



ISSN (E): 2320-3862
 ISSN (P): 2394-0530
 NAAS Rating: 3.53
www.plantsjournal.com
 JMPS 2020; 8(2): 126-132
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 Received: 13-01-2020
 Accepted: 15-02-2020

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Prospects of ethnobotanical uses of *Thonningia sanguinea* Vahl. (Balanophoraceae) among selected tribes in southern Nigeria

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Abstract

Parasitic plants are often time not recognized for their ecological and medicinal potentials but rather as weeds that oblige instant elimination. The present study is aimed at exploring the ethnobotanical potentials of *Thonningia sanguinea*, an understudied, holoparasitic plant in Southern Nigeria. Primary information about the plant was collected from randomly selected respondents from 18 ethnic groups (Bini, Boki, Efik, Ejagham, Esan, Etolu, Hausa, Etsako, Hausa, Igala, Igbo, Ijaw, Isoko, Kwale, Owan, Urhobo, and Yoruba) in 30 locations, through oral interview and a well-structured questionnaires. The result showed that a significant percentage of the respondents (75%) recognize *T. sanguinea* as an herbal remedy against ailments such as anemia, aphrodisiac, appetite restorer, asthma, child delivery, condiment, cough suppressant, diarrhea, infant illness, rheumatism, skin infection, sore throat, and stomach upset. Amongst these, its use as an appetite restorer appears to be the most prevalent. All parts of the plants are of significant importance. Nevertheless, the inflorescence bract was the most used. These sets of information indicate that *T. sanguinea*, although parasitic in nature, is indeed a promising plant with great potentials and therefore should be given more research attention and conservation priority.

Keywords: *Thonningia sanguinea*, ethnobotany, medicine, parasitic plant, Southern Nigeria

1. Introduction

In recent times, there has been an immersed increase in the volume of ethnobotanical documentation, especially in the last two decades owing to the fact that different communities have their knowledge about plants. Such indigenous knowledge represents an immense valuable database that provides mankind with an insight on how numerous communities have interacted with the changing environment, providing local solutions for local problems and suitable ways for coping with challenges posed by specific conditions, hence the need for its documentation (Nadembega *et al.* 2011) ^[12]. However, parasitic plants are often time excluded from such ethnobotanical documentation. Rather, studies on parasites have historically been focused on the control, management, and even elimination, of parasite populations because the majority of them are important pests of human agriculture and forestry (Reid 1988 ^[18]; Parker and Riches, 1993 ^[16]; Aigbokhan *et al.* 2000 ^[1]). Although, notwithstanding their harmful effects on crop plants, some parasitic plant species are highly valued for food and wood as well as for their medicinal and aesthetic properties (Marvier and Smith 1997) ^[10]. Only in few instances have parasitic plants been recognized specially for their ethnobotanical value (Gill 1992 ^[3]; Khwaja *et al.* 2013^[8]; Pranjali 2011 ^[17]; O' Neill *et al.* 2016 ^[14]).

Thonningia sanguinea Vahl. (Balanophoraceae) is an understudied species that parasitizes tree plants such as *Guarea cedrata* (Meliaceae), *Lophira alata* (Ochanaceae), *Musanga cecropiodes* (Urticaceae), *Myrianthus arboreus* (Urticaceae), and *Ricinodendron heudelotii* (Euphorbiaceae), *Hevea brasiliensis* and *Theobroma cacao* in southern Nigeria (Imarhiagbe and Aigbokhan, 2019) ^[6]. It is a fleshy dioecious herb growing from an underground tuber which horizontally ramifies up to 15 centimeters through the soil and forms a bulb-like swelling at points where it attaches to the roots of its host plants (Otoide, 1982) ^[15]. The stem is coated with spirals of scale-like leaves that lack chlorophyll. The flowering stem emerges from the ground to produce a bright red or pink inflorescence containing male or female flowers. Previous studies on the plant have attempted to address aspects of the plant such as morphology (Neuwinger 1996) ^[13]; floral structure (Otiodes 1982) ^[15], gall anatomy Idu *et al.* (2002) ^[5], pollination system Goto *et al.* (2011) ^[4], and population genetic variability (Imarhiagbe and Aigbokhan, 2019) ^[7]. Beyond these narratives, information on the ethnobotany of *T. sanguinea*, especially, among ethnic groups in southern Nigeria is currently unavailable.

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More so, the folklore patterns, which dominate the mode of transmission of this valuable knowledge from generation to generations is largely unsustainable. Consequently, it is crucial to record this fast-disappearing knowledge, mostly for an understudied species like *T. sanguinea*, before such vital information is lost along with the present generation of elderly persons. Therefore, the present study was conducted based on the following objectives: (i) to document the ethnobotanical uses of *T. sanguinea* among selected tribes in southern Nigeria (ii) to assess the cultural importance of the plant *vis a vis* its medicinal potentials.

2. Materials and methods

2.1 Study site

As shown in Table 1, the study area lies between 4.4150° N to 8.6851° N and 3.417° E to 10.0855° E Southern Nigeria. The region is heterogeneous in terms of vegetation type that tends to change as you move up north from the areas bordering the Atlantic Ocean to the inland, through the rainforest vegetation in Ondo and southern part of Edo to the guinea savanna zone which include areas like Taraba, Kogi and the northern parts of Edo state. The numerous states found in the region have endowed it with rich and diverse ethnic groups. Each ethnic group possesses a unique cultural practice that tells a lot about the heritage and identity of the group. Such cultural uniqueness has historically shaped and influenced the way nature's resources are utilized, including plant species.

2.2 Field survey

The study was carried out from June 2015 to September 2017. Field surveys were conducted around forested areas in search for the presence of *Thonningia sanguinea*. The presence of *T. sanguinea* in a location further attests to the possibility of obtaining ethnobotanical information from such a locality. Using this as a guide, reconnaissance visits were made to surrounding farms and villages to meet respondents. Discussions were held with men and women who were knowledgeable on the general uses of the *T. sanguinea*. Where the local names of *T. sanguinea* were unknown prior to the visit, photographs were presented to assist with identification. The offer of financial incentives and gifts greatly facilitated the ease with which some of the informants divulged knowledge they have about the plant.

2.3 Ethnobotany documentation

Survey of ethnobotanical knowledge of *Thonningia sanguinea* was documented using methods outlined by Maundu (1995) [11]. This method involves the use of structured open-ended and close-ended questionnaires, which is completed through an oral interview with the respondents using a 'show and tell' method. The questionnaires were administered on 10 randomly selected key informants at each location.

2.4 Phenological data

To give a better illustration of its seasonal abundance and proffer optimum collection time, a phenological assessment of *Thonningia sanguinea* was carried out at the Okomu National Park, Southern Nigeria.

2.5 Data analysis

Completed questionnaires were collated, documented and analyzed quantitatively in the form of charts using Microsoft office excel 2013.

Table 1: Sampling sites and location where ethnobotanical information were collected

Sampling site	State	Location
Edumanom	Bayelsa	4.4150° N 6.4502° E
Biseni	Bayelsa	5.2419° N 6.5416° E
Kalama	Bayelsa	5.1197° N 6.3010° E
Akamkpa	Cross River	5.3190° N 8.3499° E
Calabar municipal	Cross River	4.9757° N 8.3417° E
Calabar south	Cross River	4.8627° N 8.3307° E
Okwangwo	Cross River	6.3166° N 9.2166° E
Ika south	Delta	6.2651° N 6.1739° E
Aniocha south	Delta	6.1562° N 6.4503° E
Ethiope east	Delta	5.6782° N 5.9621° E
Ehor nu Wire	Edo	6.6145° N 5.9859° E
Epkoma	Edo	6.7491° N 6.0732° E
Ilele	Edo	7.0669° N 6.2748° E
Iyanomo	Edo	6.6070° N 5.4830° E
Nikrowa	Edo	6.2494° N 5.3551° E
Okada	Edo	6.7333° N 5.3833° E
Okokhuo	Edo	6.6533° N 5.6248° E
Okour	Edo	6.2959° N 6.0282° E
Owan	Edo	7.0969° N 6.0256° E
Udo village	Edo	6.6289° N 6.3368° E
Idanre	Ondo	7.0914° N 5.1484° E
Ofosu	Ondo	6.7938° N 5.3533° E
Ago-Owu	Osun	7.2519° N 4.3258° E
Irewole	Osun	7.3967° N 4.2128° E
Isokan	Osun	7.3108° N 4.1719° E
J4	Ogun	7.1183° N 3.9000° E
Shagamu	Ogun	6.8322° N 3.6319° E
Ijebu Ode	Ogun	6.8300° N 3.9165° E
Ibadan	Oyo State	7.3775° N 3.9470° E
Eruwa	Oyo State	7.5304° N 3.4170° E
Gbedege	Kogi state	7.9577° N 6.8244° E
Kurmi	Taraba State	8.6851° N 10.0855° E
Otukpo	Benue State	7.1982° N 8.1393° E

3. Results

Figure 1 (A-D), shows the demographic data of the respondents interviewed for ethnobotanical information on *Thonningia sanguinea*. A total of 154 respondents, comprising 18 tribes (Bini, Boki, Efik, Ejagham, Esan, Etolu, Hausa, Etsako, Hausa, Igala, Igbo, Ijaw, Isoko, Kwale, Owan, Urhobo, and Yoruba) were cross-examined. The gender profile of the respondents shows a preponderance of males, accounting for 81.10% of the total, while the female category was 18.8%. The occupation profile of the respondents revealed that the knowledge of the ethnobotanical uses of *T. sanguinea* resides significantly, with those in the farming profession, which accounted for 84.41 %, this is followed by the park rangers and teachers with 7.14% and 6.47 % respectively. The age profile of the respondents ranged from 32 to 87 years. However, the dominant age category that had much information about the plant was ^[41-60]. Other age categories such as ^[61-80], ^[18-40], and ^[>80] had 35.21 %, 9.74 % and 3.24 % respectively. In terms of the level of education, 83.76 % of the respondents were illiterate; meaning they never had a formal education, while the literate category, made up the rest, with 16.23 %.

As shown in table 2. The ethnobotanical uses of *Thonningia sanguinea* among selected tribes in southern Nigeria showed that *T. sanguinea* is a multipurpose remedial commodity for diverse ailments such as anemia, aphrodisiac, appetite restorer, asthma, child delivery, condiment, cough suppressant, diarrhea, infant illness, rheumatism, skin

infection, sore throat, stomach upset. The specific purpose of use varies from tribe to tribe. For instance, in Cross River state, the Efik speaking people use the plant as a potent remedy for all sorts of skin infections, while in Ondo state, the Yoruba people use it as a cough suppressant.

As shown in table 2. The utility frequency for a particular purpose across different ethnic groups showed that, amongst all, its use as an appetite restorer was the most cited. *T. sanguinea* is used as an appetite restorer by the people of Igala in Kogi State, Kwale in Delta State, Isoko in Delta state, Urhobo in Delta state, Bini in Edo state, and Tiv in Taraba state.

As shown in table 3 and figure 3. The method of preparation varies according to the particular ailment. In southern Nigeria, *Thonningia sanguinea* is largely recognized for its medicinal value. 75 % of the respondents exploit it for medicine, while 25 % use it as food in the form of spice for soup preparation. Figure 4 shows that all part(s) of the plant are utilized based on the purpose of use. 54.85 % of the respondent uses the

inflorescence bract in the preparation of the herbal medicine; while 38.46 % utilizes the whole plant; however, a minor proportion of 7.69 % utilizes only the underground rhizome for specific cases.

As shown in figure 5. The phenological study of *Thonningia sanguinea* showed that it is available all-year-round. However, it is more prevalent during the period of abundant rainfall.

Table 4 illustrates an inventory of folk taxonomy on *Thonningia sanguinea* in some selected ethnic groups in Nigeria. *T. sanguinea* is identified by a variety of names in the different ethnic groups in southern Nigeria. In most tribes, the name is coin as a result of belief or a resemblance. For instance, in Igala (Kogi), *Thonningia sanguinea* is referred to as *Obi-atu* which means duiker's kola nut, arising from the belief that antelopes eat the inflorescence. Also, the binis calls it *Edin-egui* or *Edion-tor* to signify ground pineapple or palm.

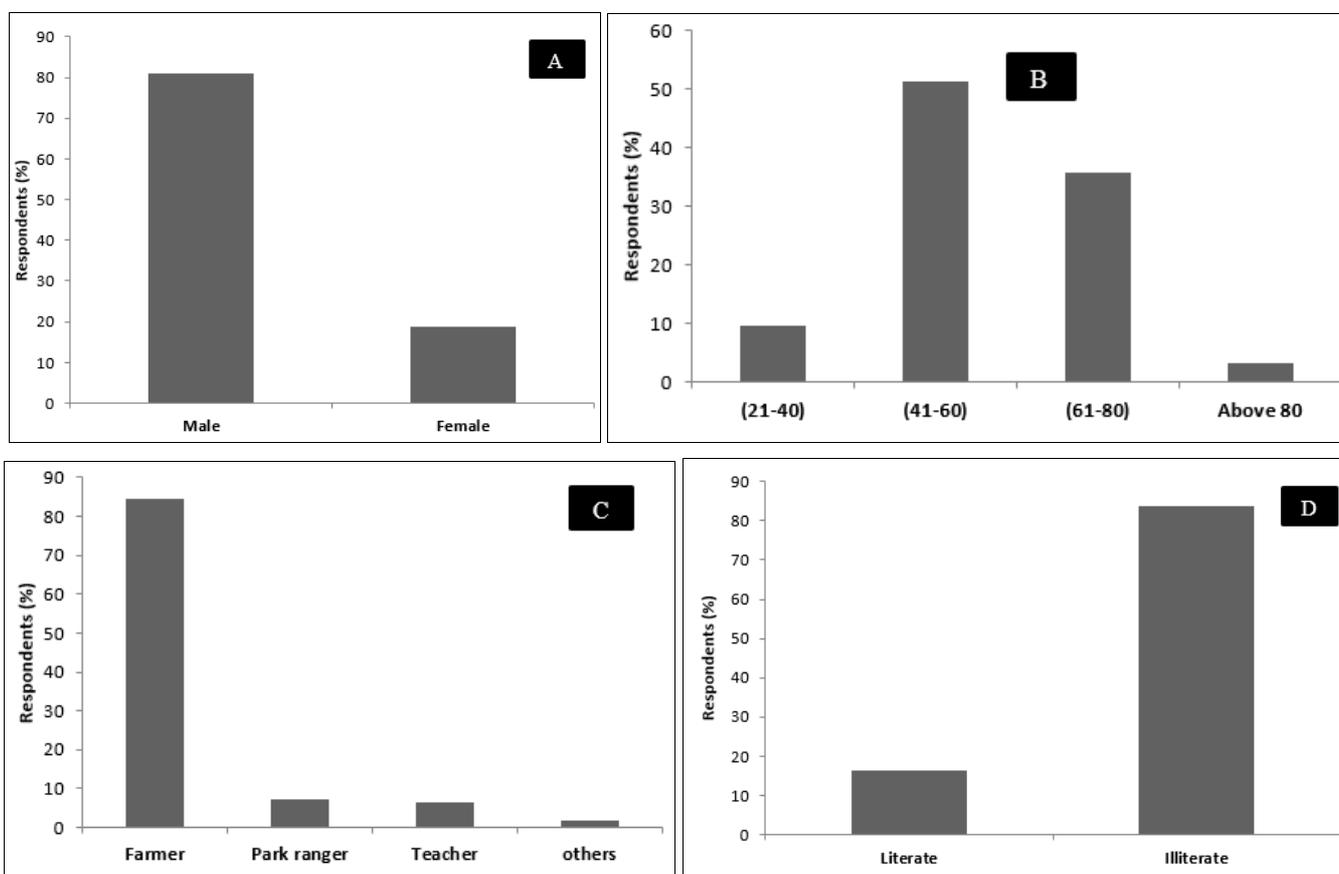


Fig 1: A profile of the respondents distinguished by (A) sex (B) age, (C) occupation, (D) education



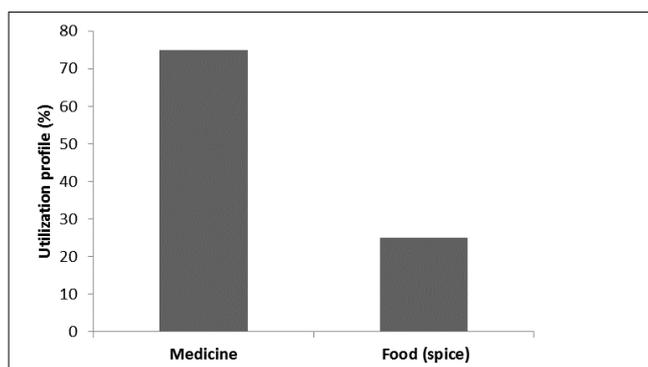
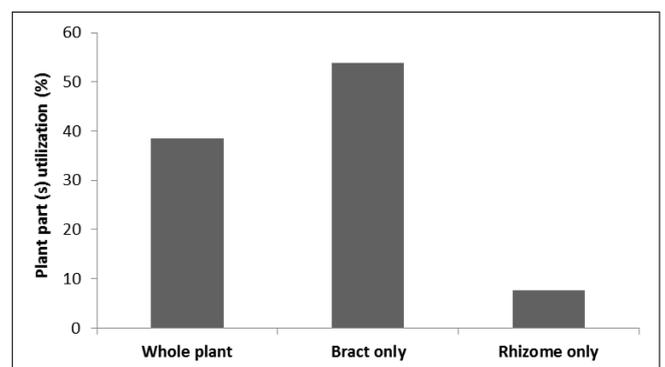
Fig 2: photograph of *Thonningia* (A) male inflorescence head (B) female inflorescence head (C) inflorescence attachment pattern (D), (E), and (F) clumps of *Thonningia sanguinea* inflorescence

Table 2: Cross-cultural ethnobotanical uses of *Thonningia sanguinea* in selected tribes in southern Nigeria

		Ethnobotanical uses												
State	Tribe	Skin infection	Asthma	Infant illness	Cough Suppressant	Sore Throat	Stomach upset	Rheumatism	Appetite Restorer	Anemia	Aphrodisiac	Diarrhea	Child delivery	Condiments
Bayelsa state	Ijaw					×							×	
Benue state	Hausa													
	Igala								×					
Cross River	Efik	×									×			
	Ejagham	×									×			
Delta	Boki										×			
	Kwale								×		×			
	Isoko								×					
	Urhobo						×		×					
	Igbo						×							
Edo	Bini		×		×	×	×		×					
	Esan	×						×						
	Owan							×						
	Etsako							×						
Ondo	Yoruba				×					×				
Osun	Yoruba										×			
Oyo State	Yoruba			×										
Taraba	Tiv								×					×
	Etolu													×
	Hausa													×
Total		3	1	1	2	2	3	4	6	1	4	1	1	3
Utility citation index (%)		16.6	5.6	5.6	11.1	11.1	16.6	16.6	33.3	5.6	22.2	5.6	5.6	16.6

Table 3: Medicinal values of *Thonningia sanguinea* and method of preparation in Southern Nigeria

Purpose	Plant part used	Indication
Skin infection	Inflorescence bract	The red or pink bracts are dried, grounded into fine powder and prepared as poultices and applied directly to the infected part of the skin.
Asthma	Inflorescence bract	The red or pink bracts are dried, grounded and mixed with oil. The resultant mixture can be swallowed or taken with pap or drinks.
Infant illness	Whole plant	The whole plant, comprising rhizomes, bracts, and inflorescence are dried, grounded and mixed with other items.
Cough Suppressant	Inflorescence bract	Either the fresh or dried powdered form can be made into paste using water or mixed with palm oil or honey.
Sore Throat	Inflorescence bract	The Inflorescence bract is grounded into powdered form and could be swallowed or taken with a drink.
Stomach upset	Inflorescence bract	the Inflorescence bract is dried, grounded into powdered form of is used as the main ingredient in preparing pepper soup
Rheumatism	Red bract	The bract is dried, grounded and made in the form of an embrocation and then applied on the part of the body affected
Appetite Restorer	Whole plant	The red or pink bracts are dried, grounded into fine powder and taken with hot water
Anemia	Red bract	For this purpose, the fresh matured inflorescence bract can be taken directly by just chewing
Aphrodisiac	Rhizome	The Dried rhizome is used to prepare a tincture. Water or alcohol can be used as the extracting solvent depending on personal preference. The type of alcohol used can vary from local gin to vodka.
Diarrhea	Whole plant	The whole plant, comprising rhizomes, bracts, and inflorescence are dried, grounded and mixed with other items.
Child delivery	Whole plant	The red or pink bracts are dried, grounded into fine powder and prepared as poultices and applied directly to the placenta. This result in easy expulsion of the placenta during child birth
Condiments	Whole plant	The whole plant is dried and grounded and used as an ingredient.

**Fig 3:** A profile on the utility value of *Thonningia sanguinea* among respondents in Southern Nigeria**Fig 4:** Distribution of *Thonningia sanguinea* part (s) utilization among respondents in Southern Nigeria**Table 4:** An inventory of Folk Taxonomy on *Thonningia sanguinea* in some selected Ethnic Groups in Nigeria

State	Languages	Folk taxonomy/Local names
Benue, Taraba	Tiv	Ikuranchi
	Etulo	Apasa
	Hausa	Kubia, Kula
Edo	Bini	Edin-egui or Edion-tor
	Etsako	Oviedilebo
Delta	Ibo	Akankwanza
Kogi	Igala	Obiatu
Delta, Ondo, Bayelsa,	Ijaw	Kpekpeleba
Cross River	Efik	Ayohison
	Ejagham	Mbinsi
Oyo, Osun, Ogun, Ondo,	Yoruba	ade-ile, Oyale

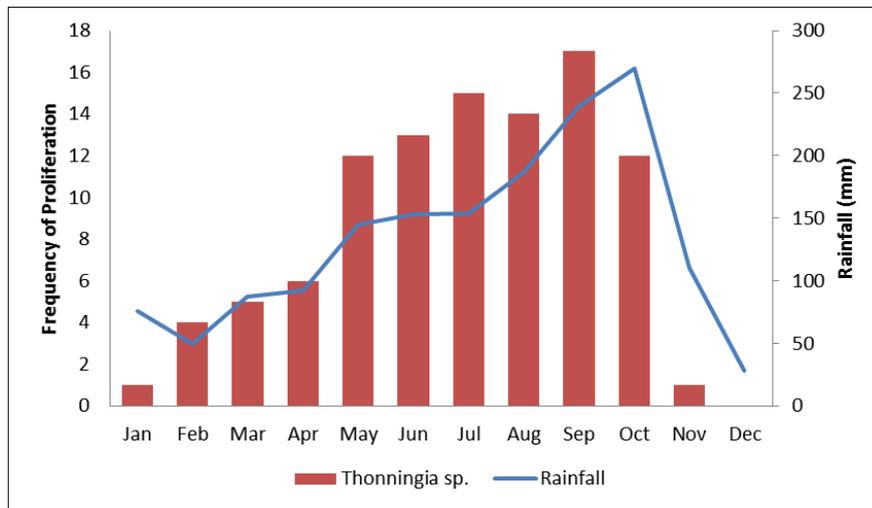


Fig 5: Representative Period of Prevalence of *Thonningia sanguinea* in contrast with rainfall pattern in the Okomu National Park from August 2015 to July, 2016; mean values of rainfall are represented in lines.

4. Discussion

The present study has shown that *Thonningia sanguinea* possesses a lot of medicinal properties as inferred from the information given by the locals who rely on the plant to cure different ailments. The plant is best recognized for its medicinal uses for health conditions such as anemia, aphrodisiac, appetite restorer, asthma, child delivery, cough, diarrhea, infant illness, rheumatism, skin infection, sore throat, stomach upset. This attests to its important contribution to the medical need of the local people. All parts of the plant are utilized by the various tribes to cure for different ailments. However, the inflorescence bract appears to be the most used. Aside from *T. sanguinea*, O' Neill *et al.* (2016) ^[14] had previously reported some members of Balanophoraceae such as *Cynomorium occineum*, *Sarcophyte sanguinea*, *Balanophora fungosa* to show promising solutions to various ailments. These lines of evidence, although from an ethnobotanical perspective, further reveals that some members of Balanophoraceae, although parasitic, can have immersed medical value, especially, to the livelihood of local people.

In evaluating the cultural importance of *Thonningia sanguinea* among tribes in southern Nigeria in terms of its most preferred use, it was discovered that the plant is mostly used as an appetite restorer. There is need to emphasized this, acknowledging the fact that loss of appetite can be linked to so many factors as a result of aging, medical conditions or a side effect of medications and could increase the risk of illness and other complications. Although several appetite stimulants are now available, these synthetic drugs come with a lot of side effects. For instance, the use of Megestrol, Oxandrolone, and Dronabinol as appetite restorer could result in side effects such as stomach upset, confusion, and hallucination (Leonard, 2019) ^[9]. Therefore *T. sanguinea* could serve as a natural remedy for loss of appetite. Aside from its appetite restoration potentials, it is widely used as an aphrodisiac by tribes such as Efik, Ejagham, Boki, Kwale. El-Mokasabi *et al.* (2018) ^[2] reported the traditional use of *Cynomorium coccineum*, another member of Balanophoraceae as a potent aphrodisiac.

The implication of the use of ethnobotanical knowledge in the affairs of mankind cannot be overemphasized especially with the recent growing shift in interest from the use of synthetic to natural products. Plants are re-emerging as a significant source of new pharmaceuticals. Industries are now interested in exploring parts of the world where plant medicine remains

the predominant form of dealing with illness. In this regard, the locals become a major stakeholder as vital insights on medicinal plants reside with them. In the current study, there was however a paucity of young adults who knew this plant. This is quite worrisome and attests to the potential loss of such information with time; hence, the advocacy for the prompt documentation of the ethnobotany of these underutilized plants becomes imperative. Apart from its use as medicine, *T. sanguinea* has been reported to serve other non-medicinal purposes in other countries of Africa, for example, it is used as part of the ingredient in the preparation of arrow poison by the Guere and Kru people of the southwest Ivory Coast. The base poison is the stem bark of *Mansonia altissima*. And in other countries such as Ghana and Gabon, the prickly flower heads are tied to the ankles of young infants to hasten their learning to walk (Neuwinger 1996) ^[13]. The current attitude towards parasitic plants requires a reconsideration. Parasitic plants have shown promising potentials of being a repository of medicine. The present study, the first report on the ethnobotany of *Thonningia sanguinea* among some ethnic groups in Nigeria justifies the need for a paradigm shift. *Thonningia sanguinea*, endemic to tropical Africa, is solely dependent upon selected tree species as host plants for its survival (Imarhiagbe and Aigbokhan, 2019) ^[6]. The mechanism of germination, a fundamental part of its biology is till date, still elusive. Contrary to its true ecological existence, inferences from interviews with the respondents reveal that none of the locals had an idea of its parasitic nature. The plant was rather seen as an independent plant that grows on its own. This impression could be detrimental to its survival, especially with the high rate of habitat destruction that could displace its host. Hence proper conservation approaches should be made to protect the population of *Thonningia sanguinea* in the wild. This can be carried out by first, identifying the host species that support its population in southern Nigeria and protecting these to bolster the population of the parasite.

5. Conclusion

This study has documented the ethnobotanical relevance of *Thonningia sanguinea* in southern Nigeria. The plant is well known for its use as medicine for different ailments such as anemia, aphrodisiac, appetite restorer, asthma, child delivery, condiment, cough suppressant, diarrhea, infant illness, rheumatism, skin infection, sore throat, stomach upset. Of all these, its use as an appetite restorer appears to predominate

over the others. This study has affirmed that parasitic plants, although sometimes constitute an ecological nuisance, could play vital roles in the wellbeing of the local people in southern Nigeria as pertaining to health. Thus, we recommend the conservation of the host species that support the parasite and also advocate for further research into its mechanism of germination.

6. Acknowledgments

The authors acknowledge the support of the respondents who graciously divulged information on *T. sanguinea* notwithstanding the fact that to some, especially, the tradomedical practitioners see such information as their little business secrets. This work was completely funded by the TETFUND 2017-2018 (Batch 12th) Research Project (RP) Intervention.

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