



## ETHNOPHARMACOLOGICAL INVESTIGATION OF FIVE PLANTS USED IN COMORIAN FOLKLORE MEDICINE

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### ABSTRACT

Comorian traditional medicine is specifically rich and well diversified but few written information existed about that. For the valorization of this traditional medicine and plants used for that, we are interested at five plants used in Ngazidja Island and investigate the different uses of these plants in indigenous care system. Total of 125 people aged between 60 and 70 years, living in rural areas, from 20 villages was interviewed. Results demonstrated the large use of these plants. Total of twenty medicinal uses were recenssed for all plants. Used against 19 diseases, *Piper borbonense* was the most used. This study has been demonstrated the important use of these plants in traditional medicine from Comoros and their ability to treat several diseases.

**Key words:** Comoros, Ngazidja, Ethnopharmacological study, Traditional medicine, Plants.

### INTRODUCTION

Plants used as medicinal sources began with the birth of human's civilizations. Despite the advent of modern medicine and the technical advances of nowadays, the use of plants for therapeutic purposes is a major part in the global health system. According to the World health organization (WHO), a large majority of rural people used traditional medicine as the first defense of health care (Goleniwsy *et al.*, 2006). These last times in developed countries medicinal plants are used as alternatives to synthetic drugs (Kettner *et al.*, 2005). However, traditional medicine and modern medicine are closely linked since the discovery of new bioactive molecules comes essentially on ethnopharmacological and ethnobotanical investigations. It was estimated that

74% of pharmacological components derived on plants used in modern medicine, was discovered after ethnomedicinal investigation (Farnsworth and Soejarto, 1991; Sheldon *et al.*, 1997).

Like many people in the world, the Comorian people have formed their health system themselves based on natural products, for centuries. Its blend African Bantu and Arab- Muslim gave it a traditional medicine specifically rich and well diversified. Due to poverty affecting families, difficult access to modern care system and lack of adequate health infrastructure, the proximity of the population with medicinal plants makes their uses more practical. Traditional medicine is part of the cultural heritage of the Comoros but few written information existed about traditional plants used in this medicine (Kaou *et al.*, 2008). Comoros is an archipelago of four islands located in Mozambique Channel, equidistant between North West of Madagascar and African coast. Their vegetal biodiversity was estimated more than 2000 species (Adjanohoun *et al.*, 1982). The

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principal island, Ngazidja contains the Karthala forest, the important forest in the archipelago.

*Aphloia theiformis* (Aphloiaceae), *Cassytha filiformis* (Lauraceae), *Piper capense*, *Piper borbonense* (Piperaceae) and *Vetiveria zizanoides* (Poaceae) are five plants largely used in Comorian folkloric medicine to treat many diseases like diarrhea, malaria, gynecological diseases, diabetes, intestinal parasites, etc. This study was conducted to investigate the different use of these plants in indigenous health care system especially in rural areas and was carried directly on local populations.

## MATERIAL AND METHODS

### Study area

This study was carried in seven regions from Ngazidja Island (Fig 1). These are the regions of Itsandra, OIchili, Dimani, Mbadjini, Hambou and Bambao, six regions around Karthala forest extending from the center to south of the island and Hamahamet, one region near "La Grille" forest in Eastern North of island. In each region, three villages were chosen by their proximity in relation to forest. The Karthala covers some 2/3 of the surface of island and represent the big forest in the archipelago. This is a tropical wet forest, where pluviometry is abundant. It's constituted by two forest types, a medium altitude forest and a high altitude forest. The "La Grille" forest is also a medium altitude forest and covered the massif of North of island. Populations leave near, are developed a compensative sanitary system using the plants because they suffered from the deficit of sanitary infrastructures.

### Plants selection and identification

In their daily lives, Comorians use different plants for various uses. These uses including, health, cosmetic, and dietary purposes. For those five plants largely used for various needs were chosen for this study. These plants were collected in different region included in the study area. *Aphloia theiformis* (Vahl) Benn. (AT) and *Piper borbonense* (Pb) were harvested in Oichili region near Bweni Oichili in Hantsongoma forest. *Piper capense* (Pc) was collected in Nkurani ya sima area. For *Cassytha filiformis* and *Vetiveria zizanoides*, they respectively harvested in Mbeni Hamahamet and Idjikundzi Dimani. Botanical identification was established by Professor Jean- Noel Labat from "Museum national d'Histoire Naturelle (Paris France)" and Ibrahim Yahya from "Centre National de Recherche Scientifique (CNDRS)". Vouchers were registered in herbarium of Faculty of Sciences and Technology, University of Comoros and Herbarium of CNDRS Moroni Comoros.

### Data collection

This study was conducted to determine the different medicinal uses of the five plants by local

populations. Total of 125 people aged between 60 and 70 years in 20 villages were interviewed which ¾ of total respondents were women. Interviews were conducted in local language so as to get the most information. The questions focused on the different diseases treated by these plants, the plant part used, and method of preparation. Another question about the precautions taken for uses of each plant was asked. Precisions about no medicinal uses were also requested including certain rituals practices. These data were collected on survey questionnaire.

## RESULTS AND DISCUSSION

### Percentage of use of five plants by diseases

Results demonstrated the large use of these plants. Total of twenty medicinal uses were recensé for all plants. Table 1 resumed the different uses of each plant. *P. borbonense* was used for treatment of nineteen diseases and remains the largest used. Used in ten diseases, *V. zizanoides* is far the least used.

Tooth skins, gynecological problems, dermal problems, diarrhea, inflammation, diabetes, malaria, intestinal worms, stomachaches are the principle diseases treated. Figure 2 showed the use percentage of each plant by diseases. To treat tooth skins, *P. borbonense* and *P. capense* were the most used with respectively 76.8 and 28.8%. For dermal problems *Cassytha filiformis* was largely used with 72.8% and for inflammation at 24.8%. *Vetiveria zizanoides* was also used in dermal problems but at 26.4%. *P. capense* was used principally to treat diarrhea (39.2%), diabetes (32%), inflammation (31.2%), intestinal worms (24%), gynecological problems (17.6%), and stomachaches at 16.8%. For *Aphloia theiformis*, their principal uses are diarrhea (31.2%), intestinal worms (21.6%), gynecological problems (18.4%), stomachaches (16.8%), malaria (11.2%), and anemia (10.4%). These results showed that for treatment of stomachaches, diarrhea, intestinal worms, malaria, gynecological problems and inflammation, the five plants can be used. In certain case the plant can associated or not. In their study, Kaou *et al.*, was revealed that *P. capense* is associated with *Citrus nobilis*, *Musa paradisiaca*, *Mangifera indica* and *Plectranthus ambonicus* for treatment of malaria (Kaou *et al.*, 2008).

Generally treatment of malaria and influenza need the association of two or more plants. Treatment of malaria required often association of 5, 6 or 7 plants in a mixture named "Djungu". However treatments of diseases like inflammation, dermal problems need locally application of one plant alone. Pathologies like diabetes, hypertension and obesity often named as diseases of rich people, and generalized now in entire population, are treated by popular pharmacopeia. To treat diabetes and hypertension *Piper* family are the most used with 32 and 20.8% respectively for *P. capense* and *P. borbonense*

while *A. theiformis* with 4% of total interviewers. The same observation can be observed on hypertension with 12, 9.6, and 6.4% respectively for *P. capense*, *P. borbonense* and *A. theiformis*.

### Regional uses of five plants by diseases

#### *Aphloia theiformis*

Leaves of *A. theiformis* are largely used for the preparation of tea. Their medicinal uses are numbers (Fig. 3). In each region *A. theiformis* is used to treat several diseases but its principal uses vary from one region to another. It's largely used to treat intestinal worms in Dimani (94.44%) but in Oichili its principal utilization is stomachaches with 72.22%. In Itsandra region, it is principally used against gynecological problems (61.11%) far ahead of diabetes (22.2%), influenza, diarrhea, rheumatism (16.67%) and anemia with 11.11%. It's used in Hamahamet at 52.94% against diarrhea, anemia at 23.53%, and hypertension at 17.65%. It's reported to treat also obesity by diminution of fat in Hambu at 16.67% and Bambao at 5.56%. In Mbadjini it's used to treat anemia (33.33%), hypertension and malaria at 16.67% and influenza at 5.56% of interviewers.

Uses of *A. theiformis* is reported in Indian ocean region. In Reunion, leaves are used to treat fever, pains, malaria, inflammation, and as a depurative, they are also used as a febrifuge in Mauritius (Jonville *et al.*, 2008). In Madagascar, young leaves are effective against haematuria and the old ones against rheumatism (Lavergne, 1983). The work of Kaou *et al.*, reported their uses for treating dizziness and leucorrhoea in Comoros (Kaou *et al.*, 2008).

#### *Cassipourea filiformis*

In traditional medicine *Cassipourea filiformis* is principally used against dermal problems in all areas (Fig. 4). The lowest utilization was observed in Mbadjini with 33.33% are probably due to the ignorance of this plant. The survey zone is located in altitude while the area of repartition cannot exceed 250 m for this plant.

The most percentage of utilisation of *C. filiformis* in dermal problems was registered in Bambao with 88.89%. Utilization of *C. filiformis* in Comoros for dermal problems was confirmed previously by an other investigation especially for treatment of scabies (TRAMIL, 2002).

*C. filiformis* is used for several diseases. Excepted in Oichili region, this plant is also used to treat inflammation with approximately 38.89% in Dimani, Hambu and Itsandra, 33.33% in Bambao, 29.41% in Hamahamet and 27.78% in Mbadjini. It's used in Dimani (16.67%), Hamahamet (11.76%), Itsandra and Hambu (22.22%) and Mbadjini with 11.11%. In Hamahamet 11.76% of interviewers used this plant against diarrhoea. For gynecological problems this plant is used in Dimani at

16.67%. In Indian Ocean, *C. filiformis* is considered one of the 215 plants most used in folkloric medicine (PLARM, 1999).

In Nigeria this plant is used to treat diabetes, ulcers, venereal discharge, hemorrhoids and cough (Abdullahi *et al.*, 2003; Babayi *et al.*, 2007; Quetin-Leclercq *et al.*, 2004; Neuwinger, 2000 ;). Treatment of cough was revealed also in this study especially in Bambao and Mbadjini with respectively 11.11% and 16.67%. It's also used in Polynesia against cancers (Nelson, 2008).

#### *Piper borbonense*

*P. borbonense* is largely used to treat the tooth diseases. In Itsandra and Oichili 100% of interviewers used it against the tooth diseases (Fig. 5). The stem was the most part used of the plant with 78.5% of interviewers. The leaves are used too (60.8%) but especially against other diseases like diabetes, malaria, intestinal worms, diarrhea.

While the other regions, Dimani region is one that uses this plant a lot with 66.67% against intestinal worms, 50% for gynecological problems, 44.44% for "diabetes" 38.89% against malaria and diarrhoea. *P. borbonense* was less studied. It was mentioned to treat diarrhoea and as diuretic in Reunion island (Fortin *et al.*, 2002). This study reported the usage of this plant against malaria in five regions among the seven concerned by the study. It mostly used in Dimani and Bambao at 38.89% compared to Hamahamet, Hambu and Mbadjini respectively with 23.53%, 22.22% and 11.11%. In precedent study in Comoros, Kaou *et al.*, reported also the usage of stem against malaria (Kaou *et al.*, 2008). It's also used at lowest proportion to treat other diseases like hypertension, influenza, inflammation,...

#### *Piper capense*

Among the five plants investigated in this study, *P. capense* is one of the most used (Fig. 6). It's used against thirteen diseases, principally diabetes, diarrhoea, inflammation, tooth, and gynecological problems.

Seeds and leaves are the parts largely used with respectively 76.8 and 52% of interviewers. It used in all regions to treat diabetes and toothaches. Against diabetes, it used at 70.59% in Hamahamet, 44.44% in Dimani and Itsandra. The few proportion was observed in Hambu with 5.56%. For toothaches, the highest utilisation was observed also in Hamahamet (64.71%), Dimani (55.56%) and Itsandra with 44.44%. The use of *P. capense* against diarrhoea was observed in six regions of the seven. Like against diabetes and toothaches, this plant was mostly used also in Hamahamet against diarrhoea (70.59%). Against the same disease it used at 66.67% in Bambao and 55.56% in Dimani. The most proportion observed for this plant was observed in Dimani against intestinal worms with 94.44%. In precedent investigation Kaou *et*

al, showed the used of this plant against diarrhae and cough (Kaou *et al.*, 2008). The use of *P.capense* against cough was also observed in our survey. Regions of Bambao, Dimani, Itsandra and Mbadjini used it respectively at 16.67, 38.89, 5.56 and 27.78%. In South Africa this plant is used as somniferous (Pedersen *et al.*, 2009).

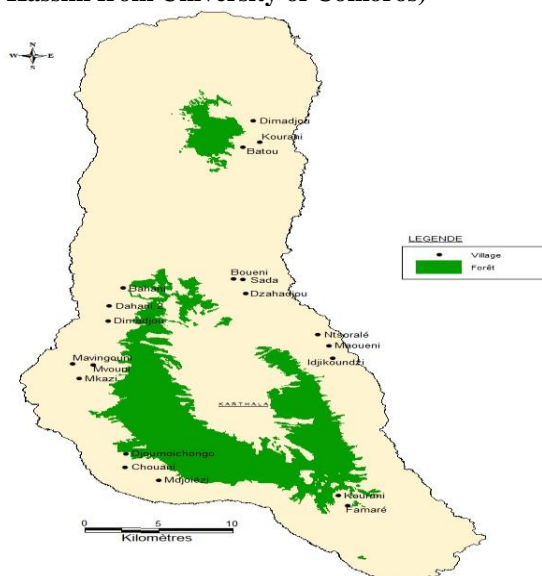
**Vetiveria zizaniodes**

It's the least used of the plants studied in this work, probably because it is least known. It is principally used against dermal problems (Fig. 7). Against dermal problems it's used at 83.33% in Mbadjini, 61.11% in

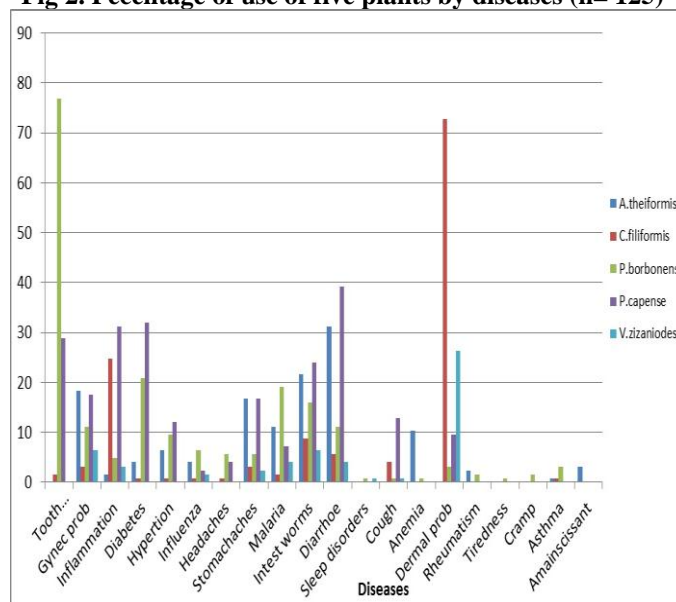
Dimani and 41.18% in Hamahamet. Plant is also used to treat gynecological problems in Hamahamet (41.18%) and Itsandra (5.56%). In Hambu it's used against intestinal worms (27.78%).

In Bangladesh, Roots are stimulant, tonic, cooling, stomachic, diuretic, antispasmodic and emmenagogue, and used in fevers, inflammations and irritability of stomach (Bhuiyan *et al.*, 2008). Its utilization in inflammation was observed in Hamahamet and Itsandra. However its stomachic activity utilization was observed in Bambao (16.67%). His taking against influenza and malaria can assimilated to symptomatic treatment of fever.

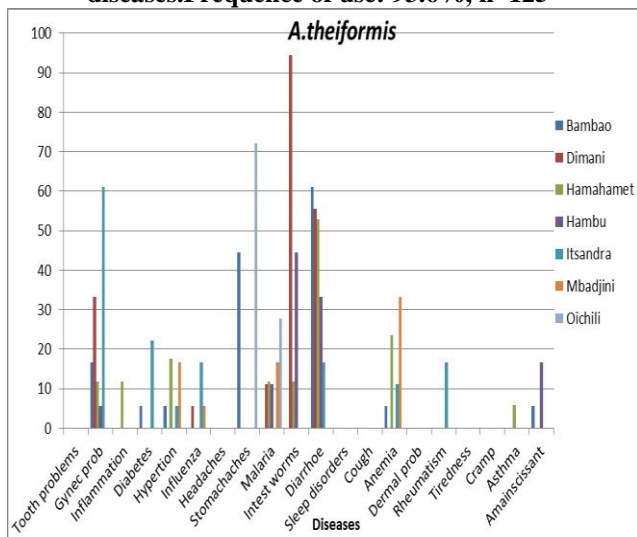
**Fig 1. Map of study area (elaborate by Ibrahim Kassim from University of Comoros)**



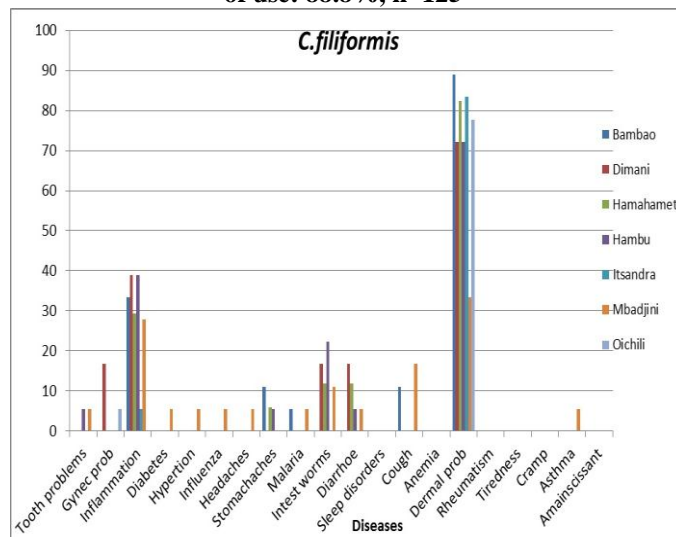
**Fig 2. Percentage of use of five plants by diseases (n= 125)**



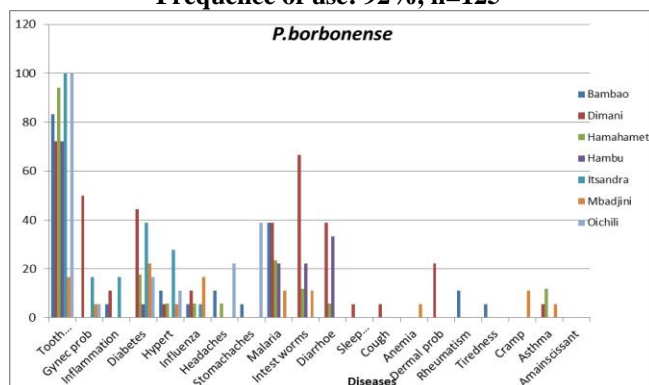
**Fig 3. Regional uses of A. theiformis by diseases. Frequency of use: 93.6%, n=125**



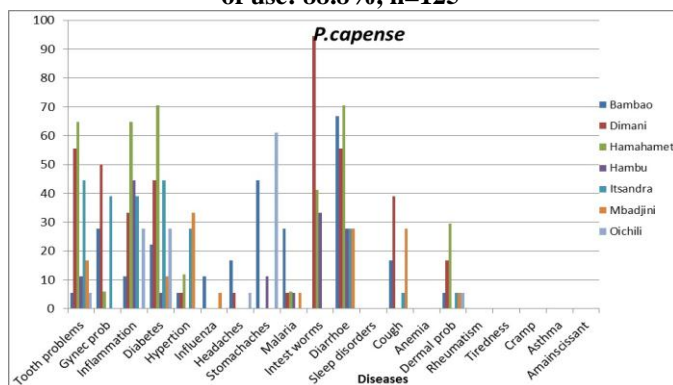
**Fig 4. Regional uses of C. filiformis by diseases. Frequency of use: 88.8%, n=125**



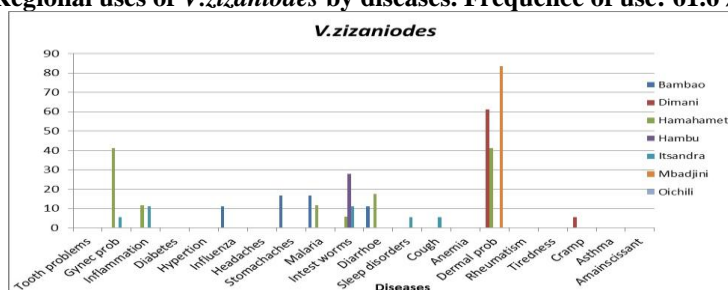
**Fig 5. Regional uses of *P.borbonense* by diseases.**  
Frequency of use: 92%, n=125



**Fig 6. Regional uses of *P.capense* by diseases. Frequency of use: 88.8%, n=125**



**Fig 7. Regional uses of *V.zizanioides* by diseases. Frequency of use: 61.6%, n=125**



**Table 1. List of traditional medicinal uses of these plants**

Family/ species	Local name	Used part and mode of use	Popular uses	Scientific investigations	Frequency of use
Aphloiaceae <i>Aphloia theiformis</i> (Vaucher : AND501)	Mfandrabo	Leaves (Decoction)	gynecological problems, stomachaches, malaria, diarrhea, intestinal worms, anemia, inflammation, diabetes, hypertension, influenza, rheumatism, fat diminution	fever, pains, malaria, inflammation, depurative, febrifuge, haematuria, rheumatism, dizziness and leucorrhoea (Jonville <i>et al.</i> , 2008; Lavergne, 1983; Kaou <i>et al.</i> , 2008)	93.6%
Piperaceae <i>Piper borbonense</i> (Vaucher: CIM 33)	Gwe la Rambuwu Msiru	Leaves (decoction), Liana (toothbrush, decoction)	Tooth problems, gynecological problems, diabetes, hypertension, malaria, intestinal worms, diarrhea, inflammation, influenza, dermal problems, headaches, stomachaches, asthma, cough	Diarrhoe, diuretic and malaria (Fortin <i>et al.</i> , 2002; Kaou <i>et al.</i> , 2008)	92%
Lauraceae <i>Cassipourea filiformis</i> (vaucher : CIM 40)	Irudakanga	Leaves (decoction), Liana (cream or decoction), Seeds (cream)	Inflammation, intestinal worms, dermal problems, tooth problems, diabetes, influenza, headaches, stomachaches, malaria, cough, asthma, diarrhea	Scabies, diabetes, ulcers, venereal discharge, hemorrhoids, cough and Cancers (TRAMIL, 2002; Abdullahi <i>et al.</i> , 2003; Quetin-Leclercq <i>et al.</i> , 2004; Neuwinger, 2000; Babayi <i>et al.</i> , 2007; Nelson, 2008)	88.8%
Piperaceae <i>Piper capense</i> (voucher : CIM 30)	Dara	Leaves (decoction), Seeds (infusion, crush and drink)	Tooth problems, gynecological problems, Inflammation, diabetes, Hypertension, stomachaches, intestinal worms, diarrhea, cough, dermal problems, headaches, influenza	Diarrhoe, cough, somniferous, antiplasmodial and malaria (Kaou <i>et al.</i> , 2008; Kaou <i>et al.</i> , 2010; Pedersen <i>et al.</i> , 2009; Matasyoh <i>et al.</i> , 2011).	88.8%
Poaceae <i>Vetiveria zizanioides</i> (voucher: CIM 26)	Sandze Marache	Roots (decoction, balm for local application)	dermal problems, gynecological problems, intestinal worms, inflammation, influenza, stomachaches, malaria, diarrhea	stimulant, tonic, cooling, stomachic, diuretic, antispasmodic, emmenagogue, fevers, inflammations, insecticidal, antioxidant, antinociceptif, (Bhuiyan <i>et al.</i> , 2008; Hammer <i>et al.</i> , 1999; Kim <i>et al.</i> , 2005; Sujatha <i>et al.</i> , 2010; Lima <i>et al.</i> , 2012)	61.6%

## CONCLUSION

Through this study we have been demonstrated the important use of these plants in traditional medicine from Comoros and their ability to treat several diseases. Our approach was different by the habitual approach on ethnobotanical and ethnopharmacological studies but it allowed us to clearly identify the different uses of these plants as possible. However we noted that this is a preliminary study but the main work will constitute in future to affirm or infirm these different observations in laboratory and eventually identified other possible pharmacological and biological activities of these plants

and their biomolecules components.

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## REFERENCES

- Abdullahi M, Mohammed G, Abdulkadir NU. Medicinal and Economic Plants of Nupeland. Bida, Nigeria: Jube – Evans Books and Publications, 2003, 140.
- Adjanohoun EJ, Aké Assi L, Ali M, Eymé J, Guinko S, Kanyonga A, Keita A, Lebras M. Contribution aux études ethnobotaniques et floristiques aux Comores. Rapport présenté à l'ACCT I.S.B.N. 92- 9028- 038- 7, 1982.
- Babayi HM *et al.*, Effect of oral administration of aqueous whole extract of *Cassipourea filiformis* on haematograms and plasma biochemical parameters in rats. *Journal of Medical Toxicology*, 3(4), 2007, 146-51.
- Bhuiyan MNI, Chowdhuri JU, Begum J. Essential oil in roots of *Vetiveria zizanioides* (L.) Nash ex small from Bangladesh. *Bangladesh Journal of Botany*, 37(2), 2008, 213-215.
- Farnsworth NR, Soejarto DD. In: O Akereb, Heywood V, Syngé H. Global Importance of Medicinal Plants. (Eds) Conservation of Medicinal Plants. Cambridge University Press, 1991, 25–52.
- Fortin H, Robin V, Vigor C, Le Bosse B, Lohezic-Le Devehat F, Boustie J, Amoros M. In vitro antiviral activity of thirty-six plants from La Reunion Island. *Fitoterapia*, 73, 2002, 346-350.
- Goleniowski ME, Bongiovanni GA, Bongiovanni L, Palacio CO, Cantero JJ. Medicinal plants from the “Sierra de Comechingones”, Argentina. *Journal of Ethnopharmacology*, 107, 2006, 324–341.
- Hammer KA, Carson CF, Riley TV. Antimicrobial activity of essential oils and other plant extracts. *Journal of Applied Microbiology*. 86, 1999, 985–990.
- Jonville MC, Kodja H, Humeau L, Fournel J, De Mol P, Cao M, Angenot L, Frédéric M. Screening of medicinal plants from Reunion Island for antimalarial and cytotoxic activity. *Journal of Ethnopharmacology*, 120, 2008, 382–386.
- Kaou AM, Mahiou-Leddé V, Canlet C, Debrauwer L, Hutter S, Azas N, Ollivier E. New amide alkaloid from the aerial part of *Piper capense* L.f. (Piperaceae). *Fitoterapia*, 81, 2010, 632–635.
- Kaou AM, Mahiou-Leddé V, Hutter S, Aïnouddine S, Hassani S, Yahaya I, Azas N, Ollivier E. Antimalarial activity of crude extracts from nine African medicinal plants. *Journal of Ethnopharmacology*, 116, 2008, 74–83.
- Kettner C, Kosch H, Lang M, Lachner J, Oborny D, Teppan E. A Medicinal Plant Database, Workshop on Database Issues in Biological Databases (DBiBD), Edinburgh. Creating, 2005.
- Kim H-J, Chen F, Wang X, Chung HY, Jin Z. Evaluation of Antioxidant Activity of Vetiver (*Vetiveria zizanioides* L.) Oil and Identification of Its Antioxidant Constituents. *Journal of Agricultural and Food Chemistry*, 53, 2005, 7691-7695.
- Lavergne R. Fleurs de Bourbon, Tome 8. Cazal, Saint-Denis, La Réunion, 1983, 288.
- Lima GM, Quintans-Júnior LJ, Thomazzi SM, Almeida EMSA, Melo MS, Serafini MR, Cavalcanti SCH, Gelain DP, Santos JPA, Blank AF, Alves PB, Neta PMO, Lima JT, Rocha RF, Moreira JCF, Araújo AAS. Phytochemical screening, antinociceptive and anti-inflammatory activities of *Chrysopsis zizanioides* essential oil. *Brazilian Journal of Pharmacognosy*, 22(2), 2012, 443-450.
- Matasyoh JC, Wathuta EM, Kariuki ST, Chepkorir R. Chemical composition and larvicidal activity of *Piper capense* essential oil against the malaria vector, *Anopheles gambiae*. *Journal of Asia-Pacific Entomology*, 14, 2011, 26–28.
- Nelson SC. *Cassipourea filiformis*. College of Tropical Agriculture and Human Resources; *Plant Disease*, 2008, PD-42.
- Neuwinger HD. African Traditional Medicine. A Dictionary of Plants' Use and Applications. *Medical Pharmacology*, 99, 2000, 1–12.
- Pedersen ME, Metzler B, Stafford GI, van Staden J, Jäger AK, Rasmussen HB. Amides from *Piper capense* with CNS Activity – A Preliminary SAR Analysis. *Molecules*, 14, 2009, 3833-3843.

- PLARM (Plantes Aromatiques et Médicinales). Rapport sur le projet : Inventaire et Etude des plantes médicinales et aromatiques, des États de l'Océan Indien. Plantes médicinales des Comores, de Madagascar, des Mascareignes (Maurice et Rodrigues), et des Seychelles. Ethnobotaniques et phytochimiques. COI/UE, 1990- 1997, 94.
- Quetin-Leclercq J, Hoet S, Block S, Wautier MC, Stévigny C. Studies on *Cassytha filiformis* from Benin: isolation, biological activities and quantification of aporphines. *Proceedings of Bioresources Towards Drug Discovery and Development*, 2004, 81- 107.
- Sheldon JW, Balick MJ, Laird SA. Medicinal Plants: Can Utilization and Conservation Co-Exists. New York Botanical Garden Press Department, New York, ISBN-13: 978-0893274061, 1997, 104.
- Sujatha S. Essential Oil and its Insecticidal Activity of Medicinal Aromatic Plant *Vetiveria zizanioides* (L.) Against the Red Flour Beetle *Tribolium castaneum* (Herbst). *Asian Journal of Agricultural Sciences*, 2(3), 2010, 84-88.
- TRAMIL. In : A Faujour, Contribution à l'amélioration des soins de santé primaires par une investigation scientifique de la pharmacopée traditionnelle populaire des COMORES- Bilan de la phase pilote du projet du projet, CNDRS (Centre National de Documentation et de la Recherche Scientifique, 2002, 248.