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Ethno-medicines for Mosquito Transmitted Diseases from South-western Nigeria

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Abstract

The present study presents the ethnobotanical survey of the plants used in the treatment of insect transmitted diseases in Egbeda, Oluyole, Ibadan South-East and Akinyele, Local Government Areas in Oyo State, Southwest Nigeria. The survey was conducted through interviews using semi structured questionnaires. Twenty-four respondents, comprising of traditional medicine practitioners (TMPs), herbalists, herb sellers, and the elderly were interviewed. Fourteen (58.3%) of them were males while ten(41.7%) were females and their ages ranged from 28 to 65 years. The use-mentions index (UMi) was calculated for each plant. Thirty-seven plant species belonging to 25 families were found to be useful for the treatment of insect transmitted diseases in the study areas. Ethno-medicinal information gathered on the plants includes vernacular names, plant parts used, forms of application and method of administration. The most prominent plant family is Euphorbiaceae with four species, while Lamiaceae, Fabaceae, Meliaceae had three species each. Other plant families include Apocynaceae, Combretaceae, Cucurbitaceae, Asteraceae with two species each. In all, the commonest species among the recipes given by the respondents was *Hyptis suaveolens* having a UMi of 0.250. *Ocimum gratissimum, Xylopia aethiopica, Chromolaena odorata*, and *Nicotiana tabacum* all hadUMiof 0.167each. The study plays an important role in documenting and conserving traditional knowledge on medicinal plants used in treating insect transmitted diseases.

Keywords: Ethno-medicine, medicinal plants, mosquito transmitted diseases, Nigeria, Oyo State

1. Introduction

Mosquitoes are considered the deadliest insects in the world as they transmit diseases to more than 700 million people annually [1]. Mosquitoes are vectors of many diseases including chikungunya, dengue, encephalitis, malaria, yellow fever, among others [1]. Over one million people worldwide die from mosquito-borne diseases every year [2]. Vector control is one of the effective ways of controlling vector borne diseases. Mosquito vector control relies on the use of long lasting insecticidal nets (LLINs) [3] and/or indoor residual spraying (IRS) [4]. However, the extensive use of synthetic organic insecticides has resulted in environmental hazards and in the development of physiological resistance in vector species [5, 6]. Development of insecticide resistance in mosquitoes has been a serious threat to current malaria control strategies [7]. This has necessitated the search for potential alternative sources, for effective mosquito control and with minimal environmental hazards. One of such alternatives is the use of plants for vector control. Several plants are used in traditional medicines

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for their mosquito larvicidal activities in many parts of the world. There are many reports on the evaluation of mosquitocidal properties of medicinal plants. These include a report on the larvicidal properties of natural product compounds isolated from Chinese herbs and synthetic analogs of Curcumin against *Aedes aegyptica* Linn. (Diptera:Culicidae) [8], mosquito larvicidal and ovicidal properties of *Eclipta alba* (L.) Hassk (Asteraceae) against *Ae. aegypti*[9], larvicidal activities of six Indian plants against mosquito species, *Ae. aegypti* and *Anopheles stephensi*Liston [10], larvicidal and ovicidal properties of leaf and seed extracts of *Delonixelata* (L.) Gamble (family:Fabaceae) against *An. stephensi* and *Ae. Aegypti* mosquitoes [11] and other plant extracts as potential mosquito larvicides [12]. In Nigeria, there are many literature reports on larvicidal and insecticidal activities of plants. In Nigeria, the larvicidal and insecticidal activities of several medicinal plants have been reported. These include *A. melegueta, Alstonia boonei, Croton zambesicus* and *Newbouldia laevis*have been reported [13–15]. The interest in the use and importance of African medicinal plants by many developing countries has led to intensified efforts on the documentation of ethno-medicinal data of medicinal plants, since most traditional healers keep scanty records and their knowledge on plants use as phytotherapies is passed on mainly verbally across generations [16]. The present survey was therefore undertaken to document indigenous knowledge on the use of medicinal plants in the treatment of mosquito transmitted diseases among indigenes of four local government areas (LGAs) of Oyo State in South-western Nigeria with a view to promoting sustainable use of the medicinal plants and further studies on testing the ethnopharmacological claim on the uses of the plants through bioassay techniques.

2. Methodology

2.1 Study Area

The study area includes four Local Government Areas (LGA) situated within Oyo States, geographically located in the South-western Nigeria. The LGAs: Egbeda LGA, Oluyole LGA, Akinyele LGA and Ibadan North LGA, inhabited by the Yoruba speaking tribe are part of the 33 local government areas of Oyo State. The areas comprise of many villages without access to modern healthcare facilities. Dwellers in these communities partly or solely rely on traditionalists and TMPs for solutions to their healthcare challenges. Hence, the chosen locations are distinct for having a high proportion of herb sellers, herbalists, aged locals or elders and traditional herbal medicine practitioners. These people treat ailments using plant remedies on the basis of their rich ethno-botanical knowledge.

2.2 Data Collection

During 2012-2013, an ethno-botanical field survey was conducted into remote areas and local markets of the region under study in Oyo-state, Southwest Nigeria. Several visits were made to the areas to consult herb sellers, TMPs, herbalists locally known as *babalawo* and aged locals or elderly people to provide information on plant species frequently used in the treatment of insect transmitted diseases. Informed consent was obtained orally from all participants made up of the TMPs, herbalists, the elderly and herb sellers before the commencement of the interview. The use of semi-structured questionnaire and oral interviews were adopted to obtain the relevant data. Ethno medicinal information obtained on the plants used in the treatment of insect transmitted diseases include; the plant part used, mode of preparation as well as administration of the various recipes. Samples of plants were thereafter collected and processed for the Department of Pharmacognosy Herbarium, University of Ibadan (DPHUI). Furthermore, the use-mentions index was calculated for all plants [17]. The use-mentions index (UMi) was taken as the number of use mentioned for a particular plant divided by the total number of respondents interviewed.

2.3 Enumeration of Recipes

Based on the information obtained from the respondents consulted in the study areas the preparation of various recipes was grouped into 12 as follows:

1. The leaves of *Ocimum gratissimum*, *Hoslundia opposita*, bark of *A. leiocarpus*, *Alstonia boonei*, *Tetrapleura tetraptera*, *Bombax buonopozense*, *Pseudocedrella kotyschyii*, *Syzgium guineense* and *Strophantus hispidus, Terminalia superba*, *Canavalia ensiformis*, *Laanea welwitschii*, and whole plant of

*Adenopus breviflorus*are dried and boiled, one teacup-full to be taken daily.

2. The seeds or fruits of *Xylopia aethiopica* and *Jatropha gossypifolia*are grinded together and mixed with Shea butter, to be applied topically as cream on the skin.
3. Seeds or fruits of *Xylopia aethiopica* to be roasted in coal ash, the smoke serve as a repellent.
4. Whole plants of *Hyptis suaveolens, Piper umbellatum, Nicotiana tabacum and Chromolaena odorata* are cultivated around the house to drive away insects. Few branchesare also collected from the plants and used to dust house in the evening.
5. The leaves of *Azadirachta indica, Lantana camara* and *Petivera aliaceae* are roasted and placed inside the house for 5-10 minutes. The smoke from the preparation drives away insects.
6. The recipes made of leaves of *Macaranga barteri* and root of *Nicotiana tabacum* are blend together and mixed with native black soap for bath.
7. The leaves of *Gossypium barbadense* and *Lawsonia inermis* are squeezed together and used for bath. The preparation is also drunk.
8. The leaves of *Momordica charantia* and *Vernonia amydalina* are cooked together and drunk.
9. The bark of *Alchornea laxiflora* and leaves of *Newbouldia laevis* are prepared as decoction and drunk.
10. The leaves of *Morinda lucida* are grounded and mixed with native black soap. The preparation is used to wash the head for three days.
11. The recipes made up of leaves of *Cymbopogon giganteus* and *Croton zambsicus* are cooked together.
12. The recipe comprising of: bark of *Kigelia africana*, root of *Morinda lucida*, leaves of *Allium ascalonicum*, seeds or fruits of *Xylopia aethiopica*, leaves of *Vernonia cinerea* and fruits of *Aframomum melegueta* are dried, blended together and dissolved in water or in pap for three days. The preparation is drunk.

3. Results and Discussion

Demographic data collected on the respondents showed that fourteen were males (58.3%), while ten (41.7%) were females. The close ratio of the male to female respondents here is of note in the practice of traditional medicine. This is against the opinion of African practitioners, who claim that traditional medicine practice should be exclusively reserved for the males [18–20]. The ages of the respondents ranged from 28-65 years. The survey revealed 37 plant species belonging to 25 families as traditional remedies for the treatment of insect transmitted diseases in the study area. Table 1 shows the list of identified plant species, families, local names and plant parts used. Euphorbiaceae is the most dominant family with 4 species accounting for 11%; followed by Meliaceae, Lamiaceae and Cucurbitaceae (with 3 species each), accounting for 8%; Fabaceae, Combretaceae, Bignoniaceae, Asteraceae and Apocynaceae (with 2 species each), accounted for 5%. The rest of the families had one species each (Fig. 1). Various plant parts like leaves, seed, bark, fruit or even whole plant are used in the form of body cream (pomade), as repellent, as concoction, juice, via bathing (with concocted black soap). The method of application and administration of the recipes varies from one case to the other, depending on the extent of infection by insect, as external application or internal administration. Among the plant parts used, leaf was the predominant (43.2%), followed by bark (32.4%) and whole plant (10.8%). Fruit/seed accounted for 5.4%, while root and whole plant/root contributed 2.7% each (Fig. 2). This observation indicating the leaf as the most commonly used plant part is in line with reports on the importance of leaf in herbal medicine in several studies [21–23]. Respondents that participated in the survey affirmed that both dry and freshly collected plants are efficient in herbal preparation except in some cases where freshly collected samples are preferred. The methods of preparations include decoction (boiling in water), concoction and roasting. Some plants were mentioned as being commonly cultivated around houses to drive away insects. These include: *Chromolaena odorata, Hyptis suaveolens, Nicotiana tabacum* and *Piper umbellatum*. Other ingredients encountered in the survey, commonly prescribed as part of the ingredients in recipes include, potash and native black soap. Although, these are non-plant components they are often included in recipes. For instance the leaves of *Macaranga barteri* and root of *Nicotiana tabacum* are blend together and mixed with black soap. This is used in taking bath. Also, the powdered leaves of *Morinda lucida* are mixed with the native black soap for washing the head. Results showed that *Xylopia aethiopica* (Dunal) A. Rich. , *Nicotiana tabacum* L. and *Morinda lucida* Benth. are dominant in

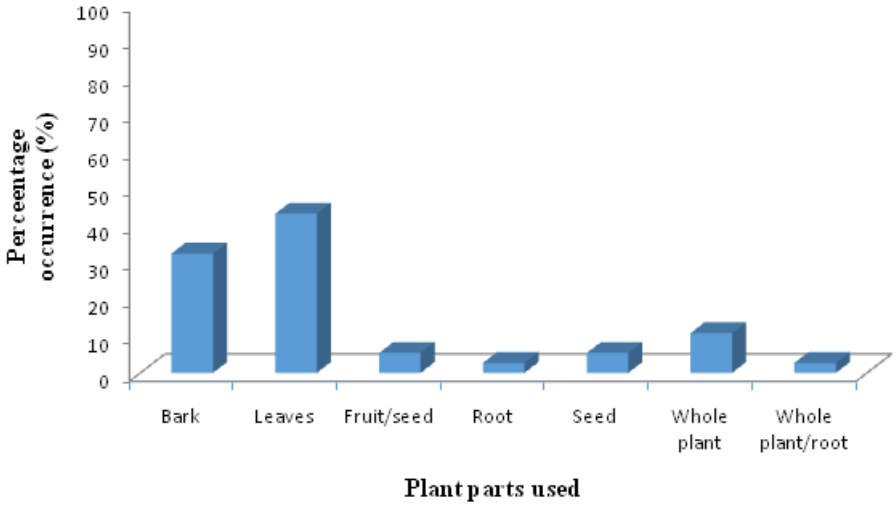

Fig. 1. Percentage occurrence of plant parts used in the treatment of Insect Transmitted Diseases from South-western Nigeria.

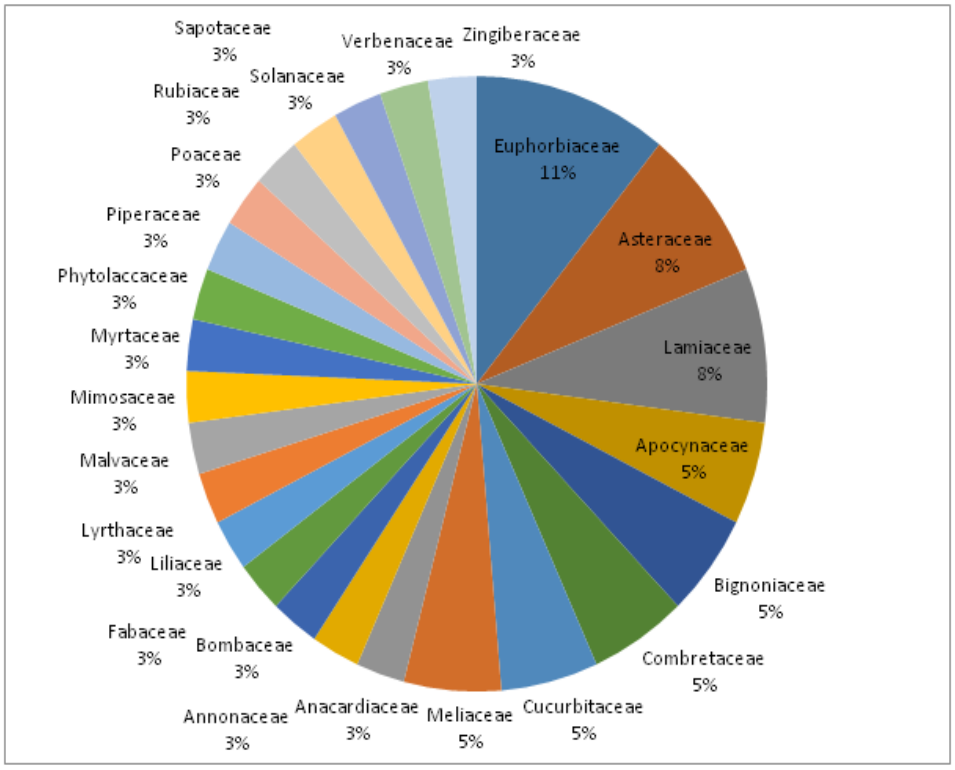

Fig. 2. Percentage occurrence of plant families.

the recipes, which are indicative of their importance in the treatment of insect transmitted diseases.

Of about 1200 plant species reported in literature as having potential insecticidal value only 344 were reported to exhibit mosquitocidal activity [24–26].The insecticidal or mosquito larvicidal activities of some of the plants encountered in the survey have been reported in literature. Table 2 [27–60] shows literature data on the insecticidal and larvicidal activities of the plants. The repellent activity demonstrated by some of the plants

Table 1: Medicinal plants used in the treatment of vector-borne diseases

S/N	Botanical name	Family	Local name	Part(s) Used	Use Mentions Index (UMi)
1	*Adenopus breviflorus* Benth.	Cucurbitaceae	Tagiri	Whole plant	0.042
2	*Aframomum melegueta* K. Schum.	Zingiberaceae	Ata dudu	Fruit/seed	0.042
3	*Alchornea laxiflora* (Benth.) Pax & K. Hoffm.	Euphorbiaceae	Ijan	Bark	0.083
4	*Allium ascalonicum* L.	Liliaceae	Alubosa elewe	Leaves	0.042
5	*Alstonia boonei* De Wild.	Apocynaceae	Ahun	Bark	0.083
6	*Anogeissus leiocarpus*(DC) Guill. & Perr.	Combretaceae	Ayin	Bark	0.042
7	*Azadirachta indica*A. Juss.	Meliaceae	Dongoyaro	Leaves	0.125
8	*Bombax buonopozense* Beauv.	Bombacaceae	Ponpola	Bark	0.042
9	*Butryospermumparadoxum* (Gaertn f.) Hepper	Sapotaceae	Oori	Seed	0.042
10	*Canavalia ensiformis* (L.) DC.	Fabaceae	Ponpon	Bark	0.042
11	*Chromolaena odorata* (L.) R. M. King & H. Rob.	Asteraceae	Akintola-taku	Whole plant	0.125
12	*Croton zambesicus* Mull. Arg.	Euphorbiaceae	Ajekofole	Leaves	0.042
13	*Cymbopogon giganteus* Chiov.	Poaceae	Koko oba	Leaves	0.042
14	*Gossypium barbadense* L.	Malvaceae	Owu	Leaves	0.042
15	*Hoslundia opposite* Vahl	Lamiaceae	Efinrin oso	Leaves	0.125
16	*Hyptis suaveolens* (L.) Poit.	Lamiaceae	Jogbo	Whole plant	0.250
17	*Jatropha gossypifolia* L.	Euphorbiaceae	Lapalapa pupa	Seed	0.083
18	*Kigelia africana*(Lam.) Benth.	Bignoniaceae	Pandoro	Bark	0.042
19	*Lannea welwitschii*(Hiern) Engl.	Anacardiaceae	Opon	Bark	0.042
20	*Lantana camara*L.	Verbenaceae	Ewon agogo	Leaves	0.042
21	*Lawsonia inermis*L.	Lythraceae	Laali	Leaves	0.042
22	*Macaranga barteri* Mull. Arg.	Euphorbiaceae	Agbaasa	Leaves	0.042
23	*Momordica charantia*L.	Cucurbitaceae	Ejinrin	Leaves	0.125
24	*Morinda lucida*Benth.	Rubiaceae	Oruwo	Root	0.125
25	*Newbouldia laevis* (P. Beauv.) Seem.	Bignoniaceae	Akoko	Leaves	0.083
26	*Nicotiana tabacum* L.	Solanaceae	Taba	Whole plant/Root	0.125
27	*Ocimum gratissimum* L.	Lamiaceae	Efinrin	Leaves	0.167
28	*Petiveria alliacea* L	Phytolaccaceae	Awogba	Leaves	0.042
29	*Piper umbellatum* L.	Piperaceae	Iyere	Whole plant	0.042
30	*Pseudocedrela kotschyi* (Schweinf.) Harms	Meliaceae	Eemi Gbegiri	Bark	0.042
31	*Stronphanthus hispidus*A. P. De Candolle	Apocynaceae	Sagere	Bark	0.042
32	*Syzygium guineense* (Willd.) DC.	Myrtaceae	Kanafuru	Bark	0.042
33	*Terminalia superba* Engl. & Diels	Combretaceae	Afara	Bark	0.083
34	*Tetrapleura tetraptera* Benth.	Mimosaceae	Aridan	Bark	0.083
35	*Vernonia amygdalina* Delile	Asteraceae	Ewuro	Leaves	0.125
36	*Vernonia cinerea*(L.) Less	Asteraceae	Ewuro	Leaves	0.042
37	*Xylopia aethiopica* (Dunal) A. Rich.	Annonaceae	Eruje	Fruit/seed	0.167

Table 2: Literature review on identified plants on their insecticidal and larvicidal activities

S/N	Species	Activity (insecticidal/larvicidal)	Chemical constituents	Reference
1	*Adenopus breviflorus*	No reference for insecticidal or larvicidal activity	-	No reference
2	*Aframomum melegueta*	Insecticidal	Essential oil	[13]
3	*Alchornea laxiflora*	No reference for insecticidal or larvicidal activity	Plant extract	No reference
4	*Allium ascalonicum*	No reference for insecticidal or larvicidal activity	-	No reference
5	*Alstonia boonei*	Insecticidal and larvicidal	Plant extract/oil	[27, 28]
6	*Anogeissus leiocarpus*	Larvicidal	Plant extract	[29]
7	*Azadirachta indica*	Insecticidal and larvicidal	Essential oil	[30, 31, 32, 33]
8	*Bombax buonopozense*	No reference for insecticidal or larvicidal activity	Plant extract	No reference
9	*Butryospermum paradoxum*	No reference for insecticidal or larvicidal activity	Plant extract	No reference
10	*Canavalia ensiformis*	Insecticidal	Seed oil	[34]
11	*Chromolaena odorata*	Insecticidal and larvicidal	Essential oil	[33, 35]
12	*Croton zambesicus*	Insecticidal and larvicidal	Plant extract	[14, 36]
13	*Cymbopogon giganteus*	Insecticidal	Essential oil	[37]
14	*Gossypium barbadense*	No reference for insecticidal or larvicidal activity	-	No reference
15	*Hoslundia opposita*	Larvicidal	Plant extract	[38]
16	*Hyptis suaveolens*	Insecticidal	Essential oil	[39, 40, 41]
17	*Jatropha gossypifolia*	Insecticidal and larvicidal	Essential oil	[42, 43]
18	*Kigelia africana*	Larvicidal	Plant extract	[44]
19	*Lannea welwitschii*	No reference for insecticidal or larvicidal activity	-	No reference
20	*Lantana camara*	Larvicidal and Insecticidal	Essential oil	[35, 45]
21	*Lawsonia inermis*	Larvicidal	Plant extract	[46]
22	*Macaranga barteri*	No reference for insecticidal or larvicidal activity	-	No reference
23	*Momordica charantia*	Larvicidal	Plant extract	[33]
24	*Morinda lucida*	Insecticidal	Plant extract	[47]
25	*Newbouldia laevis*	Larvicidal	Plant extract	[15]
26	*Nicotiana tabacum*	Insecticidal	Plant extract	[48, 49]
27	*Ocimum gratissimum*	Insecticidal and larvicidal	Essential oil	[33, 50, 51]
28	*Petiveria alliacea*	Insecticidal and larvicidal	Plant extract	[52, 53]
29	*Piper umbellatum*	Insecticidal	Plant extract	[54]
30	*Pseudocedrela kotschyi*	Insecticidal	Plant extract	[55]
31	*Stronphanthus hispidus*	Insecticidal	Plant extract	[56]
32	*Syzygium guineense*	Insecticidal	Plant extract	[57]
33	*Terminalia superba*	No reference for insecticidal or larvicidal activity	-	No reference
34	*Tetrapleura tetraptera*	Insecticidal	Plant extract	[58]
35	*Vernonia amygdalina*	Insecticidal	Plant extract	[59]
36	*Vernonia cinerea*	Larvicidal	Plant extract	[33]
37	*Xylopia aethiopica*	Insecticidal and larvicidal	Essential oil	[51, 60]

was due to their essential oil constituents, while some of the plants exhibited this activity as plant extracts. The essential oils of *Aframomum melegueta, Azadirachta indica, Chromolaena odorata, Cymbopogon giganteus, Hyptis suaveolens, Jatropha gossypifolia, Lantana camara, Ocimum gratissimum,* and *Xylopia aethiopica* have been reported to show insecticidal and or larvicidal activities [13, 30–33, 35, 37, 39–43, 45, 46, 50, 51, 60]. Thus, essential oils and their constituents have received considerable attention in the search for new biopesticides [61]. Some of the listed plants have also been reported in the management of other ailments such as: cancer where *Hyptis suaveolens* L. [62], *Xylopia aethiopica* (Dunal) A. Rich [63], haemorrhoids (*Nicotiana* tabacum L. [64], *Ocimum gratissimum* L., *Momordica charantia* L., and *Xylopia aethiopica* (Dunal) A. Rich [65] have been found effective, and diabetes in which *Alstonia boonei* De Wild., *Morinda lucida* Benth. [66], *Azardirachta indica* A. Juss, and *Momordica charantia* L. [67] have been studied.

The most mentioned species among the plants encountered in the survey was *Hyptis suaveolens* with a use mentions index (UMi) of 0.250. This underscores the importance of *H. suaveolens* as a mosquitocidal and an insecticidal plant in the communities visited in South-western Nigeria. This is in consonant with reported repellent and insecticidal activities of *H. suaveolens* leaf essential oil against four stored-grain coleopteran pests [68]. Also, *Chromolaena odorata, Nicotiana tabacum, Ocimum gratissimum* and *Xylopia aethiopica,* each had the UMi of 0.167. These plants have been cited in many herbal remedies[69–73]. *Vernonia* was the only genus in which two species; *V. amygdalina* (UMi 0.125) and *V. cinerea* (UMi 0.042) was encountered in the survey. It shows that *Vernonia* plays significant role in herbal medicine. *Vernonia amygadlina*which is an indigenous leafy vegetable in Nigeria has been part of herbal recipes for the treatment of various ailments [74–77]. The other genera mentioned in the survey had only one species each.

4. Conclusion

The survey revealed indigenous knowledge of medicinal plants use in control of mosquito vector in the four local government areas. The frequent use of plants as traditional remedies by the people in the area suggests their established curative and therapeutic significance among the indigenes. The continued identification and documentation of medicinal plants as bio-insecticides is imperative for effective vector control management of the mosquito vector. Most of the plants mentioned have been investigated for various ailments. However, some of the plants encountered in the survey could be explored for future search for newer and safer mosquitocidal agents. Further studies to determine the active principles responsible for the effectiveness of the plants as well as pharmacological activity could be carried out to provide scientific basis in support of the ethnomedicinal uses of the plants.

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