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Survey of Wild Fruits Consumed by Animals in the Forest Block of Ubangi Eco-region, Democratic Republic of the Congo

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Abstract

An ethnobotanical survey was carried out in Gbado-Lite city (Province of North Ubangi) in the Democratic Republic of Congo, among 74 hunters and bushmeat sellers in order to inventory the wild fruits consumed by animals in the forest block of the Ubangi eco-region. Data were collected using a semi-structured questionnaire containing questions that could provide information on each plant species and its main consumers. The results reveal that the majority (41.8%) of respondents live in the Kaya neighborhood. 27% of female informants live in the Mbanza neighborhood, 10.8% in the Pangoma neighborhood, and 9.7% in the Lite neighborhood. The majority of respondents were men (89.1%), while women accounted for only 10.9%. As for marital status, married people (70.2%) and widowers (14.8%) are the most represented. Hunting and the sale of bushmeat (44.5%) and agriculture (41.8%) are the main activities carried out by the respondents. The diversity of the wild flora is composed of 19 species of fruit plants, distributed in 19 genera and 16 botanical families. The main families of wild fruit plants consumed by wildlife are Malvaceae, Meliaceae, and Urticaceae. As for the wildlife, the animals inventoried belong to five classes, mammals (76.9%), Reptilia (7.8%), Aves (7.8%), and Polyplacophara (7.8%). The fauna studied is composed of 12 families of wild animals, the most abundant of which are Bovidae (27.5%), and Nesonyidae (10.0%). It is necessary that chemical and pharmacological studies be carried out on these plant taxa in order to evaluate their medicinal and food values. The domestication of these plant species should be part of the subsequent studies to ensure the sustainability of the wild fauna. Thus, the integration of local wild edible fruit plants into agroforestry systems is the best solution to combat their disappearance in the Ubangi ecoregion, which is faced with traditional slash-and-burn agriculture.

Keywords: Forest, animal edible wild fruits, biodiversity, conservation, The Democratic Republic of the Congo.

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1. Introduction

The environment has many problems because man exploits it too much and these problems will only be solved when there is application and respect for the "ten principles of the new ecologism", i.e., the knowledge and application of ecology to manage the environment [Mpiana *et al.*, 2011]. Population growth is associated with changing dietary preferences, stimulating a rapid increase in demand for animal proteins (meat, milk, eggs, fish, insects, and others) [Mpiana *et al.*, 2013]. Since time immemorial, humans have made use of nature and numerous activities that have proven to be detrimental to the natural environment, namely: the reduction of biological diversity, soil, air, and water pollution, the destruction of the ozone layer, the reduction of soil fertility, desertification, and the depletion of fish resources and the deterioration of the natural and cultural heritage [CTA, 2007].

The Democratic Republic of Congo (DRC) is 50% covered by dense forests, which represent 46% of Africa's forests and constitute a reservoir of biodiversity and an indispensable ecological buffer in the fight against greenhouse gases and global warming [Ngbolua, 2014; Lambinon, 1998]. It is important to note that the exploitation or development of all environmental resources requires rationality and economy [Ngbolua *et al.*, 2017]. However, the development of this practice continues to worry humanity. Between 2000 and 2008, the DRC lost more than 300,000 ha each year, making it the eighth-most deforested country in the world [Kpula *et al.*, 2021; Sttauch, 1960]. In general, the laws regulating access to forests and their resources are difficult to implement and enforce. States do not have the financial and human resources to control their entire protected area system [CIFOR, 2007]. Also, water, flora, and fauna, as the eco-biological basis of a human community, require rational and economic exploitation. This can be done by maintaining its balance and productive capacities; being able to restore the balance as soon as possible, or even improving its productivity; ensuring the sustainability of its resources for future generations [Bansard and Schröder, 2021]. Indeed, the biodiversity of North-Ubangi, in general, is poorly known.

Although many studies have been carried out in the past on the vegetation and flora and, to a lesser extent, on the wildlife, nothing has been done specifically on the biological type of fruit consumed by animals. If there has been any, it needs to be updated, deepened, and above all completed by new research programs.

North Ubangi province provides a bio-geographical crossroads that is underlined by the exceptional richness of the country's flora. This is due to the link between the animal-plant domains.

If certain regions have been relatively well explored from a botanical point of view, others, such as North Ubangi, remain insufficiently explored. In addition to its botanical interest, North Ubangi, through its vast forest, has a unique ecological interest that needs to be better studied and conserved (Loore, 2007). However, artisanal timber exploitation and slash-and-burn agriculture are major factors that diminish the potential of this forest. Since the conservation and the sustainable use of resources are therefore essential for food security and nutrition, the conservation and use of a wide range of inter-and input-specific diversity are opportunities to face the challenges of the future. This gives rise to the need to initiate studies to inventory plant taxa and their potential for in situ conservation. As for the flora, many of the fruits that are constantly increasing are consumed by wildlife due to the migratory flows in the country. The Democratic Republic of Congo has nearly 45% of wild trees producing fruits that are consumed by both wild and domestic wildlife (PNUE, 2008; Tchatat *et Ndoye*, 2006).

For the Ubangi River catchment area, specific studies on the identification of wild fruits are almost non-existent. However, some research conducted by the Ubangi Biodiversity Exploration Research Group called “Ubangi Bioxplore project” has focused on plant-based NTFPs. The results of these studies have shown that several NTFPs of plant origin are wild fruits that are part of the daily diet of the riparian population [Musibono, 2014]. It should be noted that all this research is limited to fruits usually consumed by the population and for which there is traditional knowledge related to their use. However, several other fruits exist in the forest of the Ubangi River Basin that may or may not be known, used, or not used by wildlife and which deserve to be identified and if necessary, introduced into the diet [Le législateur congolais, 2011; FNUAP, 1996]. The present study is therefore in line with this approach. It is to inventory the plant species producing fruits consumed by wildlife in the forest ecosystems of the Ubangi River basin. These forest species, highlighted in terms of their potential, will be the subject of further studies on the toxicity or otherwise of their fruits on the one hand and will be the subject of an in situ and/or ex-situ conservation project on the other. This thought is seen accomplished, in the demographic exploitation observed these last years in DRC in general and in the city of Gbado-Lite in particular, the ignorance of the laws in matter of environment not allowing the ecosystems to reconstitute themselves.

The forest of Gbado-Lite, located in the province of North-Ubangi, is not spared from this problem; the fact that NTFPs in general and wild animal meat, in particular, are not available in sufficient quantities is a real problem for the urban population, which has led us to reflect on how to find favorable solutions for the conservation of these products in order to avoid their definitive extinction. Understanding the interactions between wild fruits and frugivores provides fundamental information for the sustainable management of natural ecosystems. Thus, in view of this thorny situation, a preliminary inventory of plant species producing fruits consumed by wildlife in the forest ecosystems of the Ubangi River basin is very necessary in order to enable us to have a reliable database with a view to proposing sustainable conservation solutions.

1. Material and Methods

The present study was carried out in the Commune of Gbado-Lite (4° 17' north latitude; 21° 2' east longitude; altitude: 500 m above sea level) and its surroundings (North Ubangi, DRC) [Goldsmith, 1969; Mytting, 2015]. The data analyzed are from a survey conducted in the town of Gbado-Lite: Pangoma neighborhood (8 people), Kaya (31 people), Moanda (8 people), Mbanza (20 people), and Lite (7 people). A total of 74 people were interviewed using a survey form. The survey sheet consists of two parts: Sociodemographic data (age and sex of respondents, level of education, family situation) and information on wild fruits and their consumers (name of the fruit and the name of the consuming fauna). Microsoft Excel version 2010 and IBM SPSS statistics version 20 were used for data processing and analysis.

2. Results and Discussion

3.1. Socio-demographic profile of respondents

Table 1 gives the distribution of respondents according to Sociodemographic characteristics and shows that men (89.1%) outnumber women (10.9%). The results of this study are similar to other studies conducted in the provinces of South Ubangi (DRC) and North Ubangi (DRC) respectively by (Bosanza *et al.*, in press; Djolu *et al.*, in press; Bobuya *et al.*, in press). The preponderance of men in this survey can be justified by the fact that the vast majority of informants are hunters or small farmers. It is likely that it is during hunting that men have

become familiar with the plant foods of wild animals, particularly sage fruits. As for the age group, the main age groups found in this survey are those aged 40 to 50 (33.7%) and 30 to 40 (30.0%) respectively. Finally, the other age groups found were those aged 50 years and over (22.9%), and 20 to 30 years (12.1%).

Moreover, the marital status shows that married people are in the majority (70.2%) among the informants. The Other informants were widowed (14.8%), single (10.8%), and divorced (4.0%). The results of this study are similar to other studies conducted in the provinces of South Ubangi (DRC) and North Ubangi (DRC) respectively by [Bosanza *et al.* \(In Press\)](#), [Djolu *et al.* \(In Press\)](#); [Bobuya *et al.* \(In Press\)](#). Concerning the level of education, the majority (41.8%) of respondents had secondary education, followed by those who were illiterate (29.7%), those with primary education (21.6%), and 6.7% of those with higher education. The results of this study are similar to those ([Djolu *et al.* in Press](#)), that the majority of the respondents (68%) had secondary education. On the other hand, the occupation of the respondents shows that hunters and bushmeat sellers are in the majority (44.5%), followed by farmers (41.8%) and civil servants (13.5%). Finally, the majority (41.8%) of respondents reside in the Kaya neighborhood, followed respectively by Mbanza (27.0%), Pangoma (10.8%), and Lite (9.7%). Finally, Figure 1 shows the experience of respondents in hunting and selling game meat.

Figure 16 shows that the majority (28.3%) of respondents have at least 25 years of experience in the hunting and bushmeat trade sector. In addition, 27% of the informants have between 5 and 10 years of experience. Finally, the rest of the informants have experience of 15 to 20 years (16.2%), 20 to 25 years (16.2%), and 10 to 15 years (12.1%) respectively in the exercise of their profession.

3.2 Biological diversity

3.2.1 Wild flora

A total of 19 wild fruit plants consumed by wildlife were inventoried in the forests of Gbado-Lite and its surroundings (Table 2). They are divided into 19 genera and 16 botanical families. Moreover, Dicotyledons (84.2%) predominate over Monocotyledons, with 15.8% of taxa. The families Malvaceae, Meliaceae and Urticaceae all have two genera each. Morphologically, trees are predominant (68.4%). Other morphological forms are climber (10.5%), herb (10.5%), palm (5.3%), and small tree (5.3%).

3.2.2 Wild fauna

The wildlife of the forests of Gbado-Lite and its surroundings is rich, as shown in Table 2. The majority (76.9%) of the animals recorded belong to the mammal class. The other classes of animals making up the wildlife of this part of the DRC are Aves with 7.8% and Polyplacophara (7.9%), Reptilia (7.8%). In total, 12 families of wild animals feeding on forest fruits were inventoried in the study area. 27.5% of the inventoried species belong to the Bovidae. Other families are Nesonyidae (10.0%), Hominidae (7.5%), Ceropithecidae (7.5%), Hystricidae (7.5%), Sciuridae (7.5%), Suidae (7.5%), Viverridae (7.5%), Testudinidae (5.0%), and Giraffidae (5.0%). Finally, the least represented families are Bucerotidae (2.5%), Loricidae (2.3%), and Thyonomyidae (2.5%).

In a recent study ([Kpula *et al.*, 2021](#)), it has been shown that traditional agriculture is the main activity of farmers in the Ubangi ecological region, followed by NTFP harvesting, hunting, and livestock rearing respectively. Most of the fields are located in the forest about 11–20 km from the place of habitation. The duration of exploitation of agricultural land is one year and the age of fallow land is usually 5–10 years. During the one-year crop cycle, each family clears

a forest area of at least 1.5 ha. The same study indicated that the area of forest cleared during the annual cropping cycle can be estimated at 245 ha or 0.006%, which could lead to a loss of primary vegetation cover of at least 0.15% in 25 years if nothing is done now. Thus, slash-and-burn agriculture is a real threat to the North Ubangi Forest massif. It is in this context that work has recently been initiated to raise awareness among the population in favor of sustainable agriculture and the development of a forest management plan for the conservation of biodiversity in the Ubangi ecoregion. This will help to curb the phenomenon of deforestation. In addition, it should be noted that in Africa, the value of wild plants for the indigenous nutrition and/or care of people in the rural forest area is well known (Ngbolua et al., 2021). These plant species must be preserved and enhanced so that humans and animals can live in harmony, as these plant taxa are used by both wild animals and humans. This is particularly true of plant fruits such as *Myrianthus holstii* Engl., *Landolphia* spp., *Cola acuminata*, *Irvingia* spp., *Aframomum* spp., *Canarium sweinfurthii*, *Mammea africana*, *Treculia africana*, *Anonidium mannii* et *Carapa procera*. In the particular case of the oilseed *C. procera*, the high-fat content of its seeds (oleic acid) (Miralles, 1983) is an argument in favor of its domestication (and that of Porcupine) and its valorization (biodiesel and soap production). Thus, transesterification and saponification of non-conventional vegetable oils

may constitute two biochemical reactions of resilience to poverty (soap production) and climate change (biodiesel production) in this part of the country.

3. Conclusion and suggestions

The aim of this study was to make a preliminary inventory of wild fruit species consumed by wildlife in the forest ecosystems of the Ubangi River Basin. The results of the work show that men and women are aware of the faunal and floristic biodiversity of their ecosystem. Hunting and the sale of meat from the hunt are the main occupations of the informants. The forests of the study area are a great reservoir of wild flora and fauna biodiversity. 19 wild fruiting plants, mainly dicotyledons (84.2%), were inventoried. In addition, Malvaceae, Meliaceae, and Urticaceae were the most abundant. Furthermore, the wildlife is dominated by mammals (76.9%) and Bovidae (27.5%). The integration of local wild edible fruit plants into agroforestry systems is the best solution to combat their disappearance in the Ubangi ecoregion in the face of traditional slash and burn agriculture.

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Table 1. Socio-demographic characteristics of respondents

Variables	Parameters	Percentage
Gender	Male	89.2
	Female	10.8
Age group (years)	20-30	12.2
	30-40	31.1
	40-50	33.8
	50 ≤	23.0
Marital status	Married	70.3
	Divorced	4.0
	Single	10.8
	Widowed	14.9
Education	University	6.8
	Secondary	42.9
	Primary	21.6
	Illiterate	29.7

Occupation	Agriculture	41.9
	Civil service	13.5
	Hunting and commerce	41.9
Neighborhoods of residence	Pangoma	10.8
	Kaya	41.9
	Moanda	10.8
	Lite	9.5
	Mbanza	27.0

Table 2. List of wild fruiting plants consumed by the fauna biodiversity in Ubangi eco-region.

Wild fruit plants			Wild animals	
Taxa [vernacular/local name]	Family	Life form	Taxa and local name	Family
<i>Musanga cecropioides</i> R.Br. ex Tedlie [Vonvo]	Urticaceae	Tree	<i>Civettictis civetta</i> (Schreber, 1776) [Civette]	Viveridae
<i>Myrianthus arboreus</i> P. Beauv. [Ngbolo, Ekomu]	Urticaceae	Tree	<i>Cecropithercus</i> spp [Singe, Likako]	Cercopithecidae
			<i>Sciurus</i> spp [Ecureil, Esende]	Sciuridae
			<i>Cricetomys gambianus</i> (Waterhouse, 1840) [Rat géant, Mopute]	Nesonyidae
<i>Landolphia</i> spp [Matonge, Pkan]	Apocynaceae	Climber	<i>Pan troglodytes</i> (Blumenbach, 1776) [Chimpanze, Von]	Hominidae
<i>Cola acuminata</i> (P. Beauv.) Schott & Endl. [Cola, Makaso, Lio]	Malvaceae	Tree	<i>Sciurus</i> spp [Ecureil, Esende]	Sciuridae
			<i>Cecropithercus</i> spp [Singe, Likako]	Cercopithecidae
			<i>Hystrix</i> spp [Porc-épic, Mboke]	Hystricidae
<i>Irvingnia</i> spp [Bolobolo]	Irvingiaceae	Tree	<i>Phacochoerus africanus</i> (Gmelin, 1788) [Sanglier, Sombo]	Suidae
			<i>Cricetomys gambianus</i> (Waterhouse, 1840) [Rat géant, Mopute]	Nesonyidae
			<i>Tragelaphus</i> spp [Antilopes, Ngandi]	Bovidae
			<i>Sylviacapra grimmia</i> (Linnaeus, 1758) [Céphalophes de grime, Kulupa]	Bovidae
<i>Aframomum</i> spp [Tondolo]	Zingiberaceae	Herb	<i>Kinixys erosa</i> (Schweigger, 1812) [Tortues, Koba]	Testudinidae
			<i>Thyonomys</i> spp [Aulocode, Simbiliki]	Thyomyidae
<i>Gilbertiodendron dewevrei</i> (De Wild.) J.Léonard [Godo]	Fabaceae	Tree	<i>Civettictis civetta</i> (Schreber, 1776) [Civette]	Viveridae
			<i>Cephalopus monticola</i> (Thunberg 1789) [Gazelle, Mboloko]	Bovidae
			<i>Tragelaphus</i> spp [Antilopes, Ngandi]	Bovidae

<i>Canarium sweinfurthii</i> Engl. [Be]	Burseraceae	Tree	<i>Sylviacapra grimmia</i> (Linnaeus , 1758) [Céphalophes de grime, Kulupa]	Bovidae
			<i>Cephalopus monticola</i> (Thunberg 1789) [Gazelle, Mboloko]	Bovidae
			<i>Tragelaphus</i> spp [Antilopes, Ngandi]	Bovidae
			<i>Buceros bicornis</i> (Linnaeus, 1758) [Calaos, Kata]	Bucerotidae
<i>Morinda morindoides</i> (Baker) Milne-Redh. [Kongo bololo]	Rubiaceae	Climber	<i>Kinixys erosa</i> (Schreber, 1776), [Tortues, Koba]	Testudinidae
<i>Mammea africana</i> Sabine	Calophyllaceae	Tree	<i>Cricetomys gambianus</i> (Waterhouse, 1840) [Rat géant, Mopute]	Nesonyidae
			<i>Hystrix</i> spp [Porc-épic, Mboke]	Hystricidae
<i>Megaphrynium macrostachyum</i> (K.Schum.) Milne-Redh. [Ngongo]	Maranthaceae	Herb	<i>Okapia johnstoni</i> (Sclater, 1901) [Okapi]	Giraffidae
			<i>Tragelaphus</i> spp [Antilopes, Ngandi]	Bovidae
<i>Treculia africana</i> Decne. ex Trécul [Pusa]	Moraceae	Tree	<i>Phacochoerus africanus</i> (Gmelin, 1788) [Sanglier, Sombo]	Suidae
			<i>Cephalopus monticola</i> (Thunberg 1789) [Gazelle, Mboloko]	Bovidae
			<i>Tragelaphus</i> spp [Antilopes, Ngandi]	Bovidae
<i>Elaeis guineensis</i> Jacq. [Mbulu, Mbila]	Aracaceae	Palm	<i>Sciurus</i> spp [Ecureil, Esende]	Sciuridae
			<i>Phacochoerus africanus</i> (Gmelin, 1788) [Sanglier, Sombo]	Suidae
			<i>Cricetomys gambianus</i> (Waterhouse, 1840) [Rat géant, Mopute]	Nesonyidae
			<i>Cecropithercus</i> spp [Singe, Likako]	Cercopithecidae
<i>Anonidium mannii</i> (Oliv.) Engl. & Diels [Mbombi yando]	Annonaceae	Tree	<i>Pan troglodytes</i> (Blumenbach, 1776) [Chimpanze, Von]	Hominidae
			<i>Civettictis civetta</i> (Schreber, 1776) [Civette]	Viveridae
<i>Carapa procera</i> DC. [Ngezo]	Meliaceae	Tree	<i>Hystrix</i> spp [Porc-épic, Mboke]	Hystricidae

<i>Manniophyton fulvum</i> Müll. Arg. [Kosa, Wi]	Euphorbiaceae	Tree	<i>Tragelaphus</i> spp [Antilopes, Ngandi]	Bovidae
			<i>Perodicticus potto</i> (Müller, 1766) [Potto de Bosman, Ebeya]	Loricidae
<i>Thomandersia hensii</i> De Wild. & T. Durand [Ngbanda]	Thomandersiaceae	Small Tree	<i>Okapia johnstoni</i> (Sclater, 1901) [Okapi]	Giraffidae

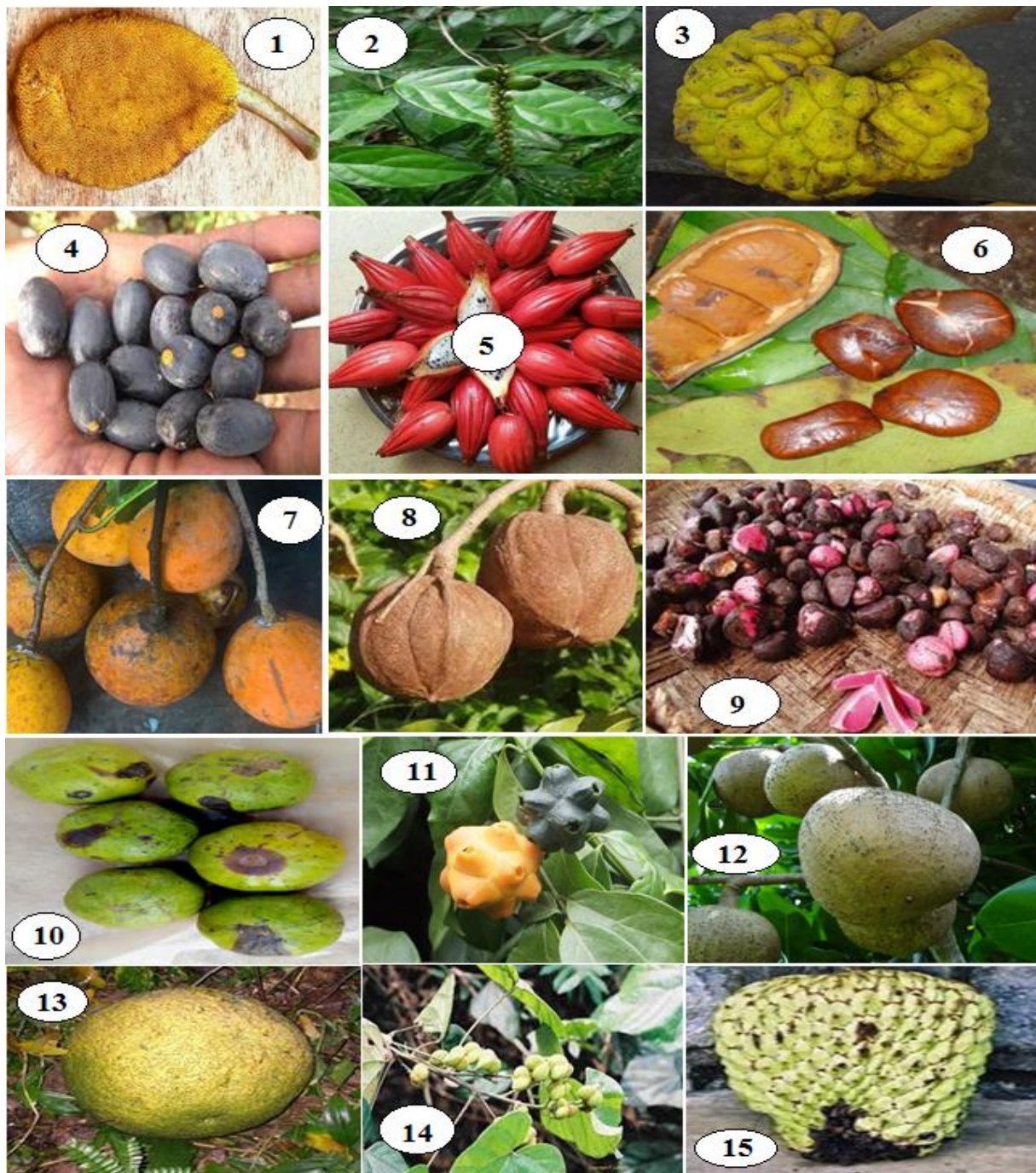


Figure 2. Fruit (s) of (1) *Musanga cecropioides*; (2) *Thomandersia hensii*; (3) *Myrianthus arboreus*; (4) *Canarium sweinfurthii*; (5) *Aframomum* spp.; (6) *Gilbertiodendron dewevrei*; (7) *Landolphia* spp.; (8) *Carapa procera*; (9) *Cola acuminata*; (10) *Irvingia* spp.; (11) *Morinda morindoides*; (12) *Mammea africana*; (13) *Treculia africana*; (14) *Manniophyton fulvum*; (15) *Anonidium mannii*.

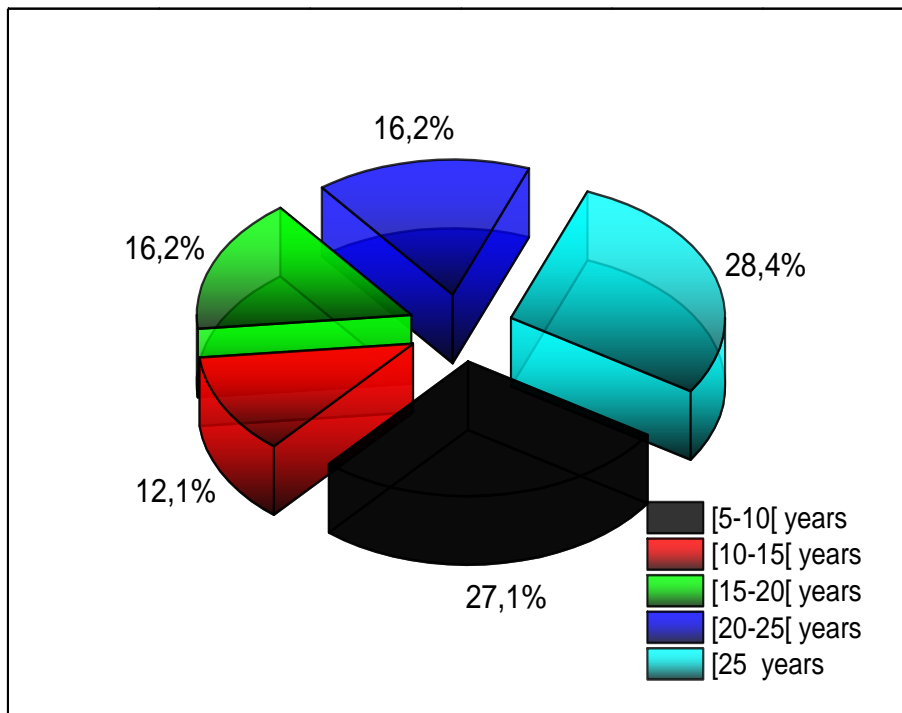


Figure 1. Hunting experience