



Nigerian Medicinal Plants with Potential for the Treatment of Neglected Tropical Disease: Onchocerciasis

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ABSTRACT

The present study is a survey of medicinal plants used to manage onchocerciasis in Ibarapa Local Government Area of Oyo State, Nigeria. Semi structured questionnaires targeted at traditional medical practitioners (TMP), traditional birth attendants, herb sellers, herbalists and elders in the communities was used to collect relevant information. Data collected were analyzed by the use of mention index (UMI) and frequency. Literature review was used to judge the usefulness of the recommended plants in onchocerciasis. There were one hundred and thirty-three respondents comprising of TMP (12.8%), herb sellers (26.3%), herbalist (31.6%) and elders in the communities who do not practice any of the listed professions (29.3%). Plants used for treatment of onchocerciasis infection cut across the local government area. The survey revealed eighty plants from 35 families. *Xylopiya aethiopica* (UMI 0.504) was the most frequently used plant. This was followed by *Tetrapleura tetraptera*, *Allium ascalonicum*, *Parkia clappertoniana*, *Securidaca longepedunculata*, *Plumbago zeylanica* and *Parquetina nigrescens*. The most used plant part was the leaf (34%) followed by the bark (27%) while decoction and infusion were the methods of preparation mostly used. The study showed that the knowledge of plants used in treatment of onchocerciasis disease exist in many communities in Ibarapa Local Government Area. There are 56 plants reportedly identified for use against onchocerciasis as shown in this study with leguminosae (13.75%) being the most dominant family. The plants included have significant UMI which should prompt further scientific studies to identify the active constituents and determine their toxicological profiles.

Keywords: Onchocerciasis, Ethnobotanical survey, Medicinal plants, Use Mention Index.

Introduction

Onchocerciasis is one of the seventeen neglected tropical diseases listed by the World Health Organization (WHO), with elimination from certain countries expected by 2020.¹ Onchocerciasis, also known as river blindness, is an infectious disease caused by a nematode *Onchocerca volvulus*.² It is a chronic parasitic disease and second most common cause of blindness after trachoma.³ The nematode (filarial worm) is spread by the bites of a blackfly of a *Simulium* type. Once inside a person, the worms changes to larvae that make their way out to the skin and they can infect the next blackfly that bites the carrier.⁴

Symptoms of onchocerciasis reflect the developmental stage of the parasite and the degree of immune response by the host. Itchy eyes, redness or photophobia may be early symptoms of ocular onchocerciasis, generalized pruritus and onchodermatitis, rash, chronic infection over several years may lead to lichenification, loss of skin elasticity, atrophy and/or depigmentation, visual loss and ultimately blindness. Weight loss and generalized myalgias may also occur.⁵ The results of many studies reveal that onchocerciasis is usually a serious threat to public health and an impediment to socio-economic development in areas with high incidence and high endemicity of the

disease. In such places, blindness and serious visual impairment are common, and mortality among the blind may be four times as high as among non-blind persons of the same age in the same community.⁶ Onchocerciasis occurs mainly in tropical areas. More than 99% of infected people live in thirty-one countries in sub-Saharan Africa including Nigeria. The disease has been widely reported in Nigeria, where about 7 million people are infected and another 40 million are at risk of infection.⁷ The endemicity of onchocerciasis has been previously established in the study area, by various workers.⁸⁻¹⁰ The prevalence of onchocerciasis in Idi-Ata village in particular is relatively high, with 54.2% infection rate among the subjects examined by Akinboye *et al.* in 2010.¹¹ This is similar to an earlier work in the same area, where a prevalence of 48.8% was observed.⁹

Management strategies include vector control and several other programmes have helped to achieve this goal.^{4,12} Treatment is basically with ivermectin and Africa programme for Onchocerciasis Control (APOC) is a programme that used community-directed treatment to reach people who need ivermectin to control the disease.¹² Surgical care – Nodulectomy can result in cure only if excision eliminates all adult worms. Thus, this is not a choice in patients with multiple nodules or in patients in whom nodules are not clinically evident.¹² Other drugs like Suramin and diethylcarbamazine have also been used in managing and treating onchocerciasis.¹³ Doxycycline, Albendazole, Minocycline and Rifampicin have also been used. Ivermectin today remains the only acceptable drug for treatment of onchocerciasis.

One of the basic requirements for a successful primary health care system is the availability and use of suitable drugs¹⁴ and more than 80% of the world population relies on traditional medicine for their primary health care.¹⁵ The World Health Organisation estimated that about 90% of the population of developing countries relied on medicinal plants to help meet their primary health care needs.¹⁶ Medicinal plants have always been a very good source of drugs either in the pure form or in

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form of traditional preparations. Africa as a rich source of medicinal plants has contributed significantly to drug discovery from natural sources. Examples include *Harpagophytum procumbens* from South Africa and Botswana, *Hibiscus sabbdariffa* from Sudan and Egypt and *Pausinystalia yohimbe* from Cameroon, Nigeria and Rwanda.¹⁷ Plants that are effective for treatment of onchocerciasis in animal are believed to be potentially applicable for treatment in human onchocerciasis. This is because of the close relationship between *Onchocerca onchengi*, the causative agent of onchocerciasis in cattle, and *Onchocerca volvulus*, the causative agents in humans. Several medicinal plant extracts have been reported to be active at different stages of the parasite development. This includes microfilaricidal effect of methanol extract of *Anchomanes difformis*,¹⁸ micro- and macrofilaricidal effect of ethanol extract of *Anogeissus leiocarpus*,¹⁹ macro and microfilariae activity of hexane extract and isolated compounds from *Cyperus articulatus*.²⁰ *Discoglyprena caloneura* extract and 3-O-Acetylauritic acid isolated from it were reported to have significant inhibitory activity on the vitality of adult male worms.²¹ *Polyalthia suaveolens* inhibited adult male worms²² while voacangine and voacamine isolated from the methylene portion of the aqueous methanol extract of the stem bark of *Voacanga africana* inhibited the motility of both macrofilariae and microfilariae.²³ It is reasonable to identify locally available plants and plant preparations that are useful in the management of diseases. Traditional medical practitioners, herb sellers and indigenous folks have knowledge of the medicinal properties of various herbs common to their locality. This paper is therefore aimed at gathering, collating and documenting information on medicinal plants used in treating onchocerciasis in Ibarapa local government area of Oyo state.

Materials and Methods

Description of the study area

This study was carried out in Ibarapa Local Government Area of Oyo State, Nigeria. The name 'Ibarapa' is derived from a local cultivar of the melon plant, known locally as "Egusi Ibara" which was historically acknowledged by neighboring people to be extensively cultivated in the area. Ibarapa is located in the Southwestern corner of Oyo state. The area falls within latitudes 7.15N and 7.55N and longitudes 30E and 30.3E. It is located approximately 100 Km north of Lagos and about 95 Km west of the Oyo state capital and neighboring city of Ibadan. The area is approximately 2,496 Km² in geographical size and consists mostly of rolling savannah with forests situated along the southern border and in isolated patches along river courses such as Ogun. Most of the land lies at elevations ranging between 120 and 200 meters above sea level, but rocky inselbergs and outcrops can be seen rising to 340 meters. It is well drained with river flowing from upland. Equatorial climate exist with wet and dry seasons and relatively high humidity. Average daily temperature ranges between 25°C and 35°C, almost throughout the year. The Ibarapa land is traditionally made up of 7 principal towns known as Ibarapa meje (the seven Ibarapa), and their surrounding villages and farmsteads. The towns include Igangan, Eruwa, Aiyete, Tapa, Idere, Igbo-Ora and Lanlate. Tapa and Aiyete are in Ibarapa North local government area, Idere and Igbo Ora are in Ibarapa Central, while Lanlate and Eruwa are located in Ibarapa East local government area. The indigenous economic activity of the people revolves around agriculture which includes farming, fishing, hunting and animal husbandry. Other economic activities include manufacturing and trading. The occupational choice of the people is influenced by the geographical location of the towns. This survey was carried out between June-September 2017.

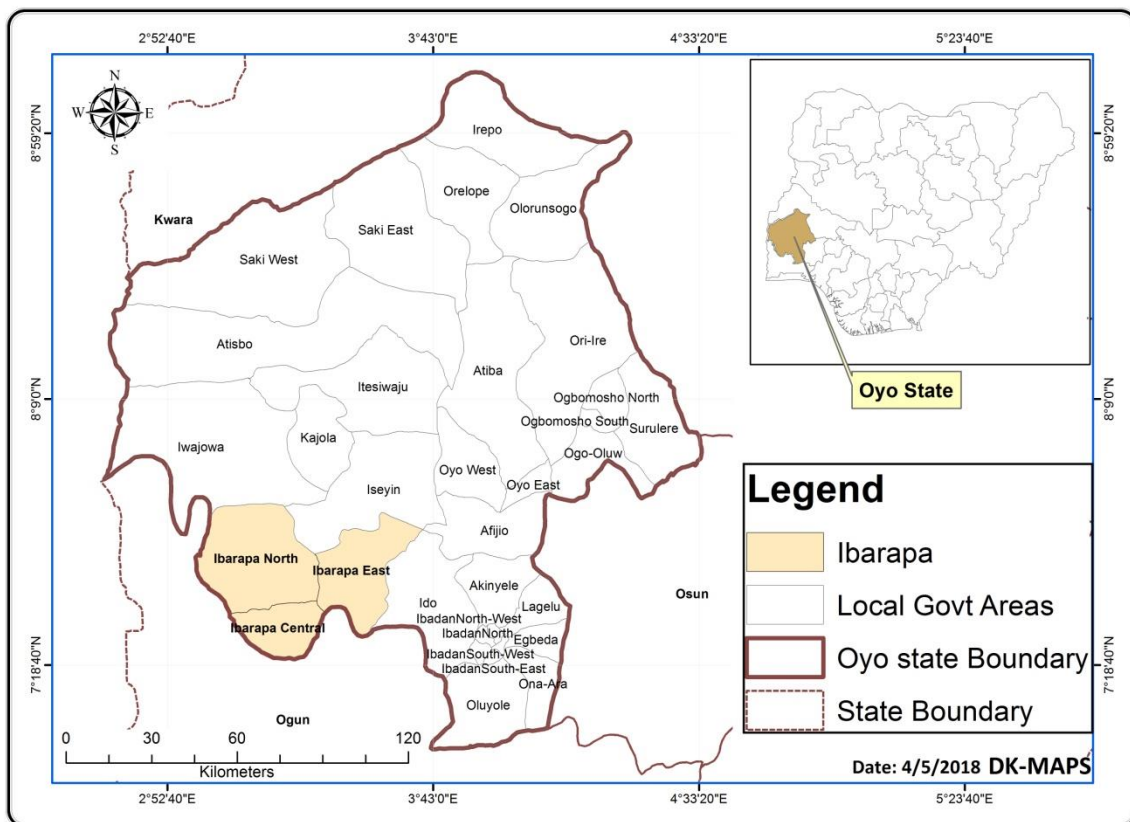


Figure 1: Map of Oyo State showing the Ibarapa Local Government Areas

Selection of respondents

The respondents were mainly traditional medical practitioners (TMP), herbalist and herb sellers within the selected community. The traditional medical practitioner or herbalist is defined as a person with competence to practice traditional medicine. The TMPs and herbalists were met at their various residences while herb sellers were reached at market places. Permission to reach the respondents was sought and obtained at the Igboora King's palace. All the respondents gave verbal informed consent and were pleased to provide required information.

Ethnomedicinal data collection

Data collected were based on oral interview with the aid of semi-structured open-ended questionnaires that allows the respondent to express themselves clearly. The questionnaire administration was a combination of face-to-face and pencil to paper mode. The questionnaire was composed of two main parts: socio-demographic information and knowledge of plants.

Method of Data Analysis

Collected data were processed manually. Percentages and Use Mention Index (UMI) were used to analyse data. UMI gives information on the frequency of use of the plants.

Verification of claims of anti-onchocerciasis plants used in Ibarapa Local Government Areas, Oyo State

Literature materials were obtained from journals, published books and the internet (google scholar, pubmed and science direct). Literature review was used to judge the usefulness of the recommended plants in onchocerciasis treatment.

Statistical Analyses of Data Collected

Biodemographic features of the respondents

Data collected were analyzed manually and summarized using percentage to compare the selected socio-economic characteristics of informants across the study areas.

Analysis of collected plants

Plant names given by the respondents in the study area were identified by processing the data obtained manually and comparing with reference book²⁴. Use Mention Index and Percentages were used to describe the importance of each plant. Use Mention Index is calculated by dividing the number of each mention of plant by the number of the total respondents²⁵.

Results and Discussion

Onchocerciasis has been confirmed endemic in Ibarapa area of Oyo state by various researchers⁸⁻¹¹ hence the choice of this location for the survey.

Bio-demographic features of respondents

The total number of respondents across the seven towns of Ibarapa local government areas was 133 comprising of 97.74 % male and 2.26 % female. This shows that the knowledge of traditional medicine is more common among males compared to females. Out of these respondents, 12.8% were traditional medical practitioners, 26.3% were herb sellers, 31.6% were herbalists while 29.3% belong to the group 'others' which are people who do not practice any of the listed occupation but are elderly and have some form of knowledge of medicinal plants. All respondents were Yoruba speaking individuals. More than half of the respondents (54.1%) were between the age ranges 41-59 years and are considered as matured adults. Other respondents were between the age ranges 21-30 years (3.8%), 31-40 years (22.6%) while the older adults (60 years and above) were 19.5 %. The age distribution of the respondents reflects the fact that experience acquired over the year might be of value in medicinal plant knowledge as it is expected that the older one is, the more likely he/she will be in possession of the knowledge in question. However, some younger people (age 21-30) have the knowledge due to their ancestral lineage while some went through training from individuals with such knowledge. Their educational level also differs, while about 18.8% attended primary school, 8.2% attended secondary school, 5.3% had tertiary education whereas majority, about 67.7% of them had no formal education (Table

1). Their years of experience in the trade ranged from 2 years upward and most of them claimed to have been born into the trade.

Educational level is often used as one of the many social and economic indicators to ascertain the state of development in an economy and the level of advancement in traditional medicine.^{26,27} The level of education could impact directly on the ethical behavior, taste, method of plants preparation and dosage regimen of the individual practitioner. Thus, it is very important to broaden the knowledge, scope and understanding of the people through education. This study unfolds that the literacy level of traditional medical practitioner within the study area is low. This could account for low advancement of tradition medicine within the area and perhaps in Nigeria in general.

Ethnomedicinal plants

The medicinal plants used for the management of Onchocerciasis in Ibarapa Local Government Areas of Oyo State, Nigeria are as listed in Table 2, in alphabetical order including local names, plant parts used, usual form of preparation and the frequency of mention. The ethnobotanical survey revealed eighty plants from 38 families with leguminosae (13.75%) being the most dominant followed by apocynaceae (8.75%) and phyllanthaceae (7.50 %). *Xylopi aethiopia* was the most frequently used plants included in the drug combination for treatment of onchocerciasis disease as shown by the use of Mention Index from data analysis. This was followed by *Tetrapleura tetraptera*, *Allium ascalonicum*, *Parkia clappertoniana*, *Securidaca longepedunculata*, *Plumbago zeylanica* and *Parquetina nigrescens*. This shows the popularity of the plants in the study area.

The most commonly used plant part was the leaves (34%) followed by the bark (27%) and the root (23%). Plant leaves are important ingredient in traditional treatment of the disease as it featured as a component in many herbal preparations which is in agreement with previous reports.^{28,29} The leaves, stems, barks, roots and seeds of the recommended plants are used preferably when fresh than when dry. The preparations are administered mainly as infusion, decoction or powder. Decoctions and infusions were the most frequently used

Table 1: Demographic features of respondents on the plants used in the management of Onchocerciasis.

Demographic features	Frequency	Percentage (%)
Gender		
Male	130	97.74
Female	3	2.26
Total	133	100.0
Age		
15-20	0	0
21-30	5	3.8
31-40	30	22.6
41-59	72	54.1
60 and above	26	19.5
Level of Education		
Primary education	25	18.8
Secondary education	11	8.2
Tertiary education	7	5.3
Others (no formal education)	90	67.7
Occupation		
Traditional medical practitioner	17	12.8
Traditional birth attendant	0	0
Herbalist	42	31.6
Herb seller	35	26.3
Others	39	29.3

Table 2: Plants used to treat onchocerciasis in Ibarapa Local Government Area.

S/N	Botanical names	Family	Local names	Parts used	Preparation	Frequen cy	Use Mention Index (UMI)	Percentage UMI (%)	Reference
1	<i>Adenopus breviflorus</i> (Benth.) G. Roberty	Cucurbitaceae	Tagiri	Fruit	Powder, Infusion	1	0.008	0.8	None
2	<i>Aframomum melegueta</i> K. Schum.	Zingiberaceae	Ata ire	Root, Seed	Powder	14	0.105	10.5	None
3	<i>Argemone Mexicana</i> L.	Papaveraceae	Mafovokanomomi	Leaf	Decoction	9	0.068	6.8	³²
4	<i>Allium ascalonicum</i> L.	Amaryllidaceae	Alubosa elewe	Root	Powder	22	0.165	16.5	None
5	<i>Allium cepa</i> L.	Amaryllidaceae	Alubosa olowo	Bark, Root	Powder, Infusion	4	0.030	3.0	³³
6	<i>Allium sativum</i> L.	Amaryllidaceae	Ayuu	Bulb	Infusion	2	0.015	1.5	³³
7	<i>Alstonia congensis</i> Engl.	Apocynaceae	Awogba	Leaf	Decoction	1	0.008	0.8	³⁴
8	<i>Annona senegalensis</i> Pers.	Annonaceae	Abo	Leaf, Root, Bark	Infusion, Powder	5	0.038	3.8	³⁵
9	<i>Anogeissus leiocarpus</i> (DC.) Guill. & Perr.	Combretaceae	Ayin	Root	Infusion	5	0.038	3.78	³⁵
10	<i>Anthonotha macrophylla</i> P. Beauv.	Leguminosae	Apado	Leaf, Bark	Decoction	1	0.008	0.8	³⁶
11	<i>Axonopus compressus</i> (Sw.) P. Beauv.	Poaceae	Idi	Root	Infusion	2	0.015	1.5	³⁷
12	<i>Azadirachta indica</i> Adr. Juss.	Meliaceae	Dongoyaro	Seed	Powder	2	0.015	1.5	³⁸
13	<i>Bambusa vulgaris</i> Schrad. Ex J.C. wendl.	Poaceae	Oparun	Leaf	Decoction, Infusion	1	0.008	0.8	None
14	<i>Blighia sapida</i> K. König	Sapindaceae	Isin	Bark	Powder	2	0.015	1.5	³⁹
15	<i>Brachystegia kennedyi</i> Hoyle	Leguminosae	Ekú	Bark	Decoction, Infusion	8	0.060	6.0	None
16	<i>Bridelia ferruginea</i> Benth.	Phyllanthaceae	Ira igbo	Leaf, Bark	Powder, Decoction, Infusion	6	0.045	4.5	⁴⁰
17	<i>Bridelia micrantha</i> (Hochst.) Baill.	Phyllanthaceae	Asa	Bark	Infusion, Decoction	2	0.015	1.5	None
18	<i>Butyrospermum paradoxa</i> C.F. Gaertn.	Sapotaceae	Emi	Leaf	Decoction Maceration	1	0.008	0.8	⁴¹
19	<i>Caesalpinia bonduc</i> (L.)Roxb.	Caesalpinaceae	Shawo	Leaf	Decoction	2	0.015	1.5	⁴²
20	<i>Calotropis procera</i> (Aiton) Aiton f.	Apocynaceae	Bomubomu	Leaf	Decoction	2	0.015	1.5	⁴³
21	<i>Chrysophyllum albidum</i> G. Don	Sapotaceae	Agbalumo	Underground seed Leaf	Powder Infusion	1	0.008	0.8	None
22	<i>Chrysophyllum delevoiy</i> A. de Candolle	Sapotaceae	Baka	Fruit	Powder, Decoction	1	0.008	0.8	None
23	<i>Citrus aurantifolia</i> (Christm.) Swingle	Rutaceae	Oronbo wewe	Fruit peel, Juice	Powder	8	0.060	6.0	⁴⁴

24	<i>Citrus sinensis</i> (L.) Osbeck	Rutaceae	Oronbo mimu	Root	Decoction, Powder	6	0.045	4.5	45
25	<i>Clausena anisata</i> (Willd.) Hook. f. ex Benth.	Rutaceae	Agbasa	Leaf, Bark, Root	Decoction Powder	1	0.008	0.8	46
26	<i>Clerodendrum violaceum</i> (Hochst. ex Nees) T.Anderson	Lamiaceae	Isedun	Root	Infusion	2	0.015	1.5	None
27	<i>Colocasia esculenta</i> (L.) Schott	Arecaceae	Isu koko	Fruit	Powder, Decoction	1	0.008	0.8	47
28	<i>Cucumeropsis mannii</i> Naudin.	Cucurbitaceae	Epo egusi	Seed	Burn, Infusion	7	0.053	5.3	None
29	<i>Daniellia oliveri</i> (Rolfe) Hutch. & Dalziel	Leguminosae	Iya	Bark	Powder, Infusion	8	0.060	6.00	19
30	<i>Detarium senegalense</i> J.F.Gmel.	Leguminosae	Ogbogbo	Leaf, Root	Powder, Infusion	1	0.008	0.8	None
31	<i>Dioscorea cayenensis</i> Lam.	Dioscoreaceae	Igangan	Leaf, Root, Tuber	Decoction	1	0.008	0.8	48
32	<i>Drypetes gossweileri</i> S. Moore	Phyllanthaceae	Aganwwo	Bark	Powder	1	0.008	0.8	None
33	<i>Elaeis guineensis</i> Jacq.	Arecaceae	Idu ope	Flower	Burn	1	0.008	0.8	49
34	<i>Erythroleum suaveolens</i> (Guillemin & Perrotet) Brenan	Leguminosae	Obo	Bark, Leaf	Decoction	2	0.015	1.5	19
35	<i>Euphorbia unispina</i> N.E.Br.	Phyllanthaceae	Oro adete	Bark, Leaf	Infusion, Decoction	2	0.015	1.5	None
36	<i>Fagara xanthoxyloides</i> (Lamarck) Zepernick & Timber	Rutaceae	Ata	Seed	Powder	9	0.068	6.8	50
37	<i>Funtumia elastic</i> (Preuss) Stapf	Apocynaceae	Ire	Bark, Leaf	Decoction, Powder	1	0.008	0.8	None
38	<i>Garcinia kola</i> Heckel.	Clusiaceae/Guttiferae	Orogbo	Seed	Powder, Infusion	4	0.030	3.0	51
39	<i>Gardenia ternifolia</i> Schumach. & Thonn.	Rubiaceae	Gangan	Leaf	Decoction	3	0.023	2.3	None
40	<i>Glyphaea brevis</i> (Spreng.) Monach.	Tiliaceae	Atori	Leaf	Decoction	1	0.008	0.8	None
41	<i>Jatropha curcas</i> L.	Euphorbiaceae	Lapalapa funfun	Leaf Juice		2	0.015	1.5	33
42	<i>Kigelia Africana</i> (Lam.) Benth.	Bignoniaceae	Pandoro/Amuyan	Leaf, Bark, Root	Decoction, Infusion	10	0.075	7.5	52
43	<i>Lactuca taraxacifolia</i> Schumach. & Thonn.	Asteraceae	Yanrin	Leaf	Decoction	1	0.008	0.8	None
44	<i>Lawsonia inermis</i> L.	Lythraceae	Laali	Leaf	Powder	1	0.008	0.8	38
45	<i>Lonchocarpus cyanescens</i> (Schum. & Thonn.) Benth.	Leguminosae	Elu	Bark	Infusion, Decoction	1	0.008	0.8	None
46	<i>Mangifera indica</i> L.	Anacardiaceae	Mongoro	Leaf, Bark	Infusion, Powder	4	0.030	3.0	53
47	<i>Momordica foetida</i> Schumach.	Cucurbitaceae	Ejirin	Leaf	Decoction	10	0.075	7.5	54

48	<i>Mondia whitei</i> (Hook.f.) Skeels	Apocynaceae	Isigun	Bark, Root		1	0.008	0.8	None
49	<i>Morinda lucida</i> Benth.	Rubiaceae	Oruwo	Leaf, Root	Powder	3	0.023	2.3	⁵⁵
50	<i>Mucuna sloanei</i> Fawc. & Rendle	Leguminosae	Ijokun/Ewe igbako	Leaf	Decoction	2	0.015	1.5	None
51	<i>Nauclea latifolia</i> Smith	Rubiaceae	Egbesi	Bark, Root, Leaf	Decoction, Infusion Juice	9	0.068	6.78	³⁵
52	<i>Nesogordonia papaverifera</i> (A. Chev.)	Malvaceae	Oro	Leaf	Powder, Decoction	10	0.075	7.5	None
53	<i>Ocimum gratissimum</i> L.	Lamiaceae	Efinrin oso	Leaf	Decoction	3	0.023	2.3	⁵⁶
54	<i>Olax subscorpioidea</i> Chevalier	Olacaceae	Ifon	Root	Infusion	1	0.008	0.8	None
55	<i>Opuntia spp</i> L.	Cactaceae	Oro agogo	Leaf	Powder	1	0.008	0.8	None
56	<i>Parkia clappertoniana</i> (Jacq.) Benth. ex G. Don f.	Leguminosae	Igba	Bark, Stem, Leaf	Powder, Infusion	18	0.135	13.5	None
57	<i>Parquetina nigrescens</i> Afzel.	Asclepiadaceae	Ogbo	Root	Infusion	16	0.120	12.0	³⁵
58	<i>Pavetta crassipes</i> K. Schum.	Rubiaceae	Lolubo	Leaf	Infusion	1	0.008	0.8	⁵⁷
59	<i>Pergularia daemia</i> (Forsskål) Chiovenda	Asclepiadoideae	Koleorogba	Leaf	Decoction, Infusion	3	0.023	2.3	None
60	<i>Pericopsis laxiflora</i> (Benth.) Meeuwen	Leguminosae	Ayan	Root, Bark	Decoction	1	0.008	0.8	⁵⁸
61	<i>Phyllanthus niruroides</i> Schumach. & Thonn.	Phyllanthaceae	Eyin olobe	Leaf	Powder	6	0.045	4.511	None
62	<i>Piper guineense</i> Schumach. & Thonn.	Piperaceae	Iyere	Fruit	Powder	10	0.075	7.5	None
63	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Inabiri	Root	Decoction, Powder	16	0.120	12.0	⁵⁹
64	<i>Pseudocedrela kotschy</i> (Schweinf.) Harms	Meliaceae	Emigbegi	Bark	Powder, Decoction Infusion	6	0.045	4.5	⁵⁷
65	<i>Psorospermum corymbiferum</i> Hochr.	Guttiferae	Legunleko	Bark	Infusion	1	0.008	0.8	None
66	<i>Rauwolfia vomitoria</i> Afzel.	Apocynaceae	Asofeyeje	Bark	Decoction	2	0.015	1.5	⁶⁰
67	<i>Securidaca longepedunculata</i> Fresen	Polygalaceae	Ipeta	Root, Bark	Infusion, Decoction Powder	17	0.128	12.8	⁶¹
68	<i>Senna alata</i> L.	Leguminosae	Asunwon	Leaf, Root	Decoction, Powder	2	0.015	1.5	³⁴
69	<i>Sesamum radiatum</i> Schumach. & Thonn.	Pedaliaceae	Ekuku gogoro	Bark	Decoction	1	0.008	0.8	None
70	<i>Strophanthus gratus</i> Oliv.	Apocynaceae	Isaa	Root, Bark	Powder, Decoction	11	0.083	8.3	⁶²
71	<i>Strophanthus sarmentosus</i> DC.	Apocynaceae	Isa	Root	Infusion	4	0.030	3.0	None
72	<i>Synedrella nodiflora</i> L. Gaertn.	Asteraceae	Oluboki/ Rerinkomi	Leaf	Marceration	2	0.015	1.5	⁶³
73	<i>Syzygium guineense</i> (Willd.) DC.	Myrtaceae	Adere	Bark	Decoction	1	0.008	0.8	⁶⁴
74	<i>Tetrapleura tetraptera</i> (Schum. & Thonn.) Taub.	Leguminosae	Aidan	Root, Seed	Powder, Decoction	23	0.173	17.3	⁶¹

75	<i>Uvaria afzelii</i> Scott-Elliot	Annonaceae	Gbogbonise	Root	Powder	5	0.038	3.78	⁶⁵
76	<i>Uvaria chamae</i> P.Beauv.	Annonaceae	Erunju	Fruit, Leaf	Powder, Decoction	7	0.053	5.3	None
77	<i>Vernonia amygdalina</i> Del.	Asteraceae	Ewuro	Leaf	Decoction, Marceration	2	0.015	1.5	⁶⁶
78	<i>Vernonia tenoreana</i> Oliver.	Compositae	Ewuro oko	Root	Infusion	1	0.008	0.8	None
79	<i>Xylopia aethiopica</i> (Dunal) A.Rich.	Annonaceae	Erun Alamo	Leaf, Root, Bark	Powder, Infusion	67	0.504	50.4	⁴⁸
				Seed	Decoction				
80	<i>Zingiber officinale</i> Rosc.	Zingiberaceae	Ata ile	Root	Powder	11	0.083	8.3	³³

Table 3: Phyto-therapeutic Remedies for Onchocerciasis.

S/N	Herbal remedy	Preparation method	Administration and dosage
1	The leaves of <i>Synedrella nodiflora</i>	Macerate in alcohol	Taken orally once daily.
2	The peel of <i>Citrus aurantifolia</i> , the leaves of <i>Lawsonia inermis</i> and <i>Xylopiya aethiopicia</i>	Grind together	Taken with hot pap once daily.
3	The root of <i>Plumbago zeylanica</i> , <i>Nauclea latifolia</i> , <i>Uvaria afzelii</i> with equivalent quantities of <i>Aframomum melegueta</i> and <i>Xylopiya aethiopicia</i> and seed of <i>Chrysophyllum albidum</i>	Grind together	Taken with hot pap twice daily or mix with black soap for creaming the body.
4	The bark of <i>Blighia sapida</i> , <i>Parkia clappertoniana</i> with <i>Allium cepa</i>	Grind together	Taken twice daily with hot pap
5	The leaves of <i>Phyllanthus nirurooides</i> and <i>Xylopiya aethiopicia</i>	Grind together	Taken twice daily with hot pap
6	The leaves of <i>Morinda lucida</i> and <i>Detarium senegalense</i> , bark of <i>Pseudocedrela kotschyi</i> and <i>Drypetes gossweileri</i> and locust bean	Grind together	Taken orally, three times a week.
7	The leaves of <i>Pavetta crassipes</i> , <i>Mangifera indica</i> , <i>Chrysophyllum albidum</i> and <i>Annona senegalensis</i>	Infuse together in supernatant water obtained from soaked maize.	Taken orally after 3 days, once daily.
8	The roots of <i>Plumbago zeylanica</i> and <i>Xylopiya aethiopicia</i>	Crushed together to powder form and mixed with black soap and water.	To be applied topically once daily.
9	The bark of <i>Parkia clappertoniana</i> with <i>Allium cepa</i> and <i>Xylopiya aethiopicia</i>	Infused in water	To be used after three days.
10	Root of <i>Annona senegalensis</i> , <i>Aframomium melegueta</i> , <i>Zingiber officinale</i> , <i>Allium ascalonicum</i> and <i>Xylopiya aethiopicia</i>	Crushed together.	Taken once daily with pap
11	The bark of <i>Daniellia oliveri</i> and <i>Pseudocedrela kotschyi</i> with <i>Xylopiya aethiopicia</i> and potash	Crushed together to powder.	One tea spoonful to be taken with hot pap or/and mixed with black soap for bathing.
12	<i>Xylopiya aethiopicia</i> , root of <i>Plumbago zeylanica</i> and <i>Tetrapleura tetraptera</i>	Crushed together	Mix with soap (Black soap or lux bathing soap). Its use depends on the severity of the condition.
13	The freely fallen dried stems of big and mature <i>Parkia clappertoniana</i> , <i>Allium ascalonicum</i> , root of <i>Morinda lucida</i> and <i>Aframomum melegueta</i> .	Ground together after drying and sieved	Half tea spoonful to be taken once daily with hot pap.
14	The root of <i>Nauclea latifolia</i> , <i>Olax subscorpioidea</i> and <i>Securidaca longepedunculata</i>	Infused together in water	Taken orally after three days.
15	The leaves of <i>Parkia clappertoniana</i> and <i>Xylopiya aethiopicia</i>	Grind together and sieved	Taken with pap.
16	The root of <i>Tetrapleura tetraptera</i> , <i>Securidaca longepedunculata</i> and <i>Plumbago zeylanica</i>	Prepared as a decoction using supernatant water from soaked maize.	To be taken once daily.
17	The leaf of <i>Nauclea latifolia</i> The root of <i>Nauclea latifolia</i>	Squeeze and mixed with palm oil Infused in water for three days.	Apply topically Taken orally after three days.
18	The bark of <i>Parkia clappertoniana</i> and <i>Daniellia oliveri</i> with <i>Aframomum melegueta</i> and a big dry cat fish.	Ground together with small quantity of salt	Taken orally.
19	The seed of <i>Azadirachta indica</i>	Ground to powder	Taken with pap.
20	The roots of <i>Vernonia tenoreana</i> , <i>Securidaca longepedunculata</i> and <i>Nauclea latifolia</i> and potash	Infused in water.	It is drunk or used for bathing after three days.
21	The root of <i>Strophanthus sermentosus</i> , <i>Parquetina nigrescens</i> and <i>Securidaca longepedunculata</i> with <i>Xylopiya aethiopicia</i>	Infused in water.	It is taken twice or three times daily after three days of the infusion process.
22	The flowery part of <i>Elaeis guineensis</i> and the bark of <i>Daniellia oliveri</i> .	<i>Elaeis guineensis</i> is burnt to ashes and infused with <i>Daniellia oliveri</i>	Taken twice daily

23	The bark of <i>Psorospermum corymbiferum</i>	Infused in water.	Used for bathing after three days of the infusion process.
24	The leaves of <i>Ocimum gratissimum</i> (preferably fresh leaves)	Decocted in water or supernatant water obtained from soaked pap.	Taken daily with milk.
25	The leaves of <i>Phyllanthus niruroides</i> , seed of <i>Garcinia kola</i> , <i>Xylopi aethiopica</i> and <i>Aframomum melegueta</i>	Crushed in a mortar and dried after crushing.	The powdered mixture is taken with hot pap.
26	The leaf and root of <i>Senna alata</i> with <i>Lagenaria breviflorus</i> fruit, <i>Aframomum melegueta</i> , leaves and root of <i>Citrus sinensis</i>	Crushed to powder form and prepared as decoction.	Taken orally and topically.
27	The fresh leaves of <i>Nesogordonia papaverifera</i>	Ground together after which water is added.	Half shot cup is taken orally once daily.
28	The barks of <i>Brachystegia kennedyi</i> , <i>Bridelia micrantha</i> , <i>Pseudocedrela kotschyi</i> , <i>Nauclea latifolia</i> and <i>Lonchocarpus cyanescens</i> , folded leaves <i>Xylopi aethiopica</i>	Decocted or infused.	Taken orally and/or topically after three days of preparation.
29	The root of <i>Zingiber officinale</i> with <i>Allium cepa</i>	Crushed together and mixed with black soap.	For topical use only.
30	The roots of <i>Detarium senegalense</i> , <i>Strophanthus sermentosus</i> , <i>Parquetina nigrescens</i> , <i>Clerodendrum violacum</i> , <i>Axonopus compressus</i> , <i>Anogeissus leiocarpus</i> and <i>Nauclea latifolia</i> barks of <i>Pseudocedrela kotschyi</i> , <i>Brachystegia kennedyi</i> , and <i>Daniellia oliveri</i>	Infused together.	Taken after three days, two or three times daily.
31	<i>Opuntia</i> spp, lemon juice and black soap.	Ground together,	Used once daily for bathing.
32	The roots of <i>Parquetina nigrescens</i> and <i>Strophanthus sermentosus</i> and five to six seed of <i>Garcinia kola</i>	Infused in water for three days. The water is discarded and replaced with fresh water for another three days.	Taken orally once daily.
33	The thick side of <i>Tetrapleura tetraptera</i> with <i>Xylopi aethiopica</i> , barks of <i>Securidaca longepedunculata</i> , <i>Annona senegalensis</i> and <i>Aframomum melegueta</i> ,	Ground together air dried and sieved	Taken with hot pap.
34	The bark of <i>Mangifera indica</i> , seed of <i>Tetrapleura tetraptera</i> and dried folded leaves of <i>Xylopi aethiopica</i>	Crushed together and mixed with black soap.	It is used for bathing, once daily.
35	The leaf of <i>Jatropha curcas</i>	Squeezed around 4-5pm. Salt and water are added after 6 hours.	It is used for washing the head in case of blindness.
36	The barks of <i>Bridelia ferruginea</i> , <i>Syzygium guineense</i> and <i>Rauvolfia vomitoria</i>	Decocted in supernatant water gotten from soaked maize.	Taken twice daily.

methods for preparation of recipes. Generally, plant parts are infused for three days with daily change of water to reduce the possibility of any toxic effect and then administered orally or topically. The oral dosages serve to kill the microfilariae of *Onchocerca volvulus* present inside the body while the topical dosages such as soap and the decoction solution use for bathing is to manage resultant itching from dead microfilariae following oral administration. Some ingredients such as salt, *Aframomum melegueta*, *Zingiber officinale* etc. used in the medicament preparation also serve as preservatives in addition to the medicinal value they contribute while others like *Xylopi aethiopica* are sweetening or flavoring agent.

Frequency (F) and Use Mention Index (UMI)

The relative importance of the mentioned plants with frequency (F) and use of mention index (UMI) is show in Table 2. *Xylopi aethiopica* Annonaceae had the highest UMI (0.504). Several reports have noted that knowing the use value of a plant might be useful in determining its reliability and pharmacological features.^{30,31} Also, further research into the activity profile of plants with high use value that have been used by study participants might be beneficial.³⁰

Verification of claims of antionchocerciasis activities of plants used in Ibarapa Local Government Area

The study recorded eighty (80) plant species used for the treatment of onchocerciasis in Ibarapa Local Government Areas. While some of these plants like *Nauclea latifolia* and *Daniellia oliveri* have been proven to have this activity (Table 2), anti-onchocerciasis activity of some recommended plants is yet to be studied and validated.

Recommended Phytotherapeutic Remedies for Onchocerciasis

The remedies recommended by the traditional medical practitioners involve the use of one or more combination of plants. Information gathered on different methods of preparation and preservation of the medicinal plants, mode of administration, and dosage are reported in table 3.

Other Materials Added to the Preparation and Method of Plant Preservation

Other materials added to the preparation include: salt, *Aframomum melegueta*, *Zingiber officinale*, potash, catfish, water, black soap, egg shell, alcohol and shea butter. These serve various purposes such as preservation, sweetening, flavoring, extraction vehicle and soap base.

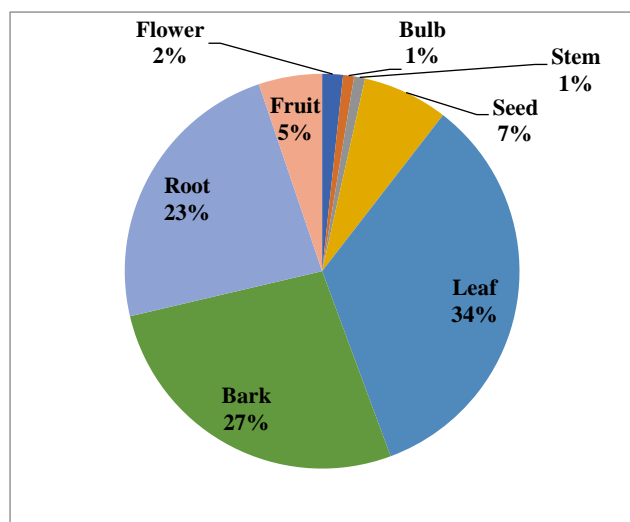


Figure 2: Morphological parts of plants used.

Conclusion

The survey revealed that the knowledge of plants use for management of onchocerciasis disease exist in Ibarapa Local Government Areas. Thirty-one plant species with potential in managing onchocerciasis is being reported for the first time in this study. It was also observed that leguminosae, apocynaceae and phyllanthaceae were the most dominant families while leaves, stem bark and roots were frequently used plant parts. Several formulations including their mode of preparation and administration were also reported. There is however the need for proper scientific backings for the use of these plants and this will require carrying out pharmacological and toxicological studies to ascertain their efficacy and safety. The possibility of losing valuable ethnomedicinal knowledge exists if there is no proper documentation. However, the development of an integrated traditional and scientific knowledge base will be a means of accessing, benefit-sharing and documenting traditional knowledge for future use.

Conflict of interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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