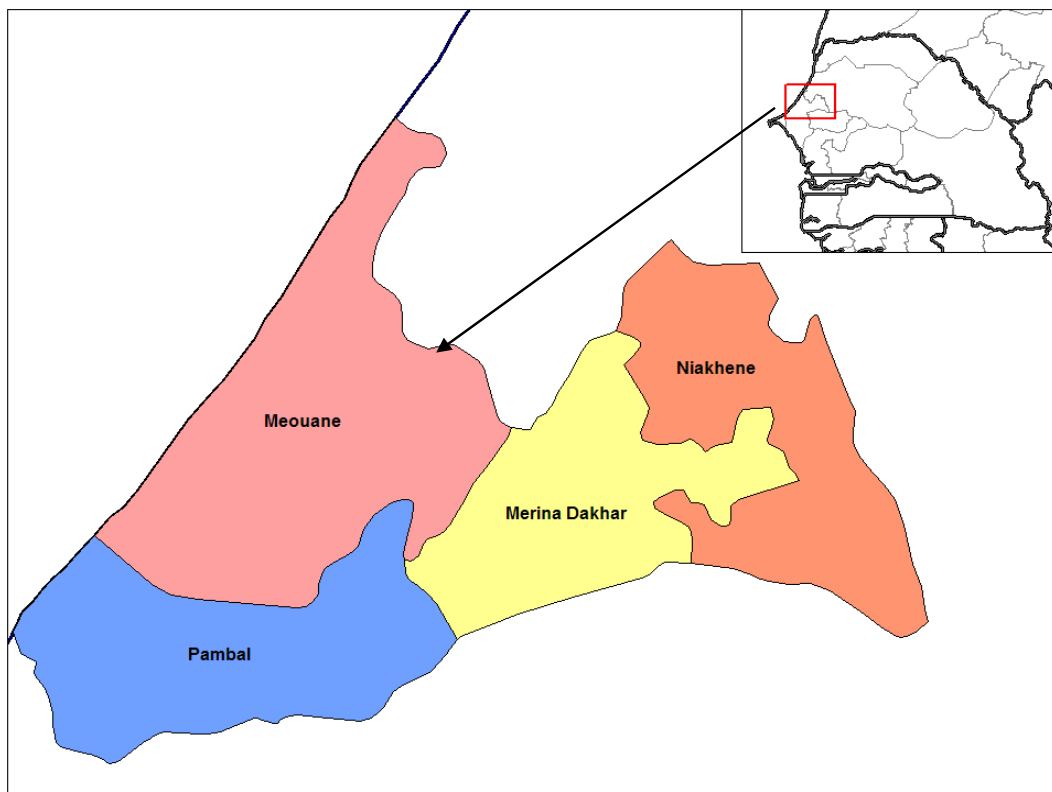


Fig. 1. Map of Tivaouane department [11]

## 2.7 Statitiscal Analysis

The data collected were analyzed using both Microsoft Excel and Statistical Package for Social Sciences (SPSS) version 3. Frequency and percentage tables were generated to summarize results for discussion.

## 3. RESULTS AND DISCUSSION

A total of 97 plant species from 89 genera and 48 families were identified as used in the management of erectile dysfunction, antipyretic, antalgic, antidiabetic, cicatrizing, antihypertensive activities. The families, botanical names, local names are given in Table 1 classified according to APG, [12,13,14]. Some families are more often referred because they include several species. Thus, Fabaceae families with 18 species; Euphorbiaceae (8 species), Combretaceae (5 species), Malvaceae (4 species), Anacardiaceae, Annonaceae, Asteraceae, Meliaceae Myrtaceae and Poaceae each with 3 species and Asclepiadaceae, Liliaceae, Lythraceae, Loganaceae and Menispermaceae each with 2 species; Apocynaceae, Balanitaceae, Bignoniaceae, Capparidaceae, Caricaceae, Casuarinaceae, Celastraceae, Cochlospermaceae, Cucurbitaceae, Hypericaceae, Lamiaceae, Loraceae, Lauraceae, Loranthaceae, Moraceae, Moringaceae, Musaceae Olacaceae, Polygalaceae, Rhamnaceae, Rosaceae, Rutaceae, Sapindaceae, Sapotaceae, Sphenocleaceae, Sterculiaceae, Tiliaceae, Verbenaceae and Zingiberaceae are represented by a single species (Fig. 2).

These results are a few similar with those found by Diatta [15] with 88 plant species from 79 genera and 35 families and the most cited families have the Fabaceae followed the Combretaceae. These results are not similar to those published by Hadj-Seyd [16] with 35 plant species from 32 genera and 14 families and the most of the cited families have the Asteraceae This state of affairs is understandable because the geographical area of studies differs. The reality with regard to the use of plants is thus different according to the geographic area.

The Fabaceae family contains many species of plants known for nutritional and medicinal value. These include the *Detarium microcarpum* species that has shown antiinflammatory, analgesic, antidiabetic and antimicrobial activity [17,18,19]. The *Tamarindus indica* species has shown antioxidant, antidiabetic and hepatoprotective activities [20,21].

The Euphorbiaceae plant family contains several species that are known to be analgesic and antiinflammatory activity [22]. *Guiera senegalensis* (Combretaceae) has shown acaricidal properties against *Hyalomma anatolicum* [23]. *Anogeissus leiocarpus* has shown antiplasmodial and antileishmanial activities [24]. The malvaceae plant family for example *Hibiscus sabdariffa* has shown an antidiabetic effect in streptozotocin induced mice, antiinflammatory and analgesic activities [25,26].

The Anacardiaceae plant family contains several species that are known to be antimicrobial, antioxidant, cyclooxygenase enzyme inhibitory, phenolic composition and acetylcholinesterase

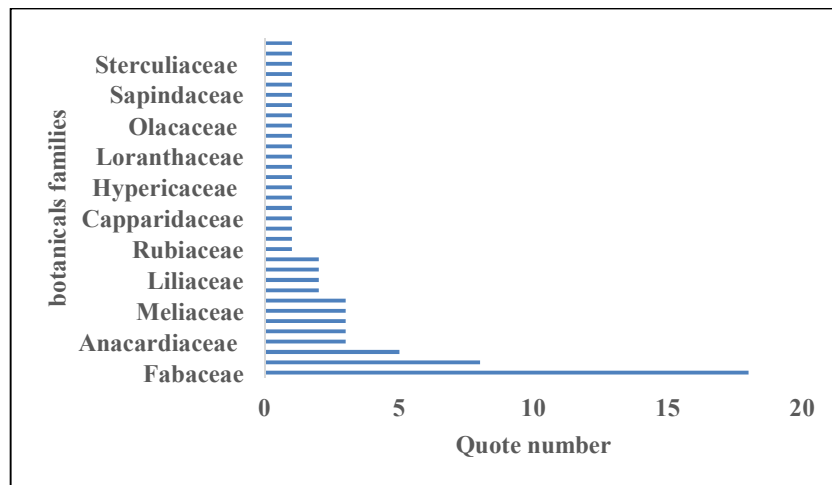
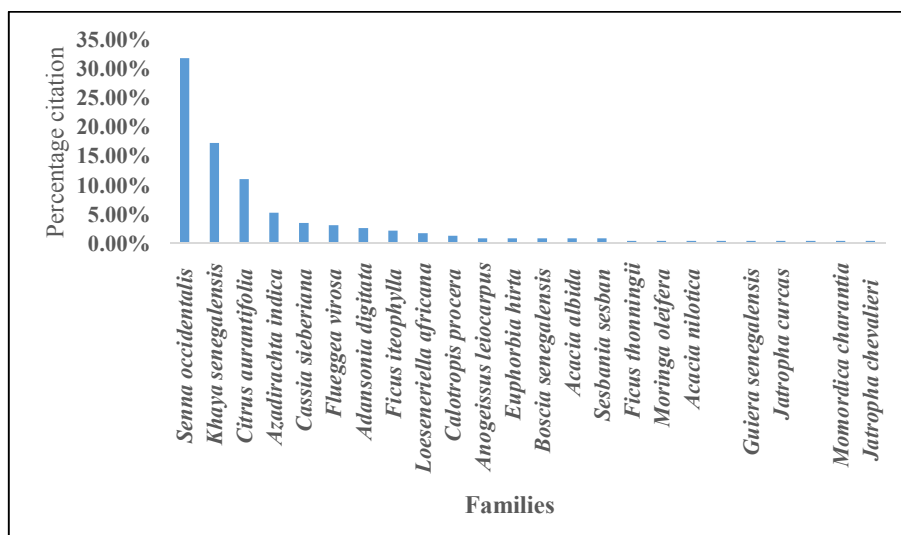


Fig. 2. Families classification plant cited



**Fig. 3. Antipyretic plants cited during the survey**

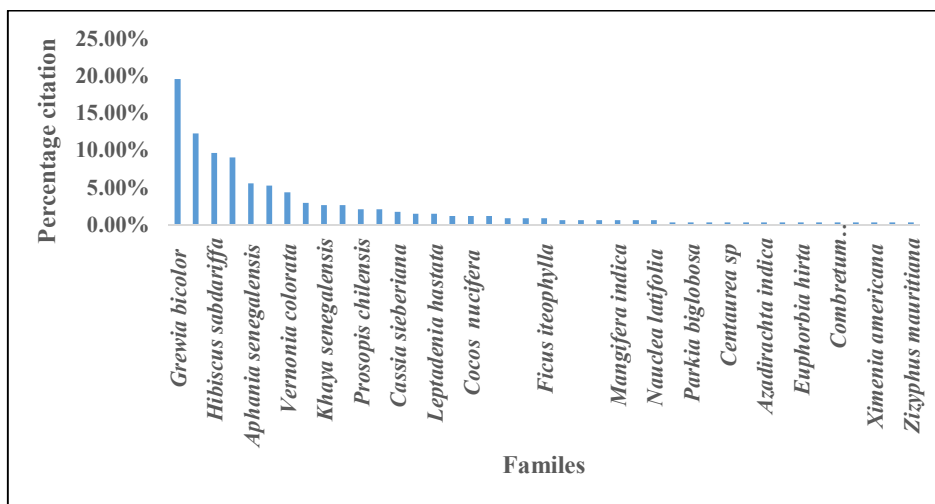
inhibitory activities etc [27,28]. The foregoing literature findings suggest that plants from the three families contain ingredients that are useful for diseases.

The most used plant for antipyretic herbal medicine is *Senna occidentalis* with a citation percentage of 31.72%. It is followed by *Khaya senegalensis* (17.18%) and *Citrus aurantifolia* (11.01%). In my knowledge, there aren't studies confirming this antipyretic activity. The Fig. 3 illustrates the different plants used for this affection.

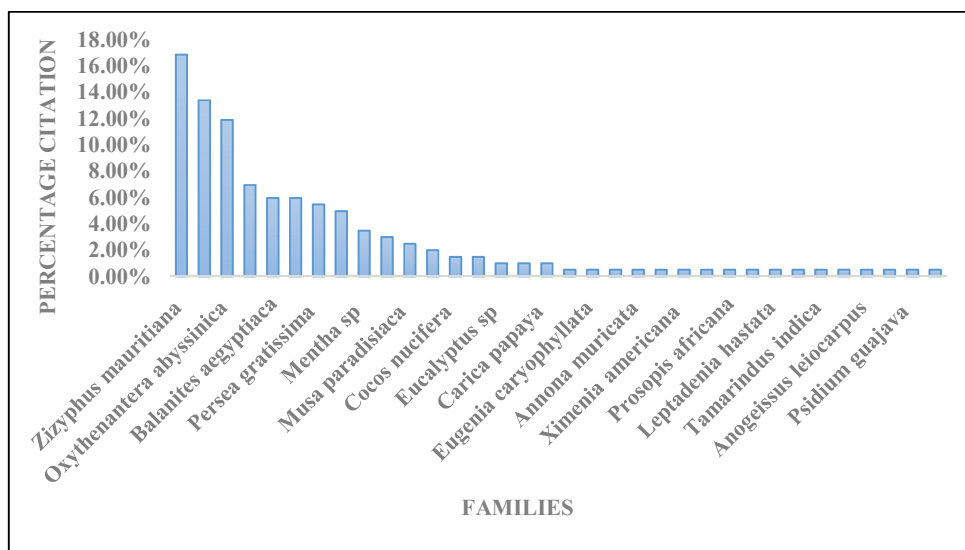
The most used plant for antalgic herbal medicine is *Grewia bicolor* with a citation percentage of

19.48%. It is followed by *Acacia nilotica* (12.21%) and *Hibiscus sabdariffa* (9.59%). In my knowledge, there aren't studies confirming this antalgic activity. The Fig. 4 shows the different plants used for this affection.

The most used plant for antihypertensive is *Zizyphus mauritiana* with a citation percentage of 16.83%, followed by *Combretum micranthum* (13.37%) and *Oxythenantera abyssinica* (11.88%). Koffi [29] has shown an antihypertensive activity of *Zizyphus mauritiana*. Two authors [30,31] confirmed the antihypertensive effects of *Combretum micranthum* and *Hibiscus sabdariffa*. The Fig. 5 shows the different plants used for this affection.



**Fig. 4. Antalgic plants cited during the survey**



**Fig. 5. Antihypertensive plants cited during the survey**

The most used plant for antidiabetic is *Parinari macrophylla* with a citation percentage of 24.18%, followed by *Sesbania sesban* (21.98%) and *Cocos nucifera* (17.58%).

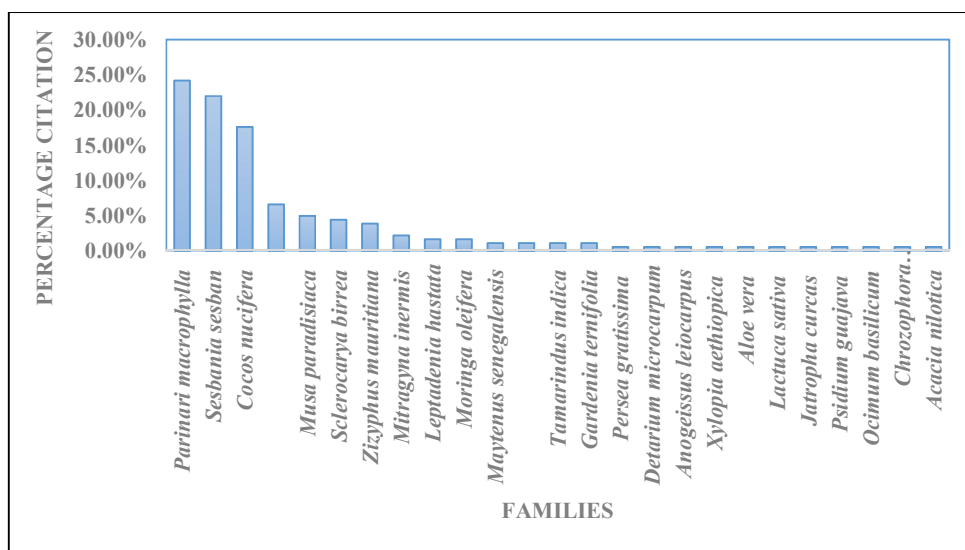
Soladoye, et al. [32] has confirmed the antidiabetic activity of *Parinari macrophylla* and *Cocos nucifera*. The Fig. 6 illustrates the antidiabetic plant.

The most used plant for cicatrizing is *Acacia nilotica* with a citation percentage of 25.71%, followed by *Vernonia colorata* (12%) and *Leptadenia hastata* (10.29%).

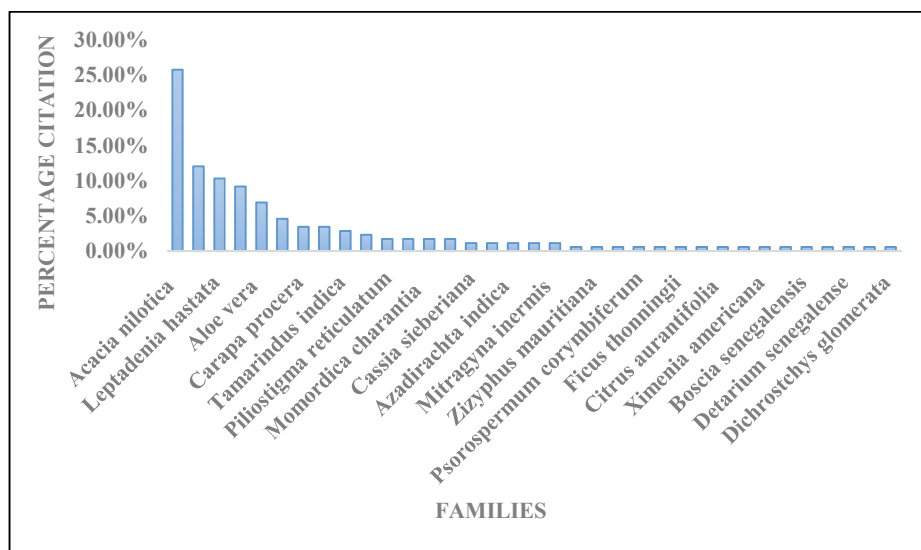
Chaha, et al. [33] has confirmed the wound healing activity of *Psidium guajava* and *Jatropha curcas* [34]. The Fig. 6 illustrates the antidiabetic plant.

The most used plant for erectile dysfunction is *Flueggea virosa* with a citation percentage of 24.14%, followed by *Zingiber officinale* (18.96 %) and *Cassia sieberiana* (12.07%).

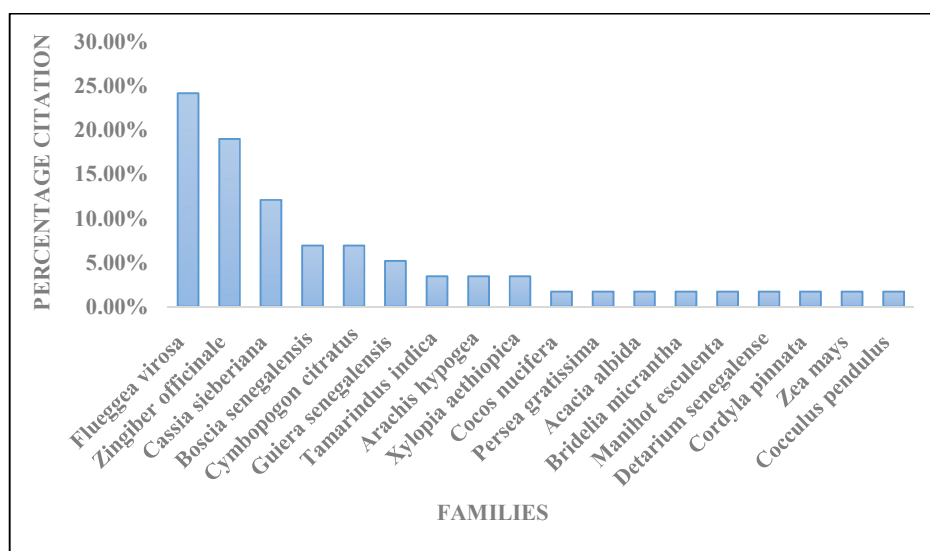
Maud [35] has confirmed the erectile dysfunction activity of *Flueggea virosa* and *Zingiber officinale*. Ramandeep [36] has shown this activity of these plant list. The Fig. 8 illustrates the erectile dysfunction plant.



**Fig. 6. Antidiabetic plants cited during the survey**



**Fig. 7. Wound healing plants cited during the survey**



**Fig. 8. Erectile dysfunction plants cited during the survey**

The leaves and barks are the organs used for the medicinal preparations. These results are according to Diatta [37] demonstrate that leaves are mainly treatments traditional and not according of Thirumalai, et al. [38] who has found that the part of the plant is the leafy stem. Harvesting tree roots and / or bark appears to have more adverse ecological impacts than leaf harvesting [39]. The utilization of Leaves in local inflicting less damaged to the medicinal treat them. This is understandable because the pathology involved and geographical study are different. Most of these plant parts were

harvested unconventionally, with no reforestation politic for future resource availability. For example, there were signs of severe tree attack, uprooting or cutting of the entire plant. Fig. 9 shown the used for the medicinal preparations.

The decoction (44%) is the most use followed by maceration (29%) and powder (16%) (Fig. 10). Bene, et al. [40] who showed that decoction and grinding are the most important methods of preparation in traditional pharmacopoeia. Some plant species have specificities of action against a given cause. These result are not according to

Tilahun [41] who has found crushing (38.5%) followed pounding (18.8%) and powdering (14.6%). This difference in medical preparation may be due to the differences between the species found on both sides of the planet. Decoction as boiling method is an effective method of preparing medicinal plant because it preserves the medicine longer when compared to cold water. Boiling is believed to be efficient in extracting active ingredient and for hygienic reasons. This prescription can also be

explained by the fact that the diseases are related to deep organs [41]. To reach them, any compound must pass through the digestive system to facilitate its assimilation. It should be made clear to readers that just because local people use a plant to treat an ailment, there is no guarantee that the plant is successful in treating the condition.

Table 1 shown the inventory of the plants mentioned during the survey.

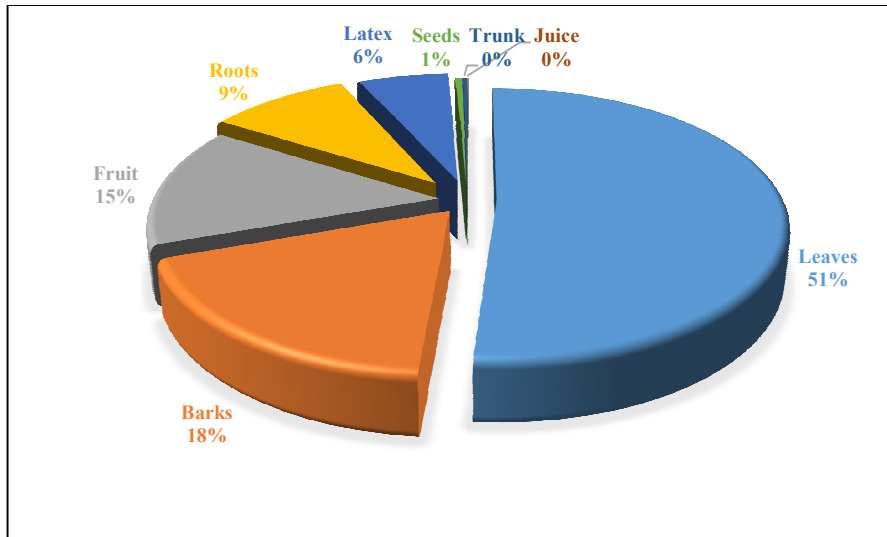


Fig. 9. Plant parts used

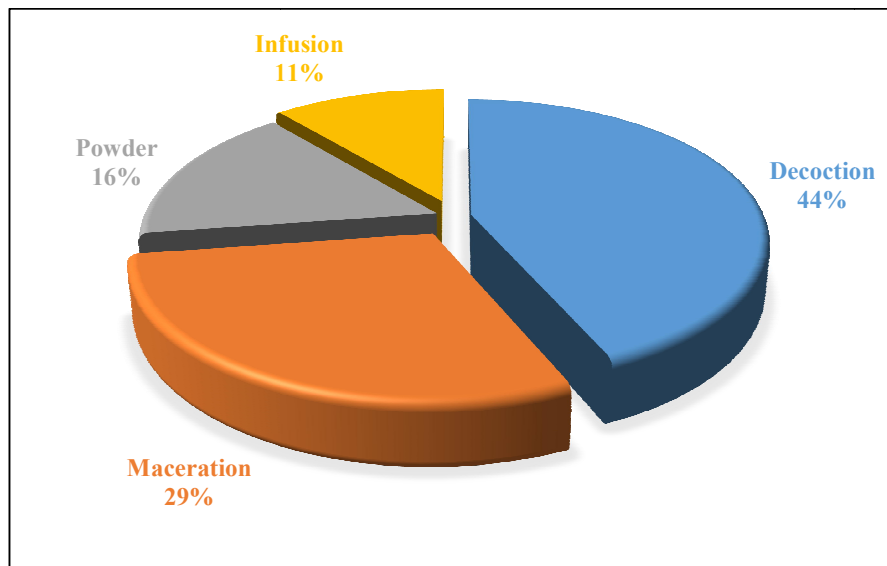


Fig. 10. Medicinal preparation of plant parts



**Table 1. The inventory of the plants mentioned during the survey**

<b>Botanicals names</b>	<b>Locals names</b>	<b>Families</b>
1. <i>Acacia albida</i>	Kad (w)	Fabaceae
2. <i>Acacia nilotica</i>	Gonakié (w)	Fabaceae
3. <i>Acacia seyal</i>	Surur (w)	Fabaceae
4. <i>Adansonia digitata</i>	Gouye (w)	Malvaceae
5. <i>Allium sativum</i>	Aye (fc)	Liliaceae
6. <i>Aloe vera</i>	Aloé verra (fc)	Liliaceae
7. <i>Anacardium occidentale</i>	Darkassé (w)	Anacardiaceae
8. <i>Annona senegalensis</i>	Dougor (w)	Annonaceae
9. <i>Annona muricata</i>	Corossolier (fc)	Annonaceae
10. <i>Anogeissus leiocarpus</i>	Guédian (w)	Combretaceae
11. <i>Aphania senegalensis</i>	Khéwer (w)	Sapindaceae
12. <i>Arachis hypogea</i>	Guerté (w)	Fabaceae
13. <i>Azadirachta indica</i>	Nim (w)	Meliaceae
14. <i>Balanites aegyptiaca</i>	Soump (w)	Balanitaceae
15. <i>Bauhinia rufescens</i>	Rande (w)	Fabaceae
16. <i>Boscia senegalensis</i>	Niandam (w)	Capparidaceae
17. <i>Bridelia micrantha</i>	Soulukum (w)	Euphorbiaceae
18. <i>Butyrospermum parkii</i>	Karité (w)	Sapotaceae
19. <i>Calotropis procera</i>	Poften (w)	Asclepiadaceae
20. <i>Carapa procera</i>	Tulukuna (w)	Meliaceae
21. <i>Carica papaya</i>	Papaya (w)	Caricaceae
22. <i>Cassia italica</i>	Leydour (w)	Fabaceae
23. <i>Senna occidentalis</i>	Mbanté (w)	Fabaceae
24. <i>Cassia sieberiana</i>	Siendiègne (w)	Fabaceae
25. <i>Casuarina equisetifolia</i>	Filao (w)	Casuarinaceae
26. <i>Ceiba pentandra</i>	Béntenié (w)	Malvaceae
27. <i>Centaurea sp</i>	Khomkhom (w)	Asteraceae
28. <i>Chrozophora senegalensis</i>	Ndamat (w)	Euphorbiaceae
29. <i>Citrus aurantifolia</i>	Limon (w)	Rutaceae
30. <i>Cissampelos mucronata</i>	Ngolomar (w)	Menispermaceae
31. <i>Cochlospermum tinctorium</i>	Fayar (w)	Cochlospermaceae
32. <i>Coffea sp</i>	Café (fc)	Rubiaceae
33. <i>Cocculus pendulus</i>	Sangol (w)	Menispermaceae
34. <i>Cocos nucifera</i>	Coco (w)	Arecaceae
35. <i>Combretum glutinosum</i>	Rate (w)	Combretaceae
36. <i>Combretum micranthum</i>	Douté (w)	Combretaceae
37. <i>Cordyla pinnata</i>	Dimb (w)	Fabaceae
38. <i>Cymbopogon citratus</i>	Citronnelle (fc)	Poaceae
39. <i>Detarium microcarpum</i>	Dankh (w)	Fabaceae
40. <i>Detarium senegalensis</i>	Ditakh (w)	Fabaceae
41. <i>Dichrostchys glomerata</i>	Sunth (w)	Fabaceae
42. <i>Ekebergia senegalensis</i>	Khakhthioye (w)	Meliaceae
43. <i>Eucalyptus camaldulensis</i>	Xotu butel (w)	Myrtaceae
44. <i>Eugenia caryophyllata</i>	Xorompolé (w)	Myrtaceae
45. <i>Euphorbia balsamifera</i>	Salann (w)	Euphorbiaceae
46. <i>Euphorbia hirta</i>	Mbal (w)	Euphorbiaceae
47. <i>Ficus iteophylla</i>	Loro (w)	Lytraceae
48. <i>Ficus thonningii</i>	Dobali (w)	Moraceae
49. <i>Gardenia ternifolia</i>	Dibutone (w)	Rubiaceae
50. <i>Gossypium barbadense</i>	Weten (w)	Malvaceae
51. <i>Guiera senegalensis</i>	Nguer (w)	Combretaceae
52. <i>Grewia bicolor</i>	Kelle (w)	Tiliaceae

Botanicals names	Locals names	Families
53. <i>Hibiscus sabdariffa</i>	Bissap (w)	Malvaceae
54. <i>Jatropha curcas</i>	Tabananie (w)	Euphorbiaceae
55. <i>Jatropha chevalieri</i>	Weutenu beut (w)	Euphorbiaceae
56. <i>Khaya senegalensis</i>	Khaye (w)	Meliaceae
57. <i>Lactuca sativa</i>	Salade (w)	Asteraceae
58. <i>Lantana camara</i>	Douté Gambi (w)	Verbenaceae
59. <i>Lawsonia inermis</i>	Foudeun (w)	Lythraceae
60. <i>Leptadenia hastata</i>	Thiakhat (w)	Asclepiadaceae
61. <i>Loeseneriella africana</i>	Tafe (w)	Loganiaceae
62. <i>Mangifera indica</i>	Mango (w)	Anacardiaceae
63. <i>Manihot esculenta</i>	Niambi (w)	Euphorbiaceae
64. <i>Mentha sp</i>	Nana (w)	Lamiaceae
65. <i>Maytenus senegalensis</i>	Ndouri (w)	Celastraceae
66. <i>Mitragyna inermis</i>	Xoss (w)	Rubiaceae
67. <i>Momordica charantia</i>	Mbeurbof (w)	Cucurbitaceae
68. <i>Moringa oleifera</i>	Nebedail (w)	Moringaceae
69. <i>Musa paradisiaca</i>	Banana (w)	Musaceae
70. <i>Ocimum basilicum</i>	Ngungun (w)	Lamiaceae
71. <i>Oxytenanthera abyssinica</i>	Waakh (w)	Poaceae
72. <i>Parinari macrophylla</i>	New (w)	Rosaceae
73. <i>Parkia biglobosa</i>	Houle (w)	Fabaceae
74. <i>Persea gratissima</i>	Avocat (w)	Lauraceae
75. <i>Piliostigma reticulatum</i>	Nguiguiss (w)	Fabaceae
76. <i>Prosopis africana</i>	Yir (w)	Fabaceae
77. <i>Prosopis chilensis</i>	Prosopis (fc)	Fabaceae
78. <i>Psidium guajava</i>	Goyab (w)	Myrtaceae
79. <i>Psorospermum corymbiferum</i>	Keutidiantabé (w)	Hypericaceae
80. <i>Pterocarpus erinaceus</i>	Wen (w)	Fabaceae
81. <i>Sclerocarya birrea</i>	Beer (w)	Anacardiaceae
82. <i>Flueggea virosa</i>	Keng (w)	Euphorbiaceae
83. <i>Securidaca longipedunculata</i>	Fouf	Polygalaceae
84. <i>Sesbania sesban</i>	Sabsab (w)	Sphenocleaceae
85. <i>Sterculia setigera</i>	Mbep (w)	Sterculiaceae
86. <i>Stereospermum kunthianum</i>	Fekh (w)	Bignoniaceae
87. <i>Strichnos spinosa</i>	Teumb (w)	Loganiaceae
88. <i>Strophantus sarmentosus</i>	Thiokh (w)	Apocynaceae
89. <i>Tamarindus indica</i>	Dakhar (w)	Fabaceae
90. <i>Tapinanthus bangwensis</i>	Tire (w)	Loranthaceae
91. <i>Terminalia avicennioides</i>	Reubreub (w)	Combretaceae
92. <i>Vernonia colorata</i>	Doctor (w)	Asteraceae
93. <i>Xanthoxylum xanthoxyloides</i>	Denguidek (w)	Rutaceae
94. <i>Ximenia americana</i>	Gologne (w)	Olacaceae
95. <i>Xylopiya aethiopica</i>	Diar (w)	Annonaceae
96. <i>Zea mays</i>	Mbokh (w)	Poaceae
97. <i>Zingiber officinale</i>	Didière (w)	Zingiberaceae
98. <i>Zizyphus mauritiana</i>	Sidème (w)	Rhamnaceae

#### 4. CONCLUSION

A total number of Ninety seven plants could be identified and divided into eighty nine genera and forty eight families. Plants from the family Fabaceae, Euphorbiaceae, Combretaceae and Anacardiaceae were the most frequently used

plants. The most commonly used plant part was leaves for the management of erectile dysfunction, antipyretic, antalgic, antidiabetic, wound healing and antihypertensive activities. The mode of application used by traditional medicinal practitioners (TMPs) was predominantly by decoction drink. The ethno-

pharmacological information provides a solid basis for further research aimed at identifying and isolating bioactive components that can be converted into drugs for the management of affections.

#### CONSENT

It is not applicable.

#### ETHICAL APPROVAL

It is not applicable.

#### ACKNOWLEDGEMENT

We thank the traditional healers, herbalists and resource persons from the department of Tivaouane for their cooperation.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

1. Dolatkhahi M, Dolatkhahi A, Nejad JB. Ethnobotanical study of medicinal plants used in Arjan–Parishan protected area in Fars Province of Iran. *Avicenna J Phytomed.* 2014;4:402–412.
2. Zhang X. Regulatory Situation of Herbal Medicines A worldwide Review. *World Health Organization*; 1998. Available:<http://apps.who.int/medicinedocs/pdf/whozip57e/whozip57e.pdf> (Accessed 14 November 2019)
3. World Health Organization. WHO traditional medicine strategy: 2014–2023. Geneva: World Health Organisation; 2013.
4. Shah A, Marwat SK, Gohar F, Khan A, Bhatti KH, Amin M, Coll. Ethnobotanical study of medicinal plants of semi-tribal area of Makerwal & Gulla Khel (lying between Khyber Pakhtunkhwa and Punjab Provinces), Pakistan. *Am J Plant Sci.* 2013;4:98–116. DOI: 10.4236/ajps.2013.41015
5. Al-Douri NA, Al-Essa LY. A survey of plants used in Iraqi traditional medicine. *Jordan J Pharm Sci.* 2010; 3:100–108.
6. Parvaiz M. Ethnobotanical studies on plant resources of Mangowal, District Gujrat, Punjab, Pakistan. *Avicenna J Phytomed.* 2014;4:364–370.
7. Bahmani M, Rafieian-Kopaei M, Avijgan M, Hosseini S, Golshahi H, Eftekhari Z, Coll. Ethnobotanical studies of medicinal plants used by Kurdish owner's in south range of Ilam province, west of Iran. *Am Eurasia J Agric Environ Sci.* 2012;12:1128–1133.
8. Newman DJ, Cragg GM. Natural Products as Sources of New Drugs over the Last 25 Years. *J Nat Prod.* 2007;70:461–477. DOI: 10.1021/np068054v
9. Diop EA, Queiroz EF, Kicka S, Rudaz S, Diop T, Soldati T, Wolfender JL. Survey on medicinal plants traditionally used in Senegal for the treatment of tuberculosis (TB) and assessment of their antimycobacterial activity. *J Ethnopharmacol.* 2018;216:71-78. DOI: 10.1016/j.jep.2017.12.037
10. Seye MB. Contribution to the study of the Senegalese pharmacopoeia: Ethnopharmacology survey in the department of Tivaouane. *Thèse Pharmacie, UCAD N°04.* 2014;129.
11. Agence Nationale Statistics and Demographics. Economic and social situation of Senegal: ANSD. 2014;129.
12. APG III. An update of the Angiosperm phylogeny group classification for the orders and families of flowering plants. *Botan J. the Linnean Society.* 2009;104.
13. Eklun NRD, Balet A, et al. Dictionary and multilingual monographs of the medicinal potential of African plants. West Africa. Geneva: Uniprint Center. 2011; 1030. (Scientific names and synonyms, names in African, French and English languages and traditional medicinal indications, vol.2)
14. Kerharo J, Adam JG. The traditional Senegalese pharmacopoeia, medicinal and toxic plants. Paris, Ed. Vigot Brothers. 1974;470-472.
15. Diatta K, Diatta W, Fall AD, Dieng SIM, Mbaye AI, Manga I. Ethnobotanic survey of aids opportunistic infections in the Ziguinchor District, Sénégal. *Asian Journal of Research in Medical and Pharmaceutical Sciences.* 2019;8(1-2):1-10.
16. Hadj SA, Kemassi A, Hadj KY, Harma A. Infertility treatment: Spontaneous plants from Northern Sahara infertility treatment: Spontaneous Plants of Northern Sahara, *Phytothérapie.* 2016;14:241-245. DOI :10.1007/s10298-015-1000-9

17. David J, Afolabi EO, Olotu PN, Ojerinde SO, Agwom FM, Ajima U. Phytochemical analysis, antidiabetic and toxicity studies of the methanolic leaf extract of *Detarium microcarpum* guill and perr in wistar albino rats. Journal of Chemical and Pharmaceutical Research. 2017;9(11):55-60.
18. Chisom F, Ugochukwu A, Okenwa UI. Phytochemical screening and antimicrobial studies of *Azelia africana* and *Detarium microcarpum* seeds. Chemistry International. 2018;4(3):170-176.
19. Yaro AH, Yusif BB, Mu'azu AB, Matinja AI, Chutiyami M. Anti-Inflammatory and analgesic effect of *Detarium microcarpum* (Guill. and Perr.) stem bark methanol extract in rats and mice. International Research Journal of Pharmacy and Medical Sciences. 2017;1(1):7-10.
20. Narendar K, Hemanth KV, Jamadar MG, Huilgo SV, Nayak N, Saeed M, Yendigeri MS. Antidiabetic and hepatoprotective activities of *Tamarindus indica* fruit pulp in alloxan induced diabetic rats, Int J Pharmacol and Clin Sci. 2013;2:33-40.
21. Mbaye AI, Gueye PM, Fall AD, Kane MO, Badji KD, Sarr A, Diattara D, Bassene E. Antioxidative activity of *Tamarindus indica* L. extract and chemical fractions. African Journal of Biochemistry Research. 2017; 11(2):6-11.  
DOI: 10.5897/AJBR2016.0896
22. Yerima M, Magaji MG, Yaro AH, Tanko Y, Mohammed MM. Analgesic and anti-inflammatory activities of the methanolic leaves extract of *Securinega virosa* (Euphorbiaceae). Nigerian Journal of Pharmaceutical Sciences. 2009;8(1):47-53.  
[ISSN: 0189-823X]
23. Ilham Mo Mohammed AS, Abdalla AB. Acaricidal properties of two extracts from *Guiera senegalensis* JF. Gmel. (Combretaceae) against *Hyalomma anatolicum* (Acari: Ixodidae). Veterinary Parasitology. 2014;199(3-4):201-205.
24. Mann A, Amupitan JO, Oyewale AO, Okogun JI, Ibrahim K. Antibacterial activity of terpenoidal fractions from *Anogeissus leiocarpus* and *Terminalia avicennioides* against community acquired infections. African Journal of Pharmacy and Pharmacology. 2009;3(1):022-025.
25. Sumaia AA, Abdelwahab HM, Galal EEM. Fatty acid composition, anti-inflammatory and analgesic activities of *Hibiscus sabdariffa* Linn. Seeds, J. Adv. Vet. Anim. Res. 2014;1(2):50-57.  
DOI : 10.5455/javar.
26. Muhd Hanis MI, Siti Balkis B, Mohamad O, Jamaludin M. Protective role of *Hibiscus sabdariffa* calyx extract against streptozotocin induced sperm damage in diabetic rats. EXCLI J. 2012;11:659–669.
27. Moyo M, Ndhala AR, Finnie JF, Staden JV. Phenolic composition, antioxidant and acetylcholinesterase inhibitory activities of *Sclerocarya birrea* and *Harpephyllum caffrum* (Anacardiaceae) extracts, Food Chemistry. 2010;123(1):69-76.
28. Moyo M, Finnie JF, Staden JV. Antimicrobial and cyclooxygenase enzyme inhibitory activities of *Sclerocarya birrea* and *Harpephyllum caffrum* (Anacardiaceae) plant extracts, South African Journal of Botany. 2011;77(3):592-597.
29. Koffi A, Traore F, Adjoungoua AL and Diafouka F. Pharmacological effects of *Ziziphus mauritiana* Lam. (Rhamnaceae) on blood pressure in rabbits, Phytothérapie. 2017;6(4):219-227.
30. Zahoui OS, Soro TY, Yao KM, Nene-Bi SA, Traoré F. Hypotensive Effect of an aqueous extract from *Combretum micranthum* G. Don (Combretaceae), Phytothérapie. 2017;15(3):138-146.
31. Seck SM, Doupa D, Dia DG, et al. Clinical efficacy of African traditional medicines in hypertension: A randomized controlled trial with *Combretum micranthum* and *Hibiscus sabdariffa*. J Hum Hypertens. 2018;32:75–81.  
DOI: 10.1038/s41371-017-0001-6
32. Soladoye MO, Chukwuma EC, Owa FP. An 'avalanche' of plant species for the traditional cure of *Diabetes mellitus* in South-Western Nigeria. J. Nat. Prod. Plant Resour. 2012;2(1):60-72.
33. Chah KF, Ezeb CA, Emuelosia CE and Esimone CO. Antibacterial and wound healing properties of methanolic extracts of some Nigerian medicinal plants, Journal of Ethnopharmacology. 2006;104(1–2):8: 164-167.
34. Pushpangadan P, Mehrota S, Rawat AKS, Rao CV, SK, Ojha, Aziz I. Herbal composition for cuts, burns and wounds, US 7344737; 2008.
35. Maud KM, Hannington OO. Traditional herbal remedies used in the management

- of sexual impotence and erectile dysfunction in western Uganda, African Health Sciences. 2005;5(1):40-49.
36. Ramandeep S, Sarabjeet S, Jeyabalan G, Ashraf A. An overview on traditional medicinal plants as aphrodisiac agent, Journal of Pharmacognosy and Phytochemistry. 2012;1(4):1-14.
37. Diatta K, Diatta W, Fall AD, Dieng SIM, Mbaye AI, Fall PA. Traditionally used anti-hepatitis plants species in Dakar District, Senegal. European Journal of Medicinal Plants. 2019;29(2):1-8.  
DOI: 10.9734/EJMP/2019/v29i230150
38. Thirumalai T, Beverly CD, Sathiyaraj K, Senthikumar B, David E. Ethnobotanical study of anti-diabetic medicinal plants used by the local people in javadhu hills Tamilnadu, India. Asian Pacific Journal of Tropical Biomedicine. 2012;2(2):S910-S913.
39. Cunningham AB. People, wild plant use and conservation. people and plants. Conservation Manuel, Applied Ethnobotany, Earthscan. 2001;300.
40. Béné K, Camara D, Fofie NBY, Kanga Y, Yapi AB, Yapou YC, Ambe SA, Zirihi GN. Ethnobotanical study of medicinal plants used in the Department of Transua, Zanzan District (Côte d'Ivoire). Journal of Animal & Plant Sciences. 2016;27(2): 4230-4250.
41. Tilahun TJ, Moa M. Ethnobotanical study of medicinal plants used to treat human diseases in Berbere District, Bale Zone of Oromia Regional State, South East Ethiopia. Evidence-Based Complementary and Alternative Medicine. 2018;16:Article ID 8602945.

© 2019 Diatta et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*

*The peer review history for this paper can be accessed here:  
<http://www.sdiarticle4.com/review-history/53039>*