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Urban Forestry and Ethno Medicine: The Meeting Point in Malaria Control in Ijesa Region, Nigeria

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Abstract: *Malaria-curing trees species were identified among the urban tree species previously identified in Ijesa Region of Nigeria. 25 communities were randomly selected from the region and used for this study. In each community, four adults who have lived in the community continuously for at least 10 years were purposively selected and interviewed on the medicinal values of the urban trees in the region through the use of a semi-structured questionnaire matrix. The ethnomedicinal recipes of the identified malaria-curing tree species were documented. Results obtained revealed that respondents were conscious of the medicinal values of the urban trees. 11 out of the 34 indentified tree species were used for malaria control. The malaria-curing trees were 344 out of 2156 urban trees sampled in the region. This was considered low in view of their medicinal value thus stressed the need to encourage urban tree cultivation among the populace. The malaria plant-based medicine was prepared using simple technology that mostly involved boiling in water. Thus their preparations are attainable by everybody. The extractions of most of the identified species were mostly non-annihilative but extractions predatory and annihilative extractions occurred in four species. Sustainable strategies to improve on urban tree cultivation were proposed.*
Keywords: *biodiversity; ethno-medicine; malaria; Ijesa region; urban forestry*

I. Introduction

Malaria remains an important public health concern in countries where transmission occurs regularly. It is a complex disease that varies widely in epidemiology and clinical manifestation in different parts of the world (Bloland 2001). This variability has been attributed to a myriad of factors such as the species of malaria parasite that occur in a given area, the distribution and efficiency of mosquito vectors, climate and other environmental condition, and the behaviour level of acquired immunity of the exposed human populations (Doolan et. al. 2009).

Anti-malaria drug resistance has emerged as one of the greatest challenges facing malaria control today. Drug resistance has been implicated in the spread of malaria to new areas and re-emergence of malaria in areas where the disease has been eradicated. Drug resistance has also played a significant role in the severity of epidemics in some parts of the world (Bloland 2001), and the economics of developing new pharmaceuticals for the disease is enormous.

Recent initiatives are now advocating the use of indigenous malaria control that involved the use of medicinal plants, otherwise referred to as 'ethnomedicine', a wide range of healthcare systems, practices, beliefs, structure and therapeutic techniques that arose from indigenous cultural development (Alino and Kimiyekato 2018). Ethnomedicine does not follow the modern structure or 'western medicine' instead; its practices are based on the unique culture of indigenous people (Chukwuma et. al., 2019). It involves the use of indigenous plants and ingredients to treat the sick (Ezekwesili-Ofili and Okaka 2019), and also focus on preventive techniques, such as the use of massage therapy, exercise, spices, herbs, and food to heal diseases (Muleady-Mecham and Schley2009).

The increasing threat to biodiversity is now a serious constraint to ethnomedicine since the decrease of biodiversity will ultimately affect the availability of the medicinal plants (Ajayi et. al. 2020). Several unprecedented anthropogenic factors with severe deteriorating effects on biodiversity are presently ravaging the rainforest vegetation of Ijesa region of south western Nigeria (Oni and Kayode 2018). Some of the tree species that were previously in abundance in the region are now rare and endangered. Efforts to encourage tree cultivation in the region have failed woefully. In the recent time, cultivation of tree species within the neighbourhood, known as urban forestry is being encouraged. These trees contribute to the physiological, sociological, and economic well-being of the urban society. The urban forestry embraces a multi-managerial system that includes municipal watersheds, wildlife and fisheries habitats, outdoor recreational opportunities, landscape design, recycling of municipal wastes, general tree care; and the future production of wood fibre as raw material. They abate noise, sight barriers, beautify the environment and have medicinal values.

The study being reported here aimed at examining the anti-malaria values of trees found in urban areas of Ijesa region of Nigeria.

II. Research Methods

Cole and Kayode (2020), while carrying out a survey of urban trees in Ijesa region, have provided the detail geographic and agronomic features of the region.

25 communities were randomly selected from the six Local Government Areas of the region and used for the study (Table 1). In each community, four adults who have lived in the community continuously for at least 10 years were purposively selected and interviewed through the use of a semi-structured questionnaire matrix. The interviews were focus, conversational and two-way communication (after Kayode et. al. 2020). During the interviews, the medicinal values of each of the 34 urban tree species previously identified in Ijesa region by Cole and Kayode (2020) were identified. The malaria-curing tree species among these urban trees were documented with their ethnomedicinal recipes.

Voucher specimens of the identified malaria-curing tree species were obtained, authenticated and deposited at the herbarium of the Department of Plant Science and Biotechnology, Ekiti State University, Ado-Ekiti, Nigeria. Group interviews, aimed at authenticating the information obtained from the individual interviews described above, were conducted. A group interview was conducted in each community. Key informants made up of health officials in each LGA were identified and interviewed on the information provided during the individual and group interviews. Secondary information on the identified species was obtained from journals and internet.

Table 1. List of communities sampled in Ijesa region, Nigeria

S/N	LGA	Community
1	Atakunmosa East	Igangan, Ikoromoja, Iperindo, Iwikun
2	Atakunmosa West	Aaye, Abebeyun, Igila, Itagunmodi, Lefaaji, Olorombo
3	IlesaEast	Olomilagbala, Osun Ankara
4	Ilesa West	Ajimoko, Arimoro. Ilo Ayegunle
5	Obokun	Esa Odo, Esa Oke, Ibokun, Ilahun, Ilase
6	Oriade	Ere Ijesa, Erinmo, Ijeda, Iloko, Iwaraja

III. Discussion

Results obtained revealed that diverse respondents were used in this study (Table 2). The respondents cut across varying socio-economic classes. They were mostly males (75%), adults (92%), married (92%), literates (58%) and adherents of the major religion sects in the country. All the respondents were conscious of the medicinal values of the trees in their neighborhoods. It is now widely recognized that socio-economic classifications are not pre-requisites to ethno-medicinal consciousness on trees (Kayode *et. al.* 2008). Respondents asserted that urban trees help in mitigating the harsh effects of malaria. The parts of the trees used were easy to harvest; the trees were readily and freely available, effective with no side effects. Thus lend credence to previous assertions on the values of medicinal plants made by Kayode and Sanni (2016), and Adedeji *et. al.* (2018).

Table 2. Socio-economic Classification of Respondents in Ijesa region, Nigeria

Feature	Classification	Proportion (%) of Respondents
Gender	Male	75
	Female	25
Age (Years)	<20	8
	21-60	42
	>60	50
Marital Status	Married	92
	Single	8
Religion	Christianity	50
	Islam	33
	Others	17
Educational Status	Literate	58
	Illiterate	42

11 of the 34 urban trees previously identified by Cole and Kayode (2020) were valued for the treatment of malaria (Table3). This constituted 32% of the identified urban trees in the region. This tends to suggest that enough tree species whose parts could be used to manage malaria abounds in the region. Indeed, in Nigeria, a high prevalence of malaria abounds (Onwujekwe *et al*., 2000, FMOH, 2001) and the disease was described as a leading cause of morbidity and mortality in the country (FMOH, 2001) especially among the most vulnerable groups - pregnant women, infants and children (Sridhar *et al.*, 2004). FMOH (2001) and Bamidele *et. al* (2012) asserted that at least 50% of the population in Nigeria suffer from at least one episode of malaria each year hence it accounts for over 45% of all out-patient visits. Thus, it could be inferred that urban trees possessed the potentials to solve this major health problem. Braubach *et. al.* (2017), Kabisch and van den Bosch (2017) had earlier subscribed to this assertion.

The identified malaria-curing trees species belonged to 10 families with the family Anacardiaceae having two species while other families have a species each. Cole and Kayode (2020) enumerated the ecological success of members of this family that bear fruits that are drupes. The number of urban tree individuals sampled in Ijesa region by Cole and Kayode (2020) was 2156. The number of identified malaria-curing trees among them was 344 which constituted 16%. Thus in view of their medicinal value, the number of the malaria-curing trees is low. This stressed the need to encourage urban tree cultivation among the populace as earlier advocated by Agbelade *et. al*. (2016)

Table 3. Demography of the identified malaria-curing tree species in Ijesa region, Nigeria

S/n	Description	
1.	*Tree Species*	
	a. Number of urban tree species identified in sampled Ijesa region (According to Cole and Kayode 2020):	34
	b. Number of identified malaria-curing tree species among (1a) above:	11
	c. % of the identified malaria-curing tree species:	32%
2.	*Tree Families*	
	a. Number of families of the urban trees sampled in Ijesa region (According to Cole and Kayode 2020):	23
	a. Number of families of the identified malaria-curing trees among (2a) above:	10
	b. % of the identified malaria-curing trees families:	43%
3.	*Number of tree individuals*	
	a. Number of tree individuals identified in sampled Ijesa region (According to Cole and Kayode 2020):	2156
	b. Number of identified malaria-curing trees among (3a) above:	344
	c. % of the identified malaria-curing trees:	16%

Table 4 revealed that the malaria plant-based medicine was prepared using simple technology that mostly involved boiling in water. Thus preparation of the plant-based medicine is attainable by everybody. The extractions of most of these species were mostly non-annihilative. The extraction in *M. indica*, *P. communis* and *P. guajava* involved debarking while that of *Elaeis guineense* involved cutting of the stem thus in these species, extractions were predatory and annihilative. Study by Kayode and Ogunleye (2008) revealed that intensive debarking often kill the plant. *P. guajava* possessed low girth hence debarking this species usually involved cutting of the branches while cutting of the entire stem is involved in *P. guajava* while sourcing for palm wine. Secondary information used in this study revealed that the identified malaria-curing tree species were rich in phytochemicals. Table 5 revealed the various active ingredients in the identified species. Field observation revealed that the plant-based medicine was perceived by respondents as effective, cheap, readily available and offer fast relieve. Thus the presence of these species in the neighbourhood made urban forestry the meeting point in malaria control in the study area.

IV. Conclusion

In conclusion, the cheap malaria-control method, that urban forestry offers, call for further encouragement to tree cultivation in the neighbourhoods. The modern conventional control method is often beyond the reach of the resource-poor especially the rural dwellers where medical facilities were observed to be inadequate, adulterated drugs are rampant in the country and their costs were expensive, often beyond the financial ability of the people. Tree species with medicinal values to sustain peoples' health should be identified and encouraged in urban forestry. Research institutions should be encouraged to produce improved varieties of these trees and make their seedlings available for cultivation. Kayode and Sanni (2016) had advocated the need to elicit the interest of the youths in tree cultivation and their values by suggesting the reintroduction of 'Nature Study' in the nation's primary schools. This suggestion is still relevant here and should be adopted urgently.

Table 4. Ethnomedicinal recipe on malaria in Ijesa Region, Nigeria.

S/n	Tree species	Family	Parts Used	Recipe
1	*Azadirachta indica*	Meliaceae	Leaf Seed	Squeeze the leaf with water and drink the juice Grind dry seeds to powder and mix with soap for bathing
2	*Carica papaya*	Caricaceae	Leaf	Squeeze/ boil the leaf to get the juice
3	*Cola acuminata*	Malvaceae	Bark	Boil the bark with cashew bark, Gmelina bark, mango leaves and guava leaves. Then consume once daily
4	*Elaeis guineense*	Arecaceae	Juice extract (Palm wine)	Use the extract to boil mango and neem leaves. Then consume morning and evening.
5	*Gmelina arborea*	Verbenaceae	Leaves	Boil the leaves with kolanut bark and cashew bark, then drink once daily
6	*Mangefera indica*	Anacardiaceae	Young leaves Leaves and Bark	Boil the young leaf of mango with lemon grass , tonic leaves and cotton leaves and consume once daily Boil the leaves and bark together with cashew bark and melina with kolanut bark
7	*Moringa oleifera*	Moringaceae	Leaves	Boil moringa and neem leaves for 20 minutes and consume half cup morning and evening.
8	*Pyrus communis*	Rosaceae	Bark	Wash the bark and cook for 10-15 minutes then sieve and drink.
9	*Psidium guajava*	Myrtaceae	Bark and leaves	Boil the leaves, the bark, neem leaves, leaves and bark of mango then consume daily.
10	*Senna siamea*	Caesalpiniaceae	Leaves	Boil leaves with neem leaves and alligator pepper and drink once daily
11	*Spondia mombin*	Anacardiaceae	Leaves	Boil the leaves and consume daily

Table 5. Active ingredients present in identified malaria-curing tree species in Ijesa region, Nigeria

S/n	Tree species	Active Ingredients
1	*A. indica*	Tannin, nimbidin, gedunin, nimbin, nimbidol, quercentin, salannum and sodium nimbinate
2	*C. papaya*	Caraine, saponin, tannins, nicotinic acid, tocopherol, papin, and glucocidecarian
3	*C. acuminate*	Caffeine, kolatein, kotin, lipids, lipase,glucae and laevulose
4	*E. guineense*	Lipids, alkaloids and beta carotene
5	*G. arborea*	lignans, iridoid glycoside, flavonoids, flavons, flavone glycoside and sterols
6	*M. indica*	Saponin, steroids, tannin, flavonoid, Anthraquinone, cardic glycosides and reducing sugar
7	*M. oleifera*	Moringine,moringinine, benil, moringic acid, athonin, spirochin, pterygospermin, gum-resin L-myrosin, K-myronate and rhamnose
8	*P. communis*	Flavanols, flavonols, and hydroxycinnamic acids
9	*P. guajava*	Tannins, resin, essential oil quercetin and eugenol
10	*S. siamea*	Tannins, Saponin, alkaloids, antraquinones and phylobatannins
11	*S. mombin*	Alkanoids, resin, tannins, saponin, quercetin and ellagic acid

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