Soule HH *et al.* / *International Journal of Phytopharmacology. 5*(6), 2014, 416-422.

e- ISSN 0975 – 9328
Print ISSN 2229 – 7472

International Journal of Phytopharmacology

Journal homepage: www.onlineijp.com

IJP

ETHNOPHARMACOLOGICAL INVESTIGATION OF FOUR PLANTS USED AS MEDICINAL IN NGAZIDJA ISLAND

Hamidou Hamada Soule[1], Said Hassane Soidrou[1], Abdellah Farah[3], Said Omar Said Hassane[1], Abdelaziz Chaouch[4], Mohammed Lachkar[2*]

[1]Faculty of Sciences and Technology, University of Comoros, Moroni, Comoros, Africa.
[2]Engineering Laboratory of Organometallic and Molecular Materials (CNRST–URAC19), Faculty of Sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah University, Po. Box 1796 (Atlas), 30000 Fez, Morocco, Africa.
[3]PAMSN, National Institute of Medicinal and Aromatic Plants, Morocco, Sidi Mohamed Ben Abdellah University, BP 159, 34000-Taounate principal, Morocco, Africa.
[4]Biotechnology Laboratory Environment Quality, Faculty of Sciences, Ibn Tofail University, BP 133-14000**,** Kénitra Morocco,Africa.

ABSTRACT

In Comoros Islands, traditional medicine is taken an important place in sanitary system but few written information exist about that. This study aims to investigate the different uses of some plants in indigenous care system. Four plants used in Ngazidja Island were chosen. Total of 128 persons aged between 45 and 100 years were interviewed in 11 villages localized in rural areas. 80% of each was women. Results demonstrated the large use of these plants. Eighteen medicinal uses were recensed for all plants. Used to treat fifteen diseases, *Cassia occidentalis* was used for treatment of most diseases. However used to treat twelve diseases, *Psidium guajava* and *Tambourissa comorensis* are the least used. *Euphorbia hirta* is itself used against thirteen diseases. This study has been demonstrated the important use of these plants in Comorian folkloric medicine and their ability to treat several diseases.

Key words: Ethnopharmacology, Comoros, Ngazidja, Folkloric medicine, Itsandra, Hamahamet, Plants.

INTRODUCTION

The World Health Organization (WHO) estimates that 80% of the population of most developing countries relies on herbal medicines for their primary health care needs (Mukherjee and Wahil, 2006). In developed countries medicinal plants are used as alternatives to synthetic drugs (Kettner *et al.*, 2005). So ethnopharmacological and ethnobotanical investigations take an important place for the research of pharmacological components. In deed, 74% of pharmacological components derived on plants used in modern medicine, was discovered after ethnomedicinal investigations (Farnsworth and Soejarto, 1991; Sheldon *et al.*, 1997).

In Comoros, majority of population live in rural area. Poverty, difficult access to modern care system and lack of adequate health infrastructure were principal problems affecting this population. In fact, as many people in the world, Comorian people have formed their health system themselves based on natural products. Its blend African Bantu and Arab-Muslim gave it a traditional medicine specifically rich and well diversified (Soidrou *et al.*, 2013).This knowledge is passed down orally from generation to the other (Kaou *et al.*, 2008).

Medicinal plants take an important place in this health system. But few written information exist about this knowledge. The principals investigations made in Comoros were these effected by Moinjoin in 1981, Adjanohoun in 1982 and PLARM project (Monjoin, 1981; Adjanohoun *et al.*, 1982; Gurib-Fakim and Gueho,

Corresponding Author

Mohammed Lachkar
Email: lachkar.mohammed@gmail.com

1999). More recently, studies of Kaou *et al.,* and Soidrou *et al.,* were added in this list (Kaou *et al*., 2008; Soidrou *et al*., 2013). But these studies were not complete. In their study, Adjanohoun *et al.,* estimated that vegetal biodiversity of Comoros was more than 2000 species (Adjanohoun *et al*., 1982). Ngazidja, the greatest island of the archipelago, was characterized by two important forests: the Karthala forest in the center of island and the La Grille forest in the north of island.

In Comoros Islands, many diseases like malaria, fever, headaches, gynecological diseases, dermal diseases, were always treated without modern medicine. *Cassia occidentalis*, *Euphorbia hirta*, *Psidium guajava* and *Tambourissa comorensis* are four plants largely used against these diseases. In the aim to collecting informations on medicinal plants, we were interested to investigate the different use of these four plants in indigenous care system especially in rural areas of Itsandra and Hamahamet regions. The study was carried directly on local populations.

MATERIALS AND METHODS

Study area

This study was conducted in two regions from Ngazidja Island (Figure 1). The first region is the Itsandra region in the center of Island. In this region, we were interested on five villages situated near the forest. These were the villages of Bahani, Sima, Wella, Dzahani II and Dimadjou. The second region is the Hamahamet region in the North-East of Island. Six villages were chosen. These villages are Batou, Bouni, Dimadjou, Gnadombweni, Nkourani and Seleani. Because their difficult access to modern sanitary infrastructures, these populations are developed a compensative sanitary system using plants.

Plants selection and identification

Four plants largely used for various needs were chosen for this study. They were collected from the two regions used in this study. *Cassia occidentalis* and *Tambourissa comorensis* were harvested in Hamahamet region, particularly in Bouni for *Cassia occidentalis* and Dimadjou-Hamahamet for *Tambourissa comorensis*. *Euphorbia hirta* and *Psidium guajava* were harvested in Itsandra region, particularly in Dimadjou for *Euphorbia hirta* and Bahani for *Psidium guajava*. Botanical determination of each species was performed by Ms. Andiliyat Mohamed Abderehmane and Ali Mohamed Kaou from Faculty of Sciences and Technology of University of Comoros. Voucher specimens (*Cassia occidentalis* (P00433758); *Tambourissa comorensis* (P00196479); *Euphorbia hirta* (P00226308); *Psidium guajava* (P00558090)) were deposited in the herbarium of the Faculty of Sciences and Technology, University of Comoros.

Data collection

The different medicinal uses of these plants were determined on the local population. Total of 128 persons aged between 45 and 100 years were interviewed in 11 villages. 80% of each was women. Interviews were conducted in local language. Questions were based on the all diseases treated by these plants, part used, method of preparation and different precaution taken for use of each plant. Other uses like rituals practices were requested. All data were collected on questionnaire file.

RESULTS AND DISCUSSION

Percentage of use of four plants by diseases

Results demonstrated the large use of these plants. Eighteen medicinal uses were recensed for all plants. Table 1 resumed the different uses of each plant. *C. occidentalis* was used for treatment of most diseases. It's treated fifteen diseases. However used to treat twelve diseases, *P. guajava* and *T. comorensis* are the least used. *E. hirta* is itself used against thirteen diseases.

Gynecological problems, dermal problems, diarrhea, inflammation, diabetes, malaria, intestinal worms, stomachaches, constipation are the principle diseases treated. Figure 2 showed the use percentage of each plant by diseases. The principal diseases treated by these plants were diarrhea and stomachaches. To treat diarrhea, *P. guajava* and *E. hirta* were largely used with respectively 71.09% and 63.28%. *C. occidentalis* was itself used up 30%. Against stomachaches, *P. guajava* was also largely used with a percentage of 58.59%. The other plants were used at 28.91%, 26.56% and 17.97% respectively for *E. hirta*, *C. occidentalis* and *T. comorensis*. *C. occidentalis* is principally used against eyes diseases like conjunctivitis (46.09%). For dermal diseases, *T. comorensis* was the principal used plant in the list (54.69%); the other plants didn't attain 10%. This plant was also used against inflammation at 35.94%.

For gynecological problems, *E. hirta* was mostly used (43.75%). *T. comorensis* and *C. occidentalis* are the only plants used against constipation in our list. To treat diseases like malaria and influenza, people used *C. occidentalis*, *P. guajava* and *E. hirta*. As demonstrated by Soidrou's study, treatment of malaria and influenza need the association of two or more plants. Against malaria, 5, 6 or 7 plants are often used in a mixture named "Djungu" (Soidrou *et al.,* 2013). In this study, interviewers are declared uses these plants in association with other plants to treated malaria and influenza. They can associate with *Plectranthus aromaticus* or *Plectranthus amboinicus*, *Citrus aurantifolia*, *Musa paradisiaca*, *Aphloia theiformis*, *Piper capens*, *Eucalyptus sp*, and *mangifera indica*. The use of these plants against malaria and influenza was demonstrated in other studies (Kaou *et al.,* 2008; Soidrou *et al.,* 2013). In their study, Kaou *et al.* demonstrated the association of *C. occidentalis* with

plants like *Annona squamosa*, *Jatropha curcas*, *Plectranthus amboinicus* and *Ipomea obscura* to treat malaria (Kaou *et al.,* 2008). Utilization of *Aphloia theiformis* and *Piper cape*ns to treat malaria and influenza was showed earlier. In their study, Soidrou *et al.,* showed the utilization of these plants in Itsandra and Hamahamet region (Soidrou *et al.,* 2013).

Regional uses of plants

Psidium guajava

P. guajava was principally used to treat diarrhea and stomachaches. In Itsandra, their leaves are used at 88.89 and 73.02% respectively against diarrhea and stomachaches. They also used against the same pathologies in Hamahamet but at low percentage than these observed in Itsandra. These percentages are respectively 53.85 and 44.65% for diarrhea and stomachaches. The leaves may be taken on two ways. Both after decoction or young leaves can be chewed and ingested juice. Other diseases like malaria, intestinal worms are also treated by *P. guajava* but at minor percent. To treat malaria, the plant was used at 6.15 and 1.59% respectively in Hamahamet and Itsandra region. In Hamahamet this plant was used to treat also gynecological problems, diabetes, inflammation and headaches.

As demonstrated in this study, the antidiarrhoeal effect of *P. guajava* leaves was discussed also in literature. Gutierrez *et al.* reported the use of this plant against diarrhae and dysentery (Gutierrez *et al.,* 2008). Mexican communities taken also a guava leaf decoction to treat digestive suffering associated with severe diarrhea (Gutierrez *et al.,* 2008). Aguilar et al. showed the use of this plant in Mexico to treat gastrointestinal and respiratory disturbances and as an anti-inflammatory medicine (Aguilar *et al.,* 1994). In the Latin America and the Caribbean traditional medicine, Guava has been used widely to treat diarrhea and stomachaches due to indigestion (Mejıa and Rengifo, 2000; Mitchell and Ahmad, 2006a,b). In Chinese traditional medicine, *Psidium guajava* leaves are example of the plant commonly used as popular medicine for diarrhea which is also used as an antiseptic (Teixeira *et al.*,2003). In Brazil, the leaves are considered for anorexia, cholera, diarrhea, digestive problems, dysentery, gastric insufficiency, inflamed mucous membranes, laryngitis, mouth (swelling), skin problems, sore throat, ulcers, vaginal discharge (Holetz *et al.,* 2002). A decoction of the leaves is used to cure cough (Gutierrez *et al.,* 2008). The use of guava against cough observed in Hamahamet region was also reported by Gutierrez *et al.,* in Mexico. In Uruguay, a decoction of the leaves is used as a vaginal and uterine wash, especially in leucorrhoea (Conway, 2002). This observation was also observed in Hamahamet region where 3.08% of interviewers used leaves against gynecological problems. Many pharmacological studies have demonstrated the ability of this plant to exhibit antioxidant, hepatoprotection, anti-allergy, antimicrobial, antiplasmodial, cytotoxic, antispasmodic, cardioactive, anticough, antidiabetic, antiinflammatory and antinociceptive activities (Gutierrez *et al.,* 2008; Metwally *et al.,* 2011). Phytochemical studies reported the contents of phenolics, flavonoids, carotenoids, terpenoids and triterpenes (Gutierrez *et al.,* 2008; Metwally *et al.,* 2011).

Euphorbia hirta

E. hirta is largely used in Comorian folkloric medecine. It's principally used in Itsandra region to treat diarrhae and stomachaches. In Hamahamet it's used principally against gynecological diseases and diarrhae. In traditional Ayurvedic medicines the whole aerial parts is used in gastrointestinal disorders (diarrhea, dysentery, intestinal parasitosis), bronchial and respiratory diseases (asthma, bronchitis, hay fever) (Mhaskar *et al.,* 2000). In our study, we found the use of this plant to treat diarrhae at 92.06% in Itsandra and 35.38% in Hamahamet and in the treatment of stomachaches at 47.62% and 10.77% in Itsandra and Hamahamet regions respectively. But against gynecological problems, this plant was used at 73.84% in Hamahamet and 12.69% in Itsandra regions. It's also used as cicatrisant at 11.11 % in Itsandra and 10.77% in Hamahamet. Eyes diseases like conjonctivitis were treated at 6.34% and 1.54% respectively in Itsandra and Hamahamet regions. It's used in hamahamet to treat headaches, malaria and instestinal worms. In Itsandra, it's used against hypertension. It's also used to treat inflammation in both regions. All most diseases treated by *E. hirta* were usually by arial part and by decoction. However, in certain case, people used only latex to treat conjonctivitis. This use was also reported by (Loh *et al.,* 2009). Divers properties were attributed to this plant such as antimicrobial (Perumal *et al.,* 2012), sedative, anxiolytic, analgesic, antipyretic, anti-inflammatory, antimalarial and anti-hypertensive properties (Hore *et al*., 2006). A serine protease, designated as hirtin, with fibrinolytic activity was purified to homogeneity from the latex of *Euphorbia hirta* (Patel *et al.,* 2011). Recently nine phenolic and flavonoid compounds were isolated from aerial part of *Euphorbia hirta* growing in China (Yi *et al.,* 2012).

Cassia occidentalis

Cassia occidentalis is largely known in Comorian folkloric medecine. Fifteen diseases present in our survey file was treated by this plant. The most percentage was enregistrated against eyes in Itsandra region (60.32%), in Hamahamet it's used at 32.31%. It's also used against diarrhae in the both regions at 42.86 and 18.46% respectively in Itsandra and Hamahamet. The *C.*

occidentalis effect on diarrhae was also reported by other studies in other countries (Jain, 1991; Payne-Jackson *et al.,* 2004). It's principally used to treat stomachaches in Hamahamet (35.38%) and gynecolocal diseases (26.15%). *C. occidentalis* leaves are also used to treat constipation at 34.92% in Itsandra and 9.23% in Hamahamet. Other diseases like headaches, malaria, and inflammation are also treated. To treat malaria, *C. occidentalis* is usually associated with other plants as demonstrated by Kaou's study (Kaou *et al.,* 2008). Diseases like diabetes, intestinal worms and fever treated by this plant, were only in Hamahamet. To treat fever, leaves or roots are usually used. In Brazil the roots are considered to be a tonic, febrifuge and diuretic, and are used against fevers, tuberculosis, anaemia, liver complaints and as a reconstituent for general weakness and illness (Coimbra, 1994). But to treat constipation people used roots. Jain made the same observation in Nigeria where the roots were boiled with water and taken as tea for constipation (Jain, 1991). Other studies showed the use of this plant to treat gonorrhea and dysmenorrhea, two gynecological diseases (Coimbra, 1994; Di Stasi and Hiruma-Lima, 2002). Treatment of gynecological diseases was also observed in this study principally in Hamahamet region. Phytochemical studies conducted on *C. occidentalis* revealed the presence of several molecules structures like flavonoids and anthraquinones. Leaves contain flavonoids (Yadav *et al*., 2010). Roots contain anthraquinones and flavonoids (Alves, 1965; Yadav *et al.,* 2010).

Tambourissa comorensis

Plants of Tambourissa genoa are largely used in Comorian traditional medecine. Known locally as "mledjeza or Mbosa", *Tambourissa comorensis* is used to treat several diseases. It is used to treat dermal diseases, constipation, diarrhae, inflammation, stomachaches, and some other diseases. Used to treat twelve diseases, it's treated principally dermal diseases, diarrhae, constipation and inflammation. In Itsandra region, it's largely used against dermal problems (74.6%), diarrhae (52.38%) and inflammation (31.74%). In Hamahamet, it's principally used to treat constipation (50.77%), inflammation (40%), diarrhae and dermal diseases at 35.38%. Other diseases like stomachaches, headaches and cough are also treated in the both regions. Against stomachaches, asked people uses *T. comorensis* at 20.63% in Itsandra and 15.38% in Hamahamet. It's used at 19.05% and 9.23% to treat headaches respectively in Itsandra and Hamahamet regions.

This plant is also used in lowest percentage as cicatrisant in the both regions. In Itsandra, it's also used to treat diabete and hypertension. To treat all diseases, all asked people affirmed used only fruit for their medecinal needs. It's can use by local application mainly against dermal diseases, inflammation, headaches and as cicatrisant. But to treat diseases like constipation, diarrhae, stomachaches, cough, diabetes, hypertension and intestinal worms it's drinking by melaging with cold water. Our study hasn't demonstrate any usage of this plants to treat malaria. However in their study, Kaou et al., showed the use of *Tambourissa leptophylla* to treat malaria (Kaou *et al*., 2008).

Table 1. List of traditional medicinal uses of these plants

Family/species	Local name	Used part and mode of use	Popular uses	Scientific investigations
M*yrtacea / Psidium guayava*	Mbera	Leaves (decoction)	Diarrhea, stomachaches, malaria, intestinal worms, malaria, gynecological problems, diabetes, inflammation and headaches.	antidiarrhoeal effect, diarrhea, dysentery, digestive suffering, gastrointestinal, respiratory disturbances, anti-inflammatory, anorexia, cholera, digestive problems, dysentery, gastric insufficiency, inflamed mucous membranes, laryngitis, mouth (swelling), skin problems, sore throat, ulcers, vaginal discharge (Gutierrez *et al.,* 2008, Aguilar *et al.,* 1994, Mejıa and Rengifo, 2000; Mitchell and Ahmad, 2006a,b, Teixeira *et al.*,2003, Holetz *et al.*, 2002,)
Euphorbiaceae/*Euphotbia hirta*	Idoindzia	Leaves (decoction)	Diarrhae, stomachaches, gynecological diseases, dysentery, intestinal worms, bronchial, respiratory diseases, malaria, worms instestinal, hypertension, inflammation,	sedative, anxiolytic, analgesic, antipyretic, anti-inflammatory, anti-malarial and anti-hypertensive properties, nine flavonoids and phenolic compounds were isolated from the aerial part (Perumal *et al.*, 2012, Hore et al., 2006, Patel *et al.*, 2011, Yi *et al.*, 2012).

Fabaceae/ *Casia occidentilis*	Sanamaka	Leaves (decoction)	Diarrhae, stomachaches, gynecological diseases, dysentery, intestinal parasitosis, bronchial, respiratory diseases, malaria, instestinal worms, hypertension, inflammation,	sedative, anxiolytic, analgesic, antipyretic, anti-inflammatory, antimalarial and anti- hypertensive properties, nine phenolic and flavonoids compounds were isolated from aerial part (Jain, 1991; Payne-Jackson *et al.*, 2004, Kaou *et al.*, 2008, Coimbra, 1994, Di Stasi and Hiruma-Lima, 2002, Yadav et al., 2010, Alves, 1965).
Monimiaceae / *Tambourissa comorensis*	Mledjeza	Leaves (decoction), Seeds (infusion, crush and drink)	Diarrhae, constipation, inflammation, stomach pain, headache, cough, wound healing, diabetes, hypertension,	However in their study Kaou et al., showed the use of *T. leptophylla* to treat malaria (Kaou et al., 2008).

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

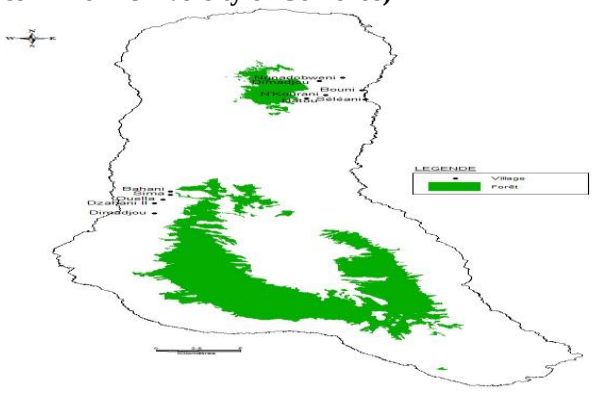


Figure 2. Percentage of use of four plants by diseases (n= 128)

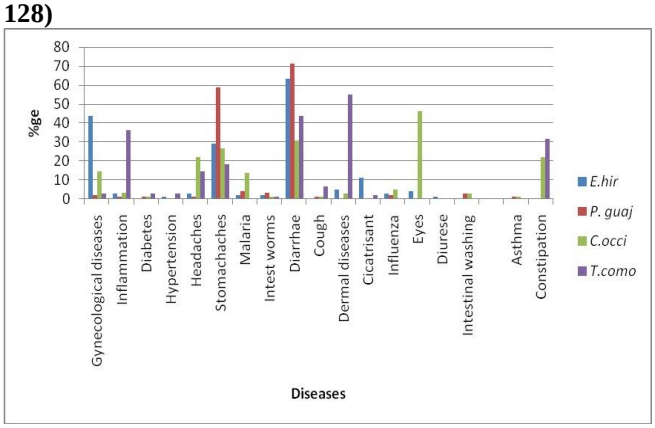
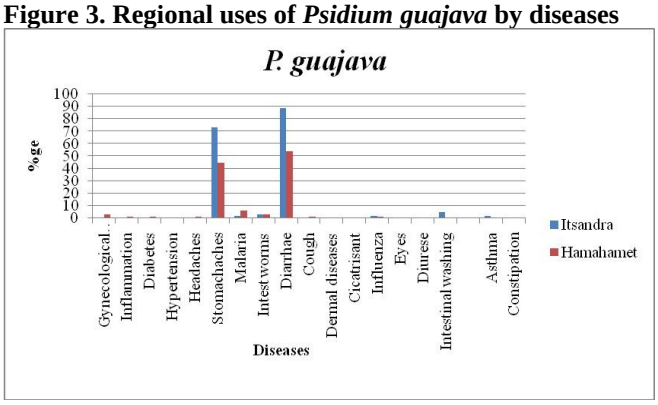


Figure 3. Regional uses of *Psidium guajava* by diseases



4. Regional uses of *Euphorbia hirta* by diseases

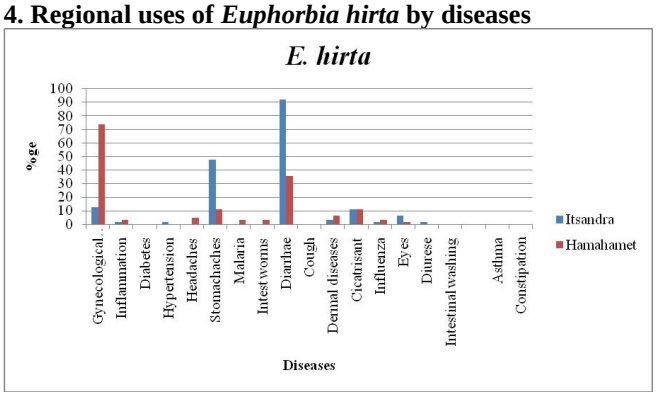


Figure 5. Regional uses of *Cassia occidentalis* by diseases

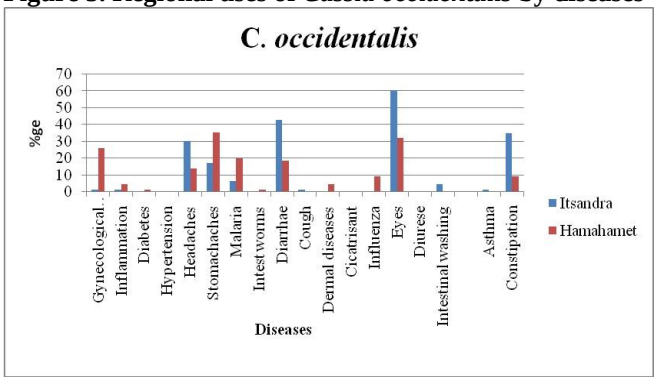
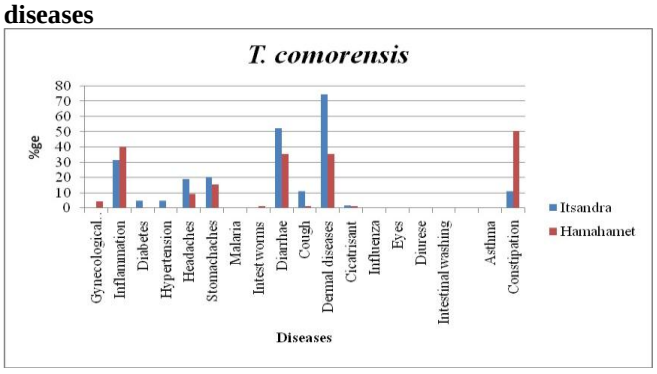


Figure 6. Regional uses of *Tambourissa comorensis* by diseases



CONCLUSION

Our study has demonstrated the important use of these plants in Comorian folkloric medicine and their ability to treat several diseases. The adopted approach allowed us to clearly identify all uses of these plants. In Comoros Islands the plant kingdom still holds many species which contains substance of medicinal values, yet to be discovered. So this study constituted a preliminary study and the next steps will consist of several laboratory investigations to identify biological activities and isolate chemical constituents of these plants who have a potential to be developed as high-value healthcare products.

ACKNOWLEDGMENT

Many people took an important part of this work. We are grateful to the students who accompanied us and facilitated the conduct of this investigation. To people who were willing to answer our questioner, we graciously thank all for their collaboration.

REFERENCES

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, 1982.

Aguilar A, Argueta A, Cano L. Flora Medicinal Indigena de Mexico. Instituto Nacional Indigenista, Mexico, 1994.

Alves AC. Pharmacological study of the root of *Cassia occidentalis*. *Anals Fac Farm Porto*, 24, 1965, 65 - 119.

Coimbra R. Manual de Fitoterapia. 2nd ed., Editora Cejup: Belem, Brazil, 1994, 26.

Conway P. Tree Medicine: A Comprehensive Guide to the Healing Power of Over 170 Trees. Judy Piatkus (Publishers) Ltd, London. 2001, 2173 - 2177.

Di Stasi LC, Hiruma-Lima CA. Plantas medicinais na Amazônia e na Mata Atlântica. 2- edição, Editora UNESP, São Paulo, 2002, 604.

Farnsworth NR, Soejarto DD. In: O Akereb, Heywood V, Synge H. Global Importance of Medicinal Plants. (Eds) Conservation of Medicinal Plants. Cambridge University Press, 1991, 25 - 52.

Gurib-Fakim A, Gueho J. PLARM (Plantes Aromatiques et Médicinales). Rapport sur le projet : Inventaire et étude des plantes médicinales et aromatiques des Etats de l'Océan Indien. Plantes médicinales des Comores, de Madagascar, des Mascareignes (Maurice et Rodrigues) et des Seychelles. Ethnobotaniques et phytochimiques. COI/UE, 1999.

Gutierrez RM, Mitchell S, and Solis RV. *Psidium guajava:* a review of its traditional uses, phytochemistry and pharmacology. *Journal of Ethnopharmacology*, 117(1), 2008, 1 - 27.

Holetz FB, Pessini GL, Sanches NR, Cortez DA, Nakamura CV, Filho BP. Screening of some plants used in the Brazilian folk medicine for the treatment of infectious diseases. Memorias do Instituto Oswaldo Cruz, 97, 2002, 1027 - 1031.

Hore AK, Ahuja V, Mehta G, Kumar P, Pandey SK, Ahmad AH. Effects of aqueous *Euphorbia hirta* leaf extract on gastrointestinal motility. *Fitoterapia*, 77, 2006, 35 - 38.

Jain SK, Dictionary of Indian Folk-Medicine and Ethnobotany. Deep Publication, New Delhi, 1991.

Kaou AM, Mahiou-Leddet 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.

Loh DSY, Er HM, Chen YS. Mutagenic and antimutagenic activities of aqueous and methanol extracts of *Euphorbia hirta*. *Journal of Ethnopharmacology*, 126, 2009, 406 - 414.

Mejia K, Rengifo E. Plantas medicinales de uso popular en la Amazonía Peruana. Instituto de Investigación de la Amazonía Peruana - Gobierno Regional de Loreto - Agencia Española de Cooperación Internacional, 2nd ed. Lima, 2000.

Metwally AM, Omar AA, Ghazy NM, Harraz FM, El Sohafy SM. Monograph of *Psidium guajava* L. leaves. *Pharmacognosy Journal*, 2011, 89 - 104.

Mhaskar KS, Blatter E, Caius JF. Kirtikar and Basu's Illustrated Indian Medicinal Plants Vol. I. XI. 3rd Edition. *Indian Medical Science Series # 86-96. Sri Satguru Publications, Indian Book Centre, Delhi, India,* 2000, 3846.

Mitchell SA, Ahmad MH, Protecting our medicinal plant heritage: the making of a new national treasure. Institute of Jamaica, Kingston, *Jamaica Journal*, 29, 2006a, 28 - 33.

Mitchell SA, Ahmad MH. A review of medicinal plant research at the University of the West Indies, Jamaica, 1948–2001.West Indies *Medical Journal*, 55, 2006b, 243 - 269.

Mojoin M. Possibilités d'utiliser la médecine traditionnelle pour améliorer les soins de santé primaires aux Comores, Thèse de doctorat en médecine, Université de Bordeaux-II, France, 1981.

Mukherjee PK and Wahil A. Integrated approaches towards drug development from Ayurveda and other systems of medicine. *Journal of Ethnopharmacology*, 103, 2006, 25 - 35.

Patel DK, Kumar R, Prasad SK, Sairam K, Hemalatha S. Antidiabetic and in vitro antioxidant potential of Hybanthus enneaspermus linn f. muell in streptozotocin-induced-diabetic rats. *Asian Pacific Journal of Tropical Biomedicine,* 1(4), 2011, 316 - 322.

Payne-Jackson A, Alleyne MC. Jamaican Folk Medicines. A Source of Healing. University of West Indies Press, 2004, 1 - 228.

Perumal S, Pillai S, Wei Cai L, Mahmud R, Ramanathan S. Determination of Minimum Inhibitory Concentration of *Euphorbia hirta* (L.) Extracts by Tetrazolium Microplate Assay. *Journal of Natural Products,* 5, 2012, 68 - 76.

Sheldon JW, Balick MJ, Laird SA. Medicinal Plants: Can Utilization and Conservation Co-exist? New York Botanical Garden Press Department, New York, 1997, 104.

Soidrou SH, Mohamed NA, Farah A, Said Hassane SO, Bousta D. Ethnopharmacoligical investigation of five plants used in Comorian folkloric medicine, *International Journal of Phytopharmacology*, 4(4), 2013, 230 - 236.

Teixeira RS, Camparoto ML, Mantovani MS, Vicentini VEP. Assessment of two medicinal plants, *Psidium guajava* L. and *Achillea millefolium* L. *in vitro* and *in vivo* assays. *Genetics and Molecular Biology,* 26, 2003, 234 - 239.

Wu Y, Qu W, Geng D, Liang J-Y, Luo Y-L. Phenols and flavonoids from the aerial part of *Euphorbia hirta. Chinese Journal of Natural Medicines*, 10(1), 2012, 40 - 42.

Yadav JP, Arya V, Sanjay Yadav, Panghal M, Kumar S, Dhankhar S. *Cassia occidentalis* L. A review on its ethnobotany, phytochemical and pharmacological profile. *Fitoterapia,* 81, 2010, 223 - 230.