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SOCIO-ECONOMIC IMPORTANCE AND PHYTOCHEMISTRY OF *Dialium guineense* (Willd) IN IBADAN METROPOLIS

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Abstract
This study investigated the socio-economic importance, profitability and phyto chemistry of Dialium guineensein Ibadan Metropolis. Data were collected using structured questionnaire administered to 100 selected traders in Bode, Bodija, Omi-adioand Oje markets in Ibadan. Data were analyzed using descriptive, econometric and inferential statistical tools. Budgetary analysis was used to estimate the profitability of the trade. Phytochemical analysis was carried out on the leaves, seed, bark and fruit of the plant. The result indicated that the presence of steroid, alkaloid, phenol, flavonoid, saponin, glycoside, anthroquinone and tannin varying percentages. The results revealed that the trade of D. guineense was female dominated (91%).Part of the species commonly used and requested for at the study areas was the fruit (55%). The result of the annual profitability of all four markets was 93%. The result of phytochemical analysis indicated that the fruit contained the highest percentages of steroid (3.77), alkaloid (5.35), phenol (3.40), flavonoid (5.54), saponin (3.38), glycoside (1.20), anthroquinone (5.88) and tannin (3.49) respectively .From this study, it can be concluded that only few people knows and understands the nutritional and medicinal values of the plant parts as majority were only aware of the sweetness of the fruit. Traders should be encouraged to go more into sales of other parts of the plant and not just the fruits alone.

Keywords: *Conservation, Preference, Profitability, Utilization.*

Introduction

Several studies support the notion that consuming fruits and vegetables may prevent chronic and degenerative disease (Adepoju, 2009). In the tropical countries, wild and/or non-commercialized fruits offer potential novel sources of macro- and micro-nutrients as well as health promoting phytochemicals for rural populations (Adepoju, 2009; Diop*et al*., 2010; Boudraa *et al*., 2010). About 80% of the world's population depends on plants-based medicine for their health care(Abolaji *et al*., 2014). Medicinal plants are plants which contain substances which can be used for therapeutic purposes or which are precursors for the synthesis of useful drugs (Abolaji *et al*., 2014). Hence, knowledge about their composition and nutrient potentials is imperative.

One of the emerging plants of interest is *Dialium guineense.* It is a medicinal plant commonly known as Velvet Tamarind or black velvet, a genus of a legume belonging to the family of Fabaceae and sub-family of Caesalpiniodeae. It is found in many parts of the sub-Saharan Africa and remains a well-known nutritional and health promoting food to local populations (Ewedje and Tandjiekpon, 2011). It has small, typically grape-sized edible fruits with brown hard inedible shells. Velvet Tamarind is an evergreen shrub or a tree with a densely leafy, compact crown; it can grow up to 30m tall but is often smaller and shrubby. The often short bole can be up to 80cm in diameter and is free of buttress but has narrow, thin, butt flares, its bark is smooth and could be grey or reddish, yielding a little red gum. The genus *Dialium* comprises five species in West Africa but *D. guineense, D. dinklagel, D. pack phylum*are well represented in Nigeria (Omotayo, 1999).It is commonly used for food; the pulp is red, with a sweet-sour astringent flavor similar to baobab, but sweeter. It can be eaten raw when dry by man or animal (Matsuda, 2006). The pulp when peeled is also eaten raw in south-east Nigeria because of its refreshing properties and pleasant scorching taste (Ubbaonu, *et al*., 2005). The thirst quenching, refreshing pulp can also be soaked in water and drunk as a beverage and also provides jam and jellies (FAO, 2004).The bark is used as chewing stick (indigenous tooth brush) among Nigerian populace (Akinpelu *et al*., 2011).Different parts of the tree have been used in folkloric medicine for treatment of different disease. For instance, the bark is used in the treatment of cancer, headache and pains. Idu, *et al*. (2009) reported the usefulness of the bark for oral hygiene and stomach ache along the Esan tribe of Edo state; the leaves are used as a remedy in fever, prenatal pains and edema; the fruits in diarrhea (Arbonnier, *et al*., 2004). It is a good source of proteins and minerals (Arogba, *et al*., 2006). The fruits of the plant are chewed among some women in

south-east Nigeria to improve lactation and check genital infection (Nwosu, 2000).According to Achoba, *et al.* (1994), the fruit is rich in minerals (magnesium, sodium, iron, potassium, copper and carotene), sugars and tartaric acid, citric acid, malic acid, ascorbic acid (vitamin C) and Niacin.

Widespread cultivation of novel nutrient dense plant foods such as *D. guineense* can play a critical role in food security and diet quality for rural and urban populations. The complete determination of both nutritional and biochemical composition of this wild fruit would provide guidelines in selecting and applying appropriate processing strategies and target processed products suitable for populations (Adepoju, 2009).

Materials and Methods

The study was conducted in four (4) markets in Ibadan, Oyo state. Ibadan is located in south-western Nigeria, 128km inland northeast of Lagos and 530km southwest of Abuja, the Federal capital and is a prominent transit point between the coastal region and the areas in the hinterland of the country. Structured questionnaire were administered to 100 selected traders in Bode, Bodija, Omi-adioand Oje markets in Ibadan metropolis (25 per market). Descriptive statistics such as frequency, mode were used to analyze the data. Budgetary analysis was used to determine cost and return of *D. guineense* traders.

Phytochemical Analysis

The phytochemical constituents of the bark, fruit, seed and leaves of *D. guineense* which include alkaloids, tannins, phenols, flavonoids, anthroquinone, **Saponin,** Glycosides and Steroids were quantitatively determined using the method described by Odebiyi and Sofowora (1978).

Results

The socio-economic characteristics of respondents were summarized in Table 1. According to the table, large percentages (91%)were female while the rest were males (9%). Most (80%) were married, 10% were single and 10% divorced. Result further showed that 55% had primary education with the remaining 45% having secondary education. Table 2 showed the utilization of the *D. guineense* in the study areas. Fruits (70%), leaves (48%) and bark (46%)of the plants were used for medicinal purposes. The profitability of the species in all the markets visited in Ibadan metropolis was shown in Table 3. Result showed that the average annual revenue generated from the trade of *D. guineense* in all markets visited was N4, 896, 000 and the net profit wasN4,410, 900. *D. guineense* had 93% profitability in all the study areas visited. The total variable cost included the cost of transportation and trade permit while total fixed cost included the rent and tax. Conservation and preference of *D. guineense* in Ibadan metropolis was represented in Table 4 and 5, while the problems associated with trade of *D. guineense* in Ibadan metropolis was shown in Table 6. The phytochemistry of the species was represented in Table 7. Result revealed that anthroquinone had the highest percentage in the fruit and seeds (5.87% and 2.02% respectively), while flavonoids had the highest percentage in the leaves with 4.81%, while saponin had the highest percentage in the bark (0.084%).

Table 1: Socio- economic Characteristics of Respondents

VARIABLE	FREQUENCY	PERCENTAGE (%)	MODE
Gender			
Male	9	9	
Female	91	91	Female
Age			
21-30years	12	12	
31-40years	26	26	
41-50years	40	40	41-50years
51-60years	16	16	
61years and above	6	6	
Marital status			
Single	10	10	
Married	80	80	Married
Divorced	10	10	
Household size			
1-4	32	32	
5-8	67	67	5-8
9-12	1	1	
Level of education			
Primary	55	55	Primary
Secondary	45	45	
Ethnicity			
Igbo	9	9	
Yoruba	89	89	Yoruba
Hausa	2	2	
Source of capital			
Co-operatives	40	40	
Personal savings	60	60	Personal savings
Annual income			
Less than N10,000	1	1	
N10,000-N50,000	42	42	N10,000-N50,000
N50,000-N100,000	38	38	
N100,000-N200,000	19	19	
How did learn this trade			
Apprenticeship			
Inheritance	61	61	Apprenticeship
	39	39	

Table 2: Utilization of *D. guinense* in Ibadan Metropolis

VARIABLES	FREQUENCY	PERCENTAGE (%)	FORM USED	MODE OF USE
Leaves			**Fresh**	
To treat fever	8	8		i. The leaves are boiled or cooked
To treat cough	7	7		ii. The leaves are boiled or cooked
Diabetes	19	19		iii. The leaves are boiled or cooked
Arthritis	4	4		The leaves are boiled or cooked
Liver problem	3	3		The leaves are boiled or cooked
Malaria	5	5		The leaves are boiled or cooked
No response	54	54		
Bark			**Dry**	Boil or cook
Diabetes	9	9		Boil or cook
Malaria	16	16		Boil or cook
Diarrhoea	15	15		Boil or cook
Antiulcer	2	2		Boil or cook
Jaundice	4	4		Boil or cook
Cough	2	2		
No response	52	52		
Fruit			**Fresh**	Peel the body and lick
Consumption	55	55		Peel the body and lick
Genital infection	9	9		Peel the body and lick
Lactation	6	6		
No response	30	30		

Table 3: Average Annual profitability of *D. guineense* of All Markets Visited in Ibadan Metropolis

VARIABLE	AMOUNT (₦)
Total variable cost	83, 055
Total fixed cost	37, 240
Return (total output x price)	4, 896, 000
Gross profit (gp) (return – tvc)	4, 559, 050
Total cost (Tvc + Tfc)	485, 910
Net profit (gp – tfc)	4, 410, 090
Net profit per respondent (net profit/100)	44, 101
Profitability index ($\frac{GP}{GR}$)	0.9312
% Profitability index $\frac{GP}{GR}$ x 100	93.12% ~93%

Table 4: Conservation of *D. guineense* in Ibadan Metropolis

VARIABLE	FREQUENCY	PERCENTAGE (%)	MODE
Do you plant *D. guineense?*			
Yes	43	43	
No	57	57	No
If yes, number of plots/acres			
One acre	4	4	
One plot	14	14	
Half plot	25	25	Half plot
No response	67	67	
Willingness to plant *D. guineense?*			
Yes	34	34	Yes
No	30	30	
No response	36	36	
Storage method of *D. guineense?*			
Store house	54	54	Store house
Refrigerator	6	6	
Others	9	9	
No response	31	31	
Shelf life			
Days	7	7	
Weeks	25	25	
Month	38	38	Month
No response	30	30	

Table 5: Preference of *D. guineense*in Ibadan Metropolis

VARIABLE	FREQUENCY	PERCENTAGE (%)	MODE
Its sweetness	30	30	Its sweetness
Nutritional value	10	10	
Medicinal value	12	12	
Multiple reasons	18	18	
No response	30	30	

Table 6: Problems associated with trade of *D. guineense* in Ibadan Metropolis

VARIABLES	FREQUENCY	PERCENTAGE (%)	MODE
Lack of customers	5	5	
Not too many people know about the plant	15	15	
Not too many people know about its benefits	17	17	
Too much heat spoils it	27	27	Too much heat spoils it
No response	36	36	

Table 7: Phytochemical Analysis of *D. guineense*parts

Sample	Flavonoid (%)	Saponin (%)	Anthroquinone (%)	Glycosides (%)	Tannin (%)	Steroids (%)	Phenol (%)	Alkaloids (%)
Seed	1.047	1.015	2.021	0.193	1.573	1.139	1.036	1.050
Leave	4.813	2.426	2.703	0.113	2.459	2.831	3.044	2.852
Bark	0.065	0.084	0.074	0.026	0.083	0.063	0.076	0.081
Fruit	5.541	3.375	5.876	1.203	3.487	3.765	3.998	5.348

Discussion

Results from this research revealed that 91% of the respondents were female while 9% were male. The large number of women involved in the trade and marketing of D. guineense could be attributed to the fact that women were more involved in the marketing processes while the men were more involved in the farming process. The age group with the highest frequency was between 41-50years. Majority(61%) acquired their knowledge via apprenticeship, while 39% acquired their knowledge via inheritance. This study revealed that 46% used the leaves to treat cough, diabetes and fever, while 48% used the bark to treat cough, jaundice, antiulcer, diarrhoea, diabetes and also to treat malaria. 70% consumed the fruits to enhance lactation and to treat genital infections. This is in line with Orji *et al.* (2012), who reported that the bark, fruit and leaves of D. guineense has medicinal properties and are used against several diseases. The large percentage of respondents that used the fruit mainly for consumption (70%) could be due to the fact that the fruit pulp contains vitamin C which acts as a good source of nutrient for humans and animals but not as much as is generally acclaimed. The edible pulp of the fruit is a source of protein, minerals and ascorbic acid (Arogba *et al.*, 2006). Results also showed that trade of this species yielded an average profitability of 93% in all the markets visited in Ibadan metropolis. This means that the trade of D. guineense was a profitable one. This is in line with Ewedje and Tandjiékpon (2011), who stated that velvet tamarind was a source of substantial income to the population in rural and suburban zones in Benin, Nigeria and Togo. The large percentage of the its profitability (93%) could be attributed to the fact that not everyone is engaged in the sales of this species and the few that traded in this species were getting returns of almost 100%, although the part that was mostly requested for and sold was the fruit. This study also revealed that 57% of the respondents did not plant D. guineense. Like other trees, populations are threatened by deforestation in the species' natural habitat and by changes in agricultural practices where it has been maintained in farmers' fields. It is thought to be over exploited for fruit and for wood, compromising the regeneration of the species with little regard for re-planting (Ewedje and Tandjiékpon, 2011). Twenty five percent (25%) of the respondents that planted D. guineense, did so on half a plot, while 14% planted on a full plot of land and 4% planted on an acre of land. Respondents (34%) who did not plant the species later showed willingness to plant it due to enlightenment about the species' medicinal and non-medicinal benefits. This research showed that the most common method of storage of the species was store houses. Half of the respondents (54%)used store houses to preserve the plant while 6% used refrigerators and 9% used other means of storage such as use of sack. Some respondents (25%) revealed that the plant, especially the fruit, had shelf life of a few weeks, while 38% revealed the plant could last for months without spoilage, only 7% said it can last for just days. This is in line with Besong, et al. (2016), who revealed that the ripe fruits are available from January till May; but the peak period for harvest is between March and April, therefore the plant could be stored for a long period of time. Some (30%) preferred D. guineense because of its sweetness, 10% preferred it because of its nutritional value, and 12% preferred it because of its medicinal value while 18% preferred it for multiple reasons. From this result, it is safe to say that a large number of the respondents (70%) were aware of only the consumptive benefits of D. guineense, few were aware of its nutritive value (10%) and medicinal value (12%). This was further articulated by the traders' perspective that not too many people know about the benefits of the plant (17%). Phytochemical screening was carried out on the bark, leaf, fruit and seed of the species and the analysis of the bark showed the presence of tannin, anthraquinone, phenol, steroid, saponin, glycosides, alkaloids and flavonoids. Gideon and Raphael (2012) reported that crude extract of stem bark revealed the presence of bioactive compounds comprising cardiac glycosides, tannins, phlobatannins, saponins, terpenoids, resins, steroids, triterpenes, alkaloids, flavonoids, reducing sugars and carbohydrates. This result also showed that the leaves, seed and fruit also contained tannin, anthraquinone, phenol, steroid, saponin, glycosides, alkaloids and flavonoids, which Ogu and Amiebenemo (2012) also found present during their research. These are known to be biologically active and their presence has been reported for several activities like antibacterial (Orjiet al., 2012), anti-plasmodial (Adumanya *et al.*, 2013), analgesic (Ezeja *et al.,* 2011), anti-ulcer (Balogunet al., 2013).

Conclusion and Recommendations

In conclusion, results from this research showed that although D. guineense is, a plant with multiple benefits as well as a high market value i.e. high profitability, very few people knew of the plants benefits. This gives probable reason as to why the species is threatened but not due to overexploitation but lack of use. It was also recorded in this study that the species had an average annual profitability of 93%, which was the average profitability of the four markets visited in the study area. This research also ascertained the various phytochemical components of D. guineense which included alkaloids, tannins, saponins, anthroquinone, phenols, glycosides, flavonoids and steroids at varying percentages in the bark, leaf, seeds and fruit of the plant. Based on the results of this research, the following recommendations are suggested; enlightenment programs should be carried out to encouraged traders to go more into sales of other parts of the species and not just the fruits alone and Forestry extension should be carried out to enlighten the public on the need to plant and conserve the species.

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