INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 26, No. 2, p. 117-125, 2025

RESEARCH PAPER OPEN ACCESS

Ethnobotanical study for malaria vector control in Couffo department in south-western Republic of Benin, West Africa

Eloi Honvoh[1], Nazaire Aïzoun[*1], Arlette Adjatin[2], Crispus Tossa[2], Daniel Chougourou[3]

[1]Laboratory of Pluridisciplinary Researches of Technical Teaching (LaRPET), Normal High School of Technical Teaching (ENSET) of Lokossa, National University of Sciences, Technologies, Engineering and Mathematics (UNSTIM) of Abomey, P. O. Box 133 Lokossa, Benin

[2]Laboratory of Genetics, Biotechnology and Applied Botany (GEBBA), National High School of Applied Biosciences and Biotechnology (ENSBBA) of Dassa-Zoumè, National University of Sciences, Technologies, Engineering and Mathematics (UNSTIM) of Abomey, Benin

[3]Department of Environment Genius, Polytechnic School of Abomey-Calavi (EPAC), University of Abomey-Calavi (UAC), Cotonou, Benin

Key words: Ethnobotany, Malaria vector control, Public health, Republic of Benin

http://dx.doi.org/10.12692/ijb/26.2.117-125 Article published on February 08, 2025

Abstract

The use of chemical insecticides causes important damages to environment and human health and there is a need to search for alternative solutions. Field surveys were organized from September to November 2023 during the small raining season in districts of Aplahoué, Djakotomey, Dogbo, Klouékanmè, lalo and Toviklin in Couffo department. Two villages were chosen in each of these districts by taking into account the sociodemographic data and the diversity of plants. The locations where these villages were chosen in each district were: Kissamey (Aplahoué), Kokohoué (Djakotomey), Totchangni (Dogbo), Tchikpé (klouekanmey), Doko (Toviklin) and Banigbé (Lalo). Then, investigations were done using ethnobotanical questions. These questions concerned: local names of plants used, the different organs of plants used, the using forms and using modes of these plants in malaria vector control in the villages surveyed. The results showed that more than thirty (30) plants were used by the people of Adja region in malaria vector control. These plants were used as powder applied on the skin of people in order to avoid that the mosquitoes took their meals on their body. The fumigation was the most using mode of cited plant species. Ethnobotanical study is very important in a context of resistance of malaria vector to the main classes of insecticide used in public health.

* **Corresponding Author:** Nazaire Aïzoun ✉ aizoun.nazaire@yahoo.fr

Introduction

Globally, in 2023, the number of malaria cases was estimated at 263 million, with an incidence of 60.4 cases per 1000 population at risk. This is an increase of 11 million cases from the previous year and a rise in incidence from 58.6 cases per 1000 population at risk in 2022. The WHO African Region continues to carry the heaviest burden of the disease, accounting for an estimated 94% of malaria cases worldwide in 2023. The WHO Eastern Mediterranean Region has experienced a 57% increase in incidence since 2021, risingto 17.9 cases per 1000 population at risk in 2023 (World Malaria Report, 2024).

Globally, in 2023, the number of deaths was estimated at 597 000, with a mortality rate of 13.7 per 100 000. The number of malaria deaths and the mortality rate steadily decreased from 622 000 and 14.9 deaths per 100 000, respectively, in 2020. The WHO African Region continues to carry the heaviest burden of mortality, with 95% of estimated malaria deaths worldwide (World Malaria Report, 2024).

Conventionally, synthetic insecticides organochlorines, carbamates, organophosphates, and pyrethroids temephos, fenthion, malathion, and dichlorodiphenyltrichloroethane (DDT) were expensive, leaving a residual effect, adapting resistance, non-biodegradable, toxicity to non-target organisms (Anyaele and Amusan, 2003). These problems urged the researchers for an expeditious search for new alternatives. Botanical-based insecticides were currently one of the most promising approaches, much research currently being devoted to plant extracts for the development of sustainable botanical insecticides (Liang *et al.*, 2015). Plant extracts contain a mixture of several chemical active ingredients and thus may be able to effectively kill the mosquito through a different mechanism (Pavela, 2015). For the past two decades, numerous researches have been conducted on the biological activity of plant extracts against larvae of mosquitoes and insects, in that few plant extracts were commercialized. This shows that plant extracts were environmentally safe, non-toxicity against humans and other organisms (Govindarajan *et al.*, 2016).

Extracts from plants may be alternative sources of mosquito control agents, since they constitute a rich source of bioactive compounds that are biodegradable into nontoxic products and potentially suitable for use to control mosquitoes. Plant extracts in general have been recognized as an important natural resource of insecticides. Phytochemicals derived from plant sources can act as larvicides, insect growth regulators, repellents, and oviposition attractants and can play an important role in the interruption of the transmission of mosquito-borne diseases at the individual as well as at the community level (Govindarajan *et al.*, 2008a; 2008b).

Very few researches were published on the ethnobotanical study for the control of mosquito-borne diseases in Republic of Benin. Therefore, there is a need to carry out new researches for this purpose.

The goal of this research was to study the ethnobotany for malaria vector control in Couffo department in south-western Republic of Benin, West Africa.

Material and methods

Study area

The study area is located in Republic of Benin (West Africa) and includes the department of Couffo. Couffo department is located in the south-westernBenin and the study was carried out more precisely in the six districts of this department (Fig.1). The choice of the study site took into account the economic activities of populations, their usual protection practices against mosquito bitesand peasant practices to control farming pests. These factors were important to do the ethnobotanical study for malaria vector control in Couffo department in south-western Republic of Benin, West Africa. Couffo has a climate with four seasons, two rainy seasons (March to July and August to November) and two dry seasons (November to March and July to August). The temperature ranges from 25 to 30°C with the annual mean rainfall between 900 and 1100 mm.

Fig. 1. Map of Republic of Benin showing the six districts surveyed in Couffo department.

Ethnobotanical data collection

Field Surveys were organized from September to November 2023 during the small raining saison in districts of Aplahoué, Djakotomey, Dogbo, Klouékanmè, Lalo and Toviklin in Couffo department. Two villages were chosen in each of these districts by taking into account the sociodemographic data and the diversity of plants.The locations where these villages were chosen in each district were: Kissamey (Aplahoué), Kokohoué (Djakotomey), Totchangni (Dogbo), Tchikpé (klouekanmey), Doko (Toviklin) and Banigbé (Lalo). Then, investigations were done using ethnobotanical questions.

These questions concerned: local names of plants used, the different organs of plants used, the using forms and using modes of these plants in malaria vector control in the villages surveyed.

Data analysis

Citation frequency of different plants was determined with the following formula:

$$\text{Citation frequency} = \frac{(\text{Number of citation of the plants}) \times 100}{\text{Total numbers of citations}}$$

Results and discussion

The table 1 showed the different plants with larvicidal and repellent activities against malaria vector according to the people met in Couffo department.

The analysis of Table 1 showed that regarding the botanical family frequency of species met, Lamiaceae (42.46%), Malvaceae (10.76%), Meliaceae (10.76%), Asteraceae (06.76%), Myrtaceae (04.92%), Caricaceae (04.92%) and Mimosaceae (04.92%) were the most represented families. Lamiaceae family followed by Malvaceae and Meliaceae families were those with most cited plants. Otherwise, ten plant species were most used in malaria vector control in Adja area. There were: *Hyptis suaveolens, Sida acuta* Burm F., *Azadiratha indica, Eucalyptus globulus* Labill., *Carica papaya, Parkia biglobosa, Artemisia afra, Chromolaena odorata*, *Citrus* sinensis, and *Launea taraxaciolia*. Four groups were obtained.

The group 1 concerned only one tree which was *Hyptis suaveolens* with very high citation frequency and very high availability. The group 2 concerned two trees which were: *Sida acuta* Burm F. and *Azadiratha indica* with same citation frequency which was lower

than that of *Hyptis suaveolens* but also available. The group 3 concerned four trees which were: *Artemisia afra, Chromolaena odorata*, *Citrus sinensis* and *Launea taraxaciolia* with same citation frequency which was lower than that of *Sida acuta* Burm F. and *Azadiratha indica*. Regarding the group 4, it concerned three plants which were: *Eucalyptus globules* Labill., *Carica papaya* and *Parkia biglobosa* with same citation frequency which was lower than that of the plants of group 3.

Table 1. Plants with larvicidal and repellent activities against malaria vector according to the people met in Couffo department.

N°	Scientific name	Local name	Family	Number of responses	Frequency of citation	Organ used
1	*Sida acuta* Burm F.	Avonha (Adja)	Malvaceae	35	20.46783626	Leaf
2	*Eucalyptus globulus* Labill.	Matèchi--tchi (Adja)	Myrtaceae	16	9.356725146	Leaf
3	*Anacardium* occidentale	Cajou (Adja)	Anacardiaceae	9	5.263157895	Leaf
4	*Allium sativum L.*	Ayo (Adja)	Amaryllidaceae	2	1.169590643	Leaf
5	*Parkia biglobosa*	Ewa (Adja)	Mimosaceae	16	9.356725146	Leaf and bark
6	*Petroselinum crispum (Mill.) Nyman ex A.W. Hill*	Djankoui (Adja)	Apiaceae	1	2.339181287	Leaf
7	*Annona muricata*	Chap-chap-man (Fon)	Annonaceae	1	0.584795322	Leaf
8	*Annona senengalensis*	Hounglé (Fon)	Annonaceae	1	2.339181287	Leaf
9	*Artemisia afra*	Artemisia (Adja)	Asteraceae	16	9.356725146	Leaf
10	*Azadiratha indica*	Sablètchi (Adja)	Meliaceae	35	20.46783626	Leaf-grain
11	*Cacia alata*	Lalui (Adja)	Fabaceae	1	0.584795322	Leaf
12	*Caesalpinia bonduc*	Adjikoui (Fon)	Leguminosae	1	0.584795322	Leaf
13	*Carica papaya*	Doubamankpa (Adja)	Caricaceae	16	9.356725146	Leaf
14	*Chromolaena odorata*	Agatouman (Fon)	Asteraceae	1	0.584795322	Leaf
15	*Citrus lymon*	Kélé (Fon)	Rutaceae	1	2.339181287	Fruit
16	*Citrus sinensis*	Umtchitchi (Adja)	Asteraceae	4	2.339181287	Fruit
17	*Cleome viscosa*	Akaya-assou (Fon)	Capparaceae	4	2.339181287	Leaf
18	*Cymbopogon citratus*	Tee-gbé (Adja)	Poaceae	9	5.263157895	Leaf
19	*Eleais geneensis*	Edé (Adja)	Arecaceae	6	3.50877193	Male flower
20	*Heliotropium indicum*	Koklossou-dekpadja (Fon)	Boraginaceae	1	2.339181287	Leaf
21	*Hyptis suaveolens*	Fihayè (Adja)	Lamiaceae	116	67.83661404	Leaf
22	*Imperata cylindrica*	Boutchou (Adja)	Poaceae	1	0.584795322	Leaf-Root
23	*Irvingia gabonensis*	Atoman (Adja)	Irvingiaceae	4	20.46783626	Leaf
24	*Launea taraxaciolia*	Yantoto (Fon)	Asteraceae	1	0.584795322	Leaf
25	*Lippia multiflora*	Aklala (Fon)	Verbenaceae	1	0.584795322	Leaf
26	*Manihote esculata*	Koutouman (Adja)	Euphobiaceae	1	2.339181287	Leaf
27	*Momordica charantia*	Adowan (Adja)	Cucurbitaceae	1	0.584795322	Leaf
28	*Ocimum basillicum*	Gnandodou (Adja)	Lamiaceae	1	0.584795322	Leaf
29	*Ocimum canum*	Héhéchou (Adja)	Lamiaceae	5	2.923976608	Leaf
30	*Ocimum gratissimum*	Yandoudoui (Adja)	Lamiaceae	16	9.356725146	Leaf
31	*Tectonia grandis*	Teckiman (Fon)	Fabaceae	2	1.169590643	Leaf

Table 2. Repartition of people met regarding their sexes.

	Man	Woman	Total
Number of people met	76	95	171
Percent of people met	44	56	100

The different organs of plants used by people in the prevention of mosquito bites were: Leaf, grain, fruit, flower, bark, Root and so on... The table 2 showed the repartition of people met during our survey in Couffo department regarding their sexes. The analysis of Table 2 showed that One hundred and seventy one (171) people were met during our survey. Among them, there were ninety five (95) women representing 56% whereas seventy six (76) people were men representing 44%.

Women were those who knew the most the plants which organs were often used in Couffo department to control malaria vector.

The table 3 showed the repartition of people met regarding their ages.

Table 3. Repartition of people met regarding their ages.

Age	24-35	35-45	45-55	55-65	65-75	75-85
Percent	36.26	28.65	16.37	8.19	6.43	4.1

Table 4. Instruction level of people met.

Level	Primary school	Secondary school	University	Without scolarisation
Percent	33.34	15.79	1.17	49.7

The analysis of table 3 showed that people aged 24 to 35 years old were the most representing among the people met during our survey.

Table 5. Repartition regarding sociolinguistic group.

	Adja	Fon	Others
Percent of Sociolinguistic group	83.62	15.37	1.01

Table 6. Percent of different organs used for cited plant species.

	Leaf	Flower	Fruit	Bark	Grain	Root
Percent of use	86.95	5.21	4.34	1.73	1.03	0.74

The table 4 showed the instruction level of people met The analysis of table 4 showed that people without scolarisation or no school attendance were the most met during our survey.

Table 7. Using forms of plant species met regarding their citation frequency.

	Decoction	Trituration	Powder	Oil
Percent of using forms	13.51	20.83	37.50	28.16

The table 5 showed the repartition regarding sociolinguistic group.

Table 8. Using mode of cited plant species.

	Fumigation	Aspersion	Coating
Percent of using forms	62.03	37.03	0.92

The analysis of table 5 showed people from Adja area were the most met during our survey.

Table 9. Advantages and disadvantages of the use of ethanolic extract of plant leaves.

Advantages	Disadvantages
Plants are cultivated in many regions in Benin country	Limited effectiveness of ethanolic extract of plants in the presence of vegetation and floating debris (is the main disadvantage)
Ethanolic extract of plants is miscible with water after mixture	
Ethanolic extract of plants is a cheap and easy method for larval control in their breeding sites	
Mosquitoes may not develop resistance to ethanolic extract of plants	
Ethanolic extract of plants is not toxic to most non-target organisms including mammals and fish.	

The table 6 showed the percent of different organs used for cited plant species.

Fig. 2. Farm of *Artemisia annua*.

The analysis of table 6 showed that the leaves were the organs the most used in malaria vector control in Adja region.

The table 7 showed the using forms of plant species met regarding their citation frequency.

The analysis of table 7 showed that the powder was the using form of plant species the most met during our survey. For that, leaves were dried and transformed in powder.

The table 8 showed the using mode of cited plant

species.

Fig. 3. Tree of *Carica papaya*.

The analysis of table 8 showed that fumigation was the most using mode of cited plant species.

The table 9 showed the advantages and disadvantages of the use of ethanolic extract of plant leaves.

Fig. 4. Tree of *Hyptis suaveolens*.

The following figures numbered from 2 to 7 are those of certain of these plants used in malaria vector control in Couffo department:

According to the people met in Couffo department, there were many plants which organs were used in malaria vector control in Adja area. Among them, ten plant species were the most used in malaria vector control in Adja area.

There were: *Hyptis suaveolens, Sida acuta* Burm F., *Azadiratha indica, Eucalyptus globules* Labill., *Carica papaya, Parkia biglobosa, Artemisia afra, Chromolaena odorata*, *Citrus* sinensis, and *Launea taraxaciolia*. These informations were confirmed by many studies carried out in Adja region mainly with the following plants: *Artemisia annua* (Asteraceae), *Carica papaya* linn (Caricaceae), *Hyptis suaveolens* Linn (Lamiaceae), *Azadirachta indica* (Meliaceae), *Sida acuta* Burm F. (Malvaceae), *Eucalyptus globules* Labill. (Myrtaceae), *Anacardium* occidentale L. (*Anacardiaceae*), *Allium sativumL.* (Amaryllidaceae), *Parkia biglobosa* (Mimosaceae), *Petroselinum crispum (Mill.)Nyman ex A.W. Hill* (Apiaceae), *Cymbopogon citratus* (Poaceae) and *Ocimum basilicum* L. (Lamiaceae).

Fig. 5. Tree of *Azadirachta indica*.

In fact, Aïzoun *et al.* (2022a) had studied the larvicidal and repellent activities of ethanolic extract of *Artemisia annua* (Asteraceae) and *Carica papaya* linn (Caricaceae)leaves in malaria vector control in Dogbo district in Couffo department in south-western Benin. Aïzoun *et al.* (2022b) had also studied the larvicidal activities of ethanolic extracts of *Hyptis suaveolens* Linn (Lamiaceae) and *Azadirachta indica* (Meliaceae) leaves and their phytochemical properties in malaria vector control in Dogbo district.

The same authors (Aïzoun and Adjatin, 2023) had also studied the repellent activities of ethanolic extract of *Hyptis suaveolens* linn. (Lamiaceae) and *Azadirachta indica* (Meliaceae) leaves in malaria vector control in Dogbodistrict in south-western

Benin.

Fig. 6. Plant of *Ocimum basilicum* L.

Other studies were also recently carried out by the same authors (Honvoh *et al,* 2025) on the comparison of larvicidal activities of ethanolic extract of six plants leaves in malaria vector control in Couffo department in south-western Benin, West Africa. The six plants were: *Sida acuta* Burm F. (Malvaceae), *Eucalyptus globules* Labill. (Myrtaceae), *Anacardium* occidentale, *Allium sativum L.* (Amaryllidaceae), *Parkia biglobosa* (Mimosaceae) and *Petroselinum crispum (Mill.)Nyman ex A.W. Hill* (Apiaceae).We also have the study by Aïzoun *et al.* (2025) about the repellent activities of ethanolic extract of *Cymbopogon citrates* (Poaceae) and *Ocimum basilicum* L. (Lamiaceae) leaves in malaria vector control in Dogbo district in south-western Benin.

In the current study, women were those who knew the most the plants which organs were often used in Couffo department to control malaria vector because they also often used these plants and other plants to make infusion for their children.

The people aged 24 to 35 years old were the most representing among the people met during our survey. Young men and women even if they knew less the plants than the old men and women, they were available and had participated to our study with contrast to the olds.

The people without scolarisation were the most met during our survey. Even if we had met less people with scolarisation during our study, the noschool attendance people were those who had given to us the local names of the plans.

The people from Adja region were the most met during our survey because this study was carried out in area and the autochtons were the most available.

The leaves were the organs the most used in malaria vector control in Adja region. In fact, it was easy to get leaves than the other organs of plants.

The powder was the using form of plant species the most met during our survey. In fact, this using form was often applied on the skin of people in order to avoid that the mosquitoes took their meals on their body.

Fig. 7. Plant of *Cymbopogon citratus.*

The fumigation was the most using mode of cited plant species. In fact, people burned the organs of these plants mainly the dry leaves of these plants in order to get repellent effect on mosquitoes, vectors of malaria and many other vector borne diseases.

The use of ethanolic extract of plant leaves presented many advantages and very few disadvantages. In fact, plants are cultivated in many regions in Benin country. Ethanolic extract of plants is miscible with water after mixture. Ethanolic extract of plants is a cheap and easy method for larval control in their breeding sites. Mosquitoes may not develop resistance to ethanolic extract of plants. Ethanolic

extract of plants is not toxic to most non-target organisms including mammals and fish.However, limited effectiveness of ethanolic extract of plants in the presence of vegetation and floating debris is the main disadvantage in its use.

Conclusion

Ethnobotanical study is important in malaria vector control in a context where it is useful to search for alternative solutions to damages cause by chemical insecticides to environment and human health. More efforts must be done in order to explore the potentiality of the plant parts available for botanical insecticide preparing in Benin in general particularly in Adja region.

Acknowledgments

The authors would like to thank Misters AFFO Johny, KODO Simplice and people from districts surveyed who had helped us in data collection. The data used in the current study concerned those of the doctoral training of Eloi Honvoh.

Author contribution

The authors designed the study, supervised the study, analyzed and interpreted the data, contributed to the mapping and drafted the manuscript.

Conflict of interest

We declare that there is no conflict of interest regarding the publication of this article.

References

Aïzoun N, Djèdatin G, Koukoui O, Chougourou D. 2022a. Larvicidal and repellent activities of ethanolic extract of *Artemisia annua* (Asteraceae) and *Carica papaya* linn (Caricaceae) leaves in malaria vector control in Dogbo district in south-western Benin, West Africa. European Journal of Pharmaceutical and Medical Research **9(9),** 80-88.

Aïzoun N, Adjatin A, Koukoui O, Chougourou D. 2022b. Larvicidal activities of ethanolic extracts of *Hyptis suaveolens* Linn (Lamiaceae) and *Azadirachta indica* (Meliaceae) leaves and their phytochemical properties in malaria vector control in Dogbo district in South-western Benin, West Africa. Global Journal of Engineering and Technological Advances **12(02),** 113–120. https://doi.org/10.30574/gjeta.2022.12.2.0143.

Aïzoun N, Adjatin A. 2023. Repellent activities of ethanolic extract of *Hyptis suaveolens* linn. (Lamiaceae) and *Azadirachta indica* (Meliaceae) leaves in malaria vector control in Dogbo district in south-western Benin, West Africa. European Journal of Biomedical and Pharmaceutical Sciences **10(9),** 46-51.

Aïzoun N, Codjia S, Honvoh E, Chougourou D. 2025. Repellent activities of ethanolic extract of *Cymbopogon citratus* (Poaceae) and *Ocimum basilicum* L. (Lamiaceae) leaves in malaria vector control in Dogbo district in south-western Benin, West Africa. International Journal of Current Microbiology and Applied Sciences **14(01),** 159-167.

Anyaele OO, Amusan AAS. 2003. Toxicity of hexanoic extracts of *Dennettiatripetala* (G. Baxer) on larvae of *Aedes aegypti* (L.). African Journal of Biomedical Research **6**, 49-53.

Govindarajan M, Jebanesan A, Pushpanathan T. 2008a. Larvicidal and ovicidal activity of Cassia fistula Linn. leaf extract against filarial and malarial vector mosquitoes. Parasitology Research **102,** 289-292. https://doi.org/10.1007/s00436-007-0761-y.

Govindarajan M, Jebanesan A, Pushpanathan T, Samidurai K. 2008b. Studies on effect of Acalypha indica L. (Euphorbiaceae) leaf extracts on the malarial vector, Anopheles stephensi Liston (Diptera: Culicidae). Parasitology Research **103,** 691-695. https://doi.org/10.1007/s00436-008-1032-2.

Govindarajan M, Rajeswary M, Bhattacharyya A, Benelli G. 2016. Eugenol, apinene and ß-caryophyllene from *Plectranthusbarbatus* essential oil as ecofriendly larvicides against malaria, dengue and Japanese encephalitis mosquito vectors. Parasitology Research **115(2),** 807-815. https://doi.org/10.1007/s00436-015-4809-0.

Honvoh E, Aïzoun N, Adjatin A, Chougourou D. 2025. Comparison of larvicidal activities of ethanolic extract of six plants leaves in malaria vector control in Couffo department in south-western Benin, West Africa. European Journal of Biomedical and Pharmaceutical Sciences **12(1),** 41-49.

Liang Y, Li Xiuwei, Zumin Gu Peiwen Qin, Ji Mingshan. 2015. Toxicity of amorphigenin from the seeds of *Amorpha fruticosa* against the larvae of *Culex pipiens pallens* (Diptera: Culicidae). Molecules **20,** 3238–3254. https://doi.org/10.3390/molecules20023238

Pavela R. 2015. Acute toxicity and synergistic and antagonistic effects of the aromatic compounds of some essential oils against *Culex quinquefasciatus* Say larvae. Parasitology Research **114,** 3835–3853. https://doi.org/10.1007/s00436-015-4614-9

WHO. World Malaria Report 2024. Geneva. World Heath Organization.