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Diversity and variability of the diet of Walter's duiker (*philantomba walteri*, Bovidae Colyn, 2010) in the forests of southern Benin

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Abstract
Walter's duiker (*Philantomba walteri*) is endemic to the Dahomey Gap area. Very rare, and very hunted, its diet is very diversified. The objective of this research is to determine the composition of Walter's duiker diet in the forests of southern Benin. Observations using the linear transect method in the natural environment were made. In addition, individual questionnaires were sent to hunters, farmers, and forest agents in villages bordering the forests of southern Benin. Thus, twenty-nine (29) plant species divided into twenty genera and twenty-nine families have been recorded. The most represented family is the Euphorbiaceae with 5 species (*Mallotus oppositiliformis, Hymenocardia acida, Manihot esculenta, Alchornea cordifolia*). The diet of forest Walter's duiker South Benin is made up of Eight (8) types of plant organs for all 29 plant species consumed. It is mainly dominated by the leaves (29 species, 100%), the bark (72%), the fruits (27%), and the stems (24%) which constitute the most palatable organs. Regarding the chorology of palatable species, taxa from the Guinean-Congolese (GC) regions are the most palatable with a proportion of (20.68%). They are followed by taxa from the Sudano-Zambezi (SZ) and Pantropical (Pan) regions with each a proportion of (13.79%).Walter's duiker eats 58.62% dicot and 41.37% monocot. It, therefore, has a varied diet. It is therefore desirable to deepen research on the diet in order to propose a better habitat restoration method for this species. He, therefore, has a varied diet.
Keywords: Diversity, variability, diet, Walter's duiker, southern Benin

Introduction

Today, some species of mammals are now rare or endangered; this is essentially due to various anthropogenic pressures such as hunting, the reduction of ecosystem surfaces, the use of pesticides (insecticides and herbicides), the growing demand for living space around large cities (Sinsin, 2010) . These threats have reached such seriousness that some species risk disappearing if nothing is done to protect them (Giotto, 2010). These species include: duikers (DGFRN, 2004). Duikers are small antelopes of the family Bovidae and the subfamily Cephalophinae endemic to Africa (Haltenorth & Diller, 1985, Houngbégnon, 2018). They are among the most hunted species (FAO, 2010) and as such constitute an important protein source and income through the sale of their meat (Poulsen et al. 2009; Fargeot, 2013). However, hunting has a significant impact on many species (Delvingt et al, 2001; Laurance et *al.* 2006), including those once considered resilient to hunting pressure (Grande-Vega et al., 2016). Duikers include around twenty species, including species of the genus Ceplalophus, that of the genus Sylvicapra and the genus Philantomba (Diller, 1985; Houngbégnon, 2018). Duikers are herbivorous animals whose diet consists mainly of leaves, fruits, shoots, buds, bark and seeds. They sometimes manage to hunt birds or rodents and occasionally consume insects and carrion, which is quite exceptional for an ungulate. (Colyn, 2010). The different plant species whose fruits are eaten by duikers are from the Annonaceae, Burseraceae, Euphorbiaceae, Fabaceae, Myristicaceae, Rubiaceae and Sapotaceae families (Houngbénon, 2018).

Walter Duiker is present instead in the Dahomey Gap region, then in Togo, Ghana and Benin neighboring regions. Walter's duiker is a small antelope with a height of about 40 cm at the withers and a weight of 4 Kg to 6 Kg and the discovery of this species of duiker is surprising, because it is a group of widely studied animals (Colyn, 2010). However, Walter's duiker is not listed in the CITES Appendices internationally. It remains a Not Evaluated (NE) species on the IUCN Red List of Threatened Species (Colyn, 2010; Soniké, 2018). Although the Walter's duiker is now an officially recognized species, the taxonomic registers of the ITIS do not yet show this duiker in the genus Philantomba (Houngbégnon, 2018). Most data on this species is still lacking and the IUCN Red List does not yet list it in the database. (Colyn, 2010). In Benin, Walter's duiker is a little-known species (Soké, 2015). Nevertheless, it is under strong anthropogenic pressure. Walter's duiker is a rare species whose meat is very popular on the market according to respondents. Anthropogenic pressures on the extent of forest islands have driven animals away from areas where agricultural encroachment takes precedence over protected areas. The use of jaw traps (Soké, 2015). In southern Benin, there is a lack of endemic species promotion. Similarly, we are witnessing the non-valorization of species with special status for ecotourism

(P. Offio, 2020) In Benin, very few scientific studies have focused on Walter's duiker duikers. These studies only reported the presence of Walter's duiker in Benin. Hence the need to determine the diversity and variability of the diet of Walter's duiker (Bovidae, Colyn) in the forests of southern Benin. This study aims to determine the composition of the diet of the duiker in southern forests Benign.

Material and methods

Study environment

Starting from the coast of Benin (Atlantic Ocean) in Niger, Benin is subdivided into three phytogeographical zones (the Guinean Congolese zone, the Guinean-Sudanian transition zone and the Sudanian zone). The South of Benin which is the subject of this research corresponds to the Guinean or Subequatorial region of Benin. It starts from the coast of Benin to the latitude of Zagnanado. This area is subdivided into four phyto-districts. These are the coastal phyto-district, the phyto-district of Pobè, the phyto-district of the plateau, the phyto-distict of the Ouémé valley. The figure 1 show the localisation of Benin with Overview of Southern Benin (Fig. 1).

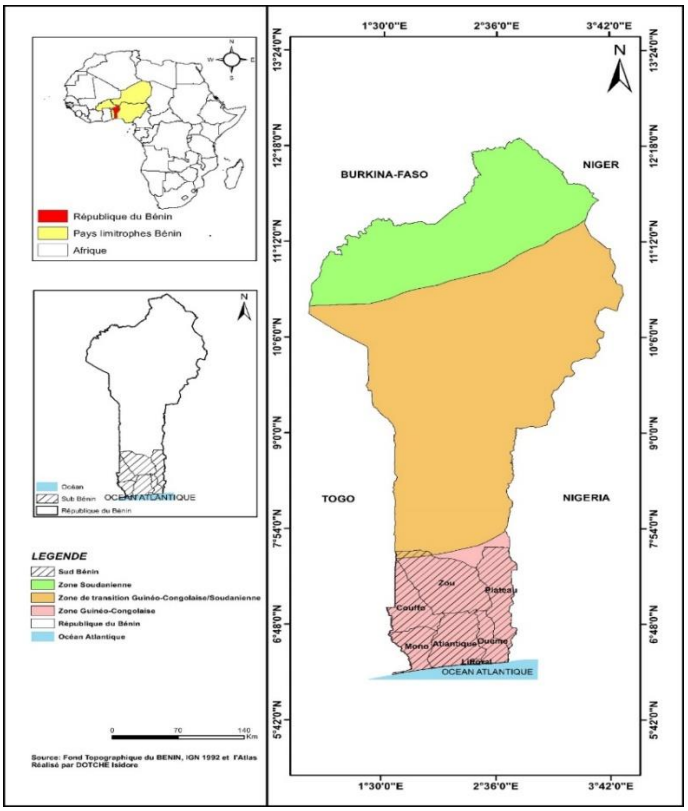

Fig. 1 Geographical localization of Benin with Overview of Southern Benin

Benin with the major phyto-geographical subdivisions the Guinean-Congolese zone the hatched study area at the bottom of the (figure 1), the Guinean-Sudanian transition zone and the Sudanian

zone that goes as far as Niger (Figure 1). The climatic nuance of southern Benin is of the subequatorial or Beninian type (Adam & Boko, 1993). The average annual temperature is 27.5°C. Based on the distribution of precipitation, there are two rainy seasons and two intercalated dry seasons. The first rainy season extends from March to June with a maximum in June and the second from September to November, with a maximum in October. The first dry season extends from July to August and the second, from December to March (Houndagba, 1984). The forest cover of this zone consists of dense semi-deciduous forests corresponding to the dry evergreen forest (Guineo-Congolese/Sudanian zone transition forest) of White (1983). Figure 2 illustrates the habitats of Walter's duiker in southern Benin.

Sacred Forest of Togbozoun in the Municipality of Adjohoun Note here the density of the sacred forest of Togbozoun with the Togbo stream which borders the forest

Note the monastery forest island at Hèkanmè (Zè) in the natural park of the Sitatunga valley with an abundance of lianas

Fig. 2 Walter's duiker habitats in southern Benin

The mammalian fauna in the southern part of Benin is composed of mammals, birds, reptiles, marine gastropods etc. Figure 3 illustrates the photo of the Walter's duiker who done object of this study.

Fig.3 Walter's duiker killed in Goulo near the protected forest of Djigbé (Commune of Zè).
Photo: Dotche Isidore, March 2022

Southern Benin, which represents only 10% of the national territory, includes at least 50% of the Beninese population with densities rarely lower than 150 inhabitants per km². This area, which has become the most urbanized in the territory, is characterized by a large population estimated at more than half of Benin's population of approximately 5.5 million (INSAE, 2013).

Data collection methods

In order to collect reliable information, an exploratory survey was carried out among hunters and other socio-professional categories of the populations bordering the forests of southern Benin, to apprehend the degree of knowledge of the populations on Walter's duiker. The choice of villages is based on proof of evidence (footprints, droppings, and feces) of the presence of Walter's duiker reported during the exploratory survey phase. 34 villages located around the forests of southern Benin were surveyed. Thus, 10 people were randomly selected around each site to prospect. The size N of the study sample is determined by the Dagnelie formula (2011):

$$N = \frac{U^2_{(\alpha-1/2)} \times P(1-P)}{d^2}$$

Where N is the total number of people surveyed.

$U_{(1-\alpha/2)}$ is the normal distribution value for a value of 1.96 at a significance level $\alpha = 0.05$;

P is the proportion of individuals with knowledge of the Walter's duiker and holding information related to its various hunting techniques. For this study, the authorized margin of error d is retained at 8%.

A total of 340 people from different ethnic groups, genders and socio-professional categories were interviewed (Table 1). The questions asked during the interviews essentially concerned the presence of the Walter's duiker, whether it is hunted and the means used to hunt it.

Table 1. presents the forests and their geographical locations (cities/municipalities).

Chosen site	**Villages / Town**
Bahazoun island forest	Lanzron /Zinvié
Ninkouizoun island forest	Ninkouin / Zè
Monastère forest	Hèkanmè/ Zè
Houédota forest	Houédota / Zè
Ahounssè island forest	Ahounssè / Zè
Djigbé Protected forest	Djigbé / Zè
Gnanhouizoumè sacred forest	Gnanhouizoumè / Bonou
Niaouli classified forest	Attogon/ Allada
Togbozoun sacred forest	Togbota
Vazoun sacred forest	Gla/ Adjohoun
Bamèzoun sacred forest	Bembè/ Aguégués
Igbo-itché protected forest	Pobè
Ahozon forest	Ouidah/ Pahou
Lama protected forest	Têgon

Observations were also made using the line transect method

From December 2019 to February 2020 and April to June 2020 and November to December 2021, January and February 2022, the forests of southern Benin were surveyed in search of traces, food remains, signs of the presence of Walter's duiker (footprints , hair, droppings) in order to monitor it. The prospecting periods correspond to the dry periods and the beginning of the rainy seasons or, according to the local hunters, we have the chance to observe the animal. Walks (4 km) following a precise azimuth (North-South) of the chosen sites while noting information relating to the animal's diet was made.

Data analysis

The database thus constituted allowed us to know not only the specific richness but also the number of species eaten by the family. In addition, the data obtained allowed us to calculate the frequencies of the distribution of organs consumed by Walter's duiker, the morphology of the species consumed by Walter's duiker, the life forms of plant species palatable by Walter's duiker, the chorology of plant species palatable by Walter's duiker and types of plant species palatable to Walter's duiker.

To analyze the data, the citation frequencies of:

- Distribution of organs consumed by Walter's duiker

FC1=n/N x 100

With n: number of respondents on Walter's duiker organ consumed and N: total number of organs consumed.

- Morphology of species consumed by Walter's duiker

FC2=n/N x 100

With n: citation of an organ and N: total number of organs.

- Life forms of plant species palatable to Walter's duiker

FC3=n/N x 100

With n: quote of a number of life and N: total number of life form.

- chorology of plant species palatable to Walter's duiker

FC4=n/N x 100

With n: number of species according to geographical distribution and N: total number of people surveyed who mentioned the species.

- Class of forages in the diet of Walter's duiker

FC5=n/N x 100

With n: number of people who responded to forage classes and N: total number of people surveyed who mentioned a species.

Results

Wealth and diversity of plant species palatable by Walter's duiker in southern Benin forests

In the forests of southern Benin, Walter's duiker appeals to a diversity of species for its diet.

Table II: Plants, families, and parts palatable by Walter's duiker.

N°	Nom localAizo, Fon	Nom scientifique	Famille
1	Yankplébo/Mitin	*Olaxsubscorpioiidae*	Olacaceae
2	Hèountin	*Zanthozullum zanthoxilloides*	Rutaceae
3	woko	*Panicum maximum*	Poaceae
4	Glovikan	*Dismodium scorpiurus*	Leguminoseaepapillionoidae
5	Atokouékoué	*Uvariachameae*	Annonaceae
6	kanmlinman	*Alchornia cordifolia*	Euphorbiaceae
7	kissekisseman	*Mallotus oppositifolius*	Euphorbiaceae
8	toflo	*Cussonia arboréa*	Araliaceae

9	Tounglé	*Ethulia conizoides*	Asteraceae
10	Amanvivèzounmè ton	*Vernonia pauciflora*	Asteraceae
11	Assunssun	*Dialium guineense*	Leguminoseae-
12	Akouéman	*Culcasia scandens*	Araceae
13	Amanvivèhouéton	*Vernonia guineensis*	Asteraceae
14	Fontin	*Vitex doniana Sweet*	Verbenaceae
15	Manioc	*Manihot esculenta*	Euphorbiaceae
16	Févi	*Abelmochus esculentus*	Malvaceae
17	Azin	*Arachis hypogeae*	Fabaceae
18	Takin/ Atakin	*Capsicum annuum*	Solanaceae
19	Glin	*Colocasia esculenta*	Araceae
20	Ninnouwizounmè ton	*Corchorusoliturius*	Tiliaceae
21	Agbadé	*Zea mais*	Poaceae
22	Aikoun/Aivi	*Vigna ambacensis*	Fabaceae
23	Wèli man	*Ipomoae babatas*	Convolvulaceae
24	Tévi	*Diascorea alata*	Diascoréaceae
25	Allotin	*Uapacaheudelotii*	Euphorbiaceae
26	Kinkountin	*Psidiumgua java L.*	Myrtaceae
27	Détin	*Elaeis guineensis*	Arecaceae
28	Mangatin/Amangatin	*Mangifera indica*	*Anacardiaceae*
29	Sodja man	*Hymenocadia acida*	Euphorbiaceae

Table 5 shows that the specific richness R of palatable species is R =29. Walter's duiker feed on forest species, field species, plantation species and field crops research. These 29 species have been divided into Twenty-nine (29) genera and Twenty (20) families. These forest species are however the main wild plant species constituting food resources for duikers in the area. The figure 4 shows photos of some plant species eaten by Walter's duiker in the forests of southern Benin.

Culcasia scandes in the Togbozoun sacred forest (Adjohoun)

Deinbollia pinnata in the Gnanhouizounmè sacred forest (Bonou)

Zantozyllum zantosolloides the Djigbé protected forest (Zè)

Panicum maximum the Bahazoun island forest at Lanzron in the Sitatunga valley (Abomey-Calavi)

Fig. 4some plant species eaten by Walter's duiker

These palatable species have been divided into genera and families.

Distribution by family of species palatable to Walter's duiker in the forests of southern Benin

The knowledge of the twenty-nine plant species palatable by Walter's duiker with the respondents allows us to know the number of palatable species per family. Figure 5 shows the number of palatable species per family.

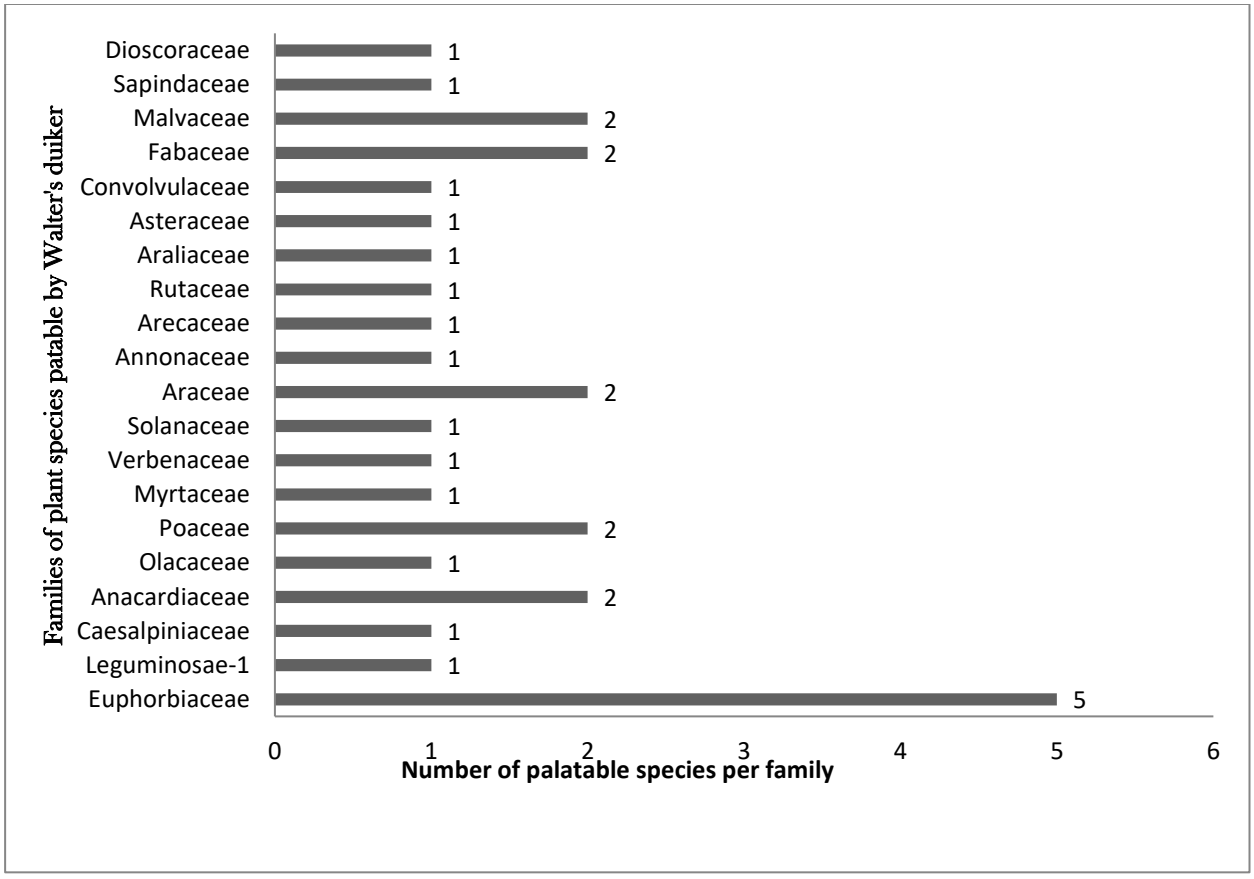

Fig . 5 Number of palatable species per family

The diet is dominated by 29 plant species. They are divided into 29 genera and 20 families. The most represented families are Euphorbiaceae with 5 species (*Mallotus oppositiformis*, *Hymenocardiacida*, *Manihot esculenta*). They are followed by Araceae (*Culcasia scandes*, *Collocacia esculenta*), Malvaceae (*Hibiscus sabdorifa*, *Abelmochus*), Fabaceae, Poaceae (*Panicum maximum*, *Zea mays*) represented with each two (2) species, finally come the other families including Olaceae, Cesalpiniaceae, Myrtaceae, Asteraceae, Rutaceae, Sapindaceae, Anonaceae represented by one (1) species

Diversity of plant organs consumed by Walter's duiker in the forests of southern Benin

Several plant organs are palatable to Walter's duiker in the forests of southern Benin. Figure 6 illustrates the distribution of plant organs consumed by Walter's duiker.

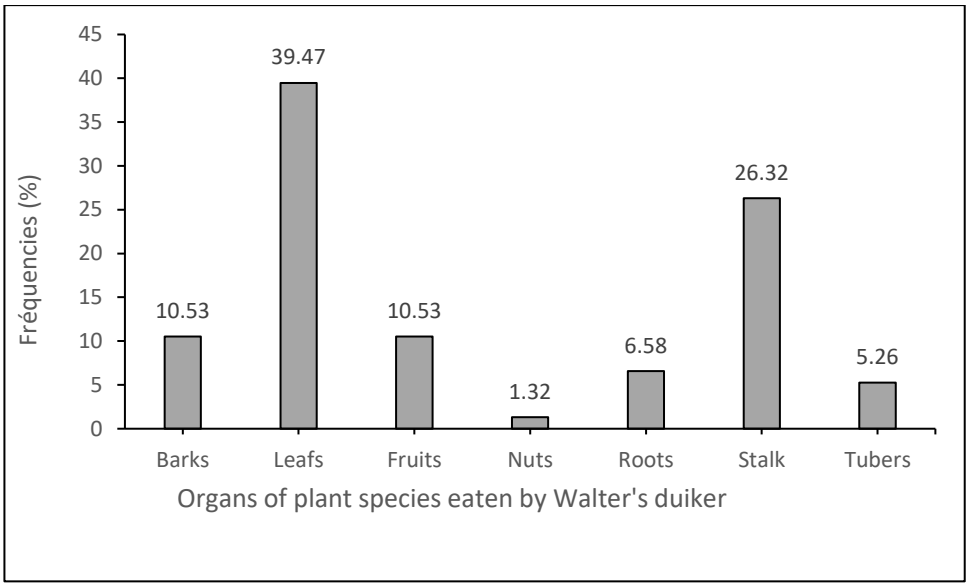

Fig . 6 Histogram of distribution of organs consumed by the Walter's duiker

The diet of Walter's duiker from the forests of southern Benin consists of eight (8) types of plant organs (Figure 5) for all 29 plant species consumed. It is mainly dominated by the leaves (29 species, 100%), the barks (72%), the fruits (27%), the stems (24%) which constitute the most palatable organs. Next come roots (13%), tubers (13%), seeds and nuts respectively (6%) and (3%) which constitute the types of organs least consumed by the Walter's duiker.

Morphology and area of distribution of the flora of the diet in the forests of southern Benin

The flora of the diet of the Walter's duiker of the forests of southern Benin presents several forms. Figure 7 illustrates the diet morphology proportions of Walter's duiker

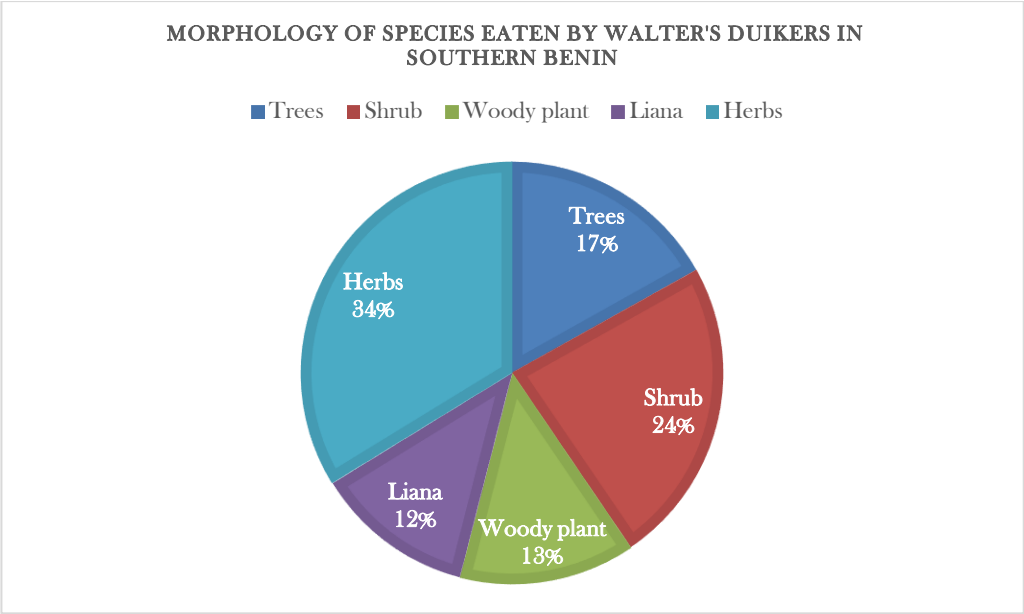

Fig. 7 Morphological spectrum of species consumed by Walter's duiker in the forests of southern Benin

To know the variability of the diet of this animal species, the life forms of palatable species were determined.

Biological spectrum of palatable species by Walter's duiker in the forests of southern Benin

The biological spectrum of the species palatable by Walter's duiker is represented by figure 8

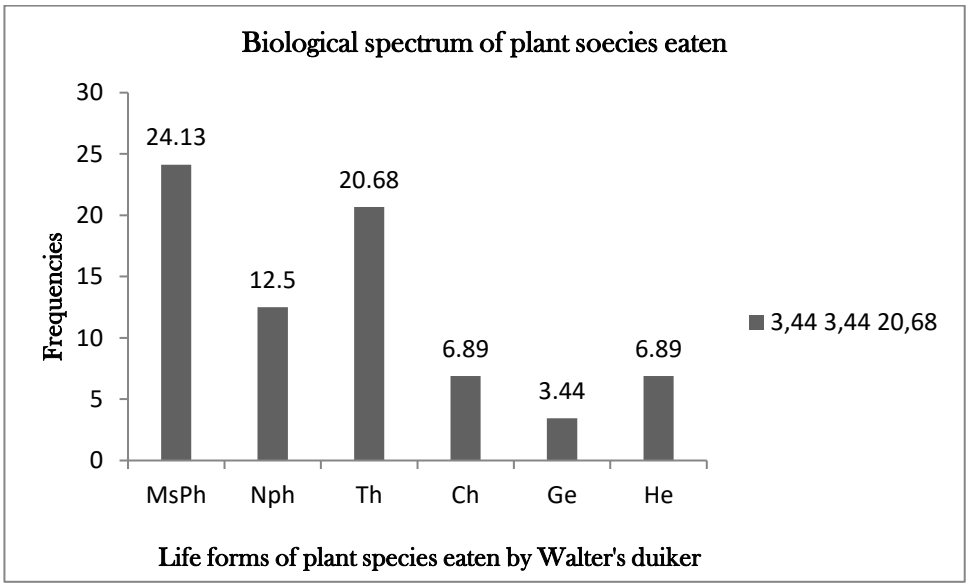

Fig. 8 Biological spectrum of plant species palatable to Walter's duiker in the forests of southern Benin

From this figure, it appears that mesophanerophytes are the most represented life forms with a proportion of (24.13%). They are followed by therophytes with a proportion of (20.68%), Nanophanerophytes (12.5%). chamephytes and hemicriptophytes with a proportion of (6.89%) and finally come geophytes with a proportion of (3.44%) To know the variability of the diet of this animal species, the chorology of palatable species were determined.

Distribution area of plant species palatable by Walter's duiker in the forests of southern Benin

To know the variability of the diet of this animal species, the chorology of palatable species were determined. The figure illustrates the Chorological spectrum of plant species palatable by Walter's duiker in the forests of southern Benin.

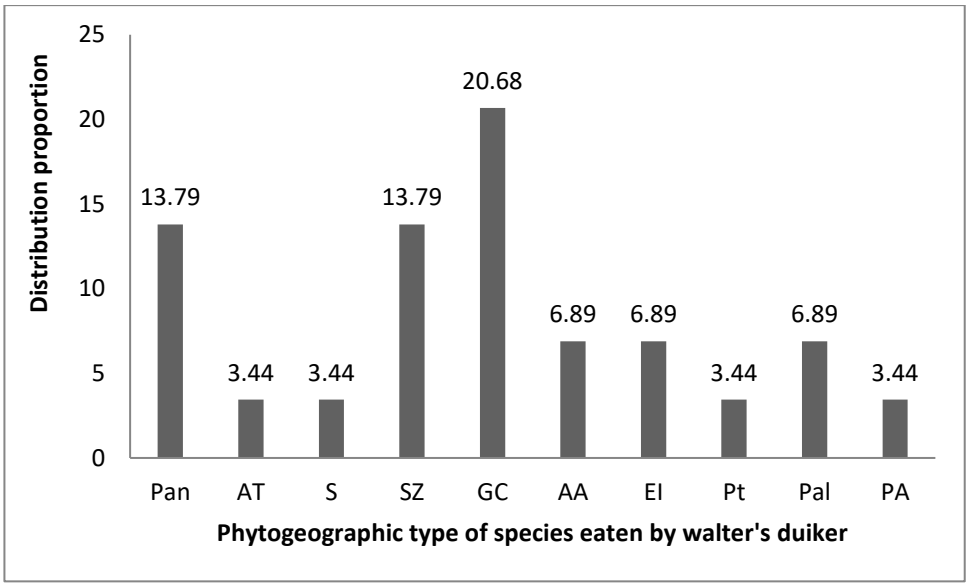

Fig .9 Chorological spectrum of plant species palatable to Walter's duiker in the forests of southern Benin

From this figure, it appears that the taxa of the Guinean-Congolese regions are the most palatable with a proportion of (20.68%). They are followed by the taxa of the Sudano-Zambezi (SZ) and Pan tropical (Pan) regions with each a proportion of (13.79%), after come the taxa of the African-American regions (AA), the introduced species (EI), the taxa of the regions (Pal) with a proportion of (6.89%) finally come the taxa of the Sudanian regions (S), the taxa of the Afro-tropical regions (AT), the pantropical ones (Pt), the (PA) with a proportion of (3.44%). Walter's duiker appeals to several categories of plants.

Classes of fodder in the diet of Walter's duiker in the forests of southern Benin

The walter's duiker is palatable to several classes of forage. Figure 10 presents the forage class in terms of its diet.

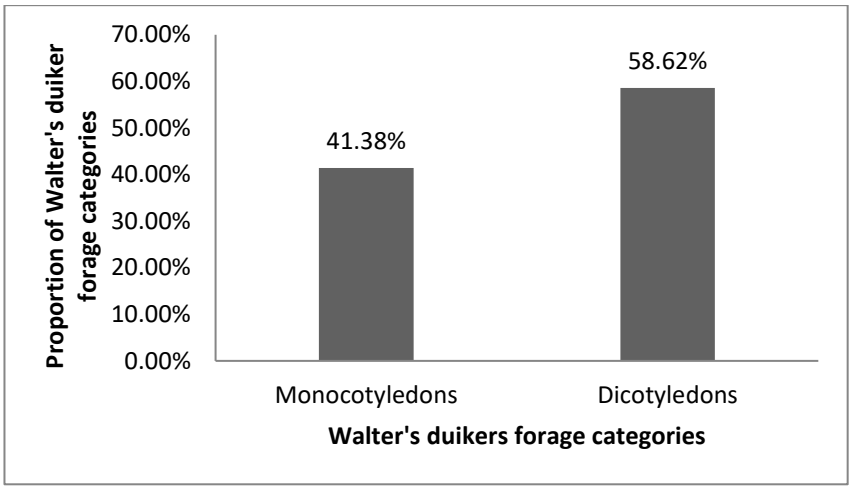

Fig . 10 Proportion of forage class in the diet of Walter's duiker in the forests of southern Benin

From the figure 10, it appears that Walter's duiker eats 58.62% dicots and 41.37% monocots. Walter's duiker has a rich and diversified diet. This diet varies from season to season depending on the availability and quality of food (Massemin, 1992). It consumes dicots as well as monocots but its diet is dominated by dicots (*Hymenocardi acida*), *Culcasia scandes, Collocacia esculenta Dembolipinata* etc).

Correlation between species and palatable organs by Walter's duiker

A correlation made between species and organs shows that for a species, several organs can be consumed. Figure 11 shows the number of species consumed in relation to the organ.

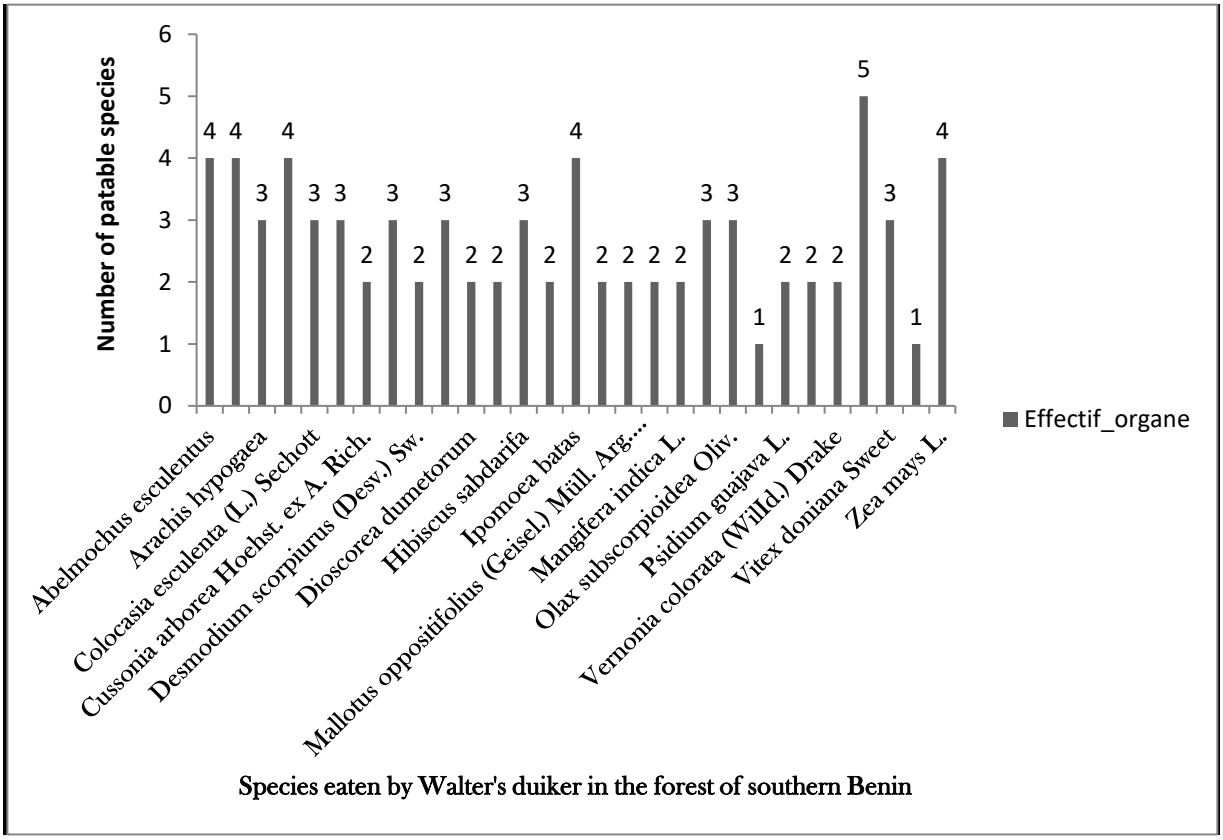

Figure 11. Relative proportions of plant species in the diet of Walter's duiker

Source: Survey results and laboratory work, 2021 and 2022

From this figure, it appears that Walter's duiker consumes 5 organs of *Vigna amambacensis*, 4 organs of *Abelmochus esculentus*, 4 organs of *Arachis hypogaea*, 4 organs of *Ipomea batatas*, 4 organs of *Zea mays*, they followed plants of which three organs are consumed such as *Colocasia esculenta*, *Vitex doniana*, *Hibiscus sabdarifa*, *Deinbollia pinnata*, *Culcasia scandens*. Finally come the other species represented by 2 organs and 1 organ.

Correlation between organs and species palatable by Walter's duiker

A correlation made between the organ and the species shows that for a species several organs can be consumed. Figure 12 shows the number of species consumed in relation to the organ.

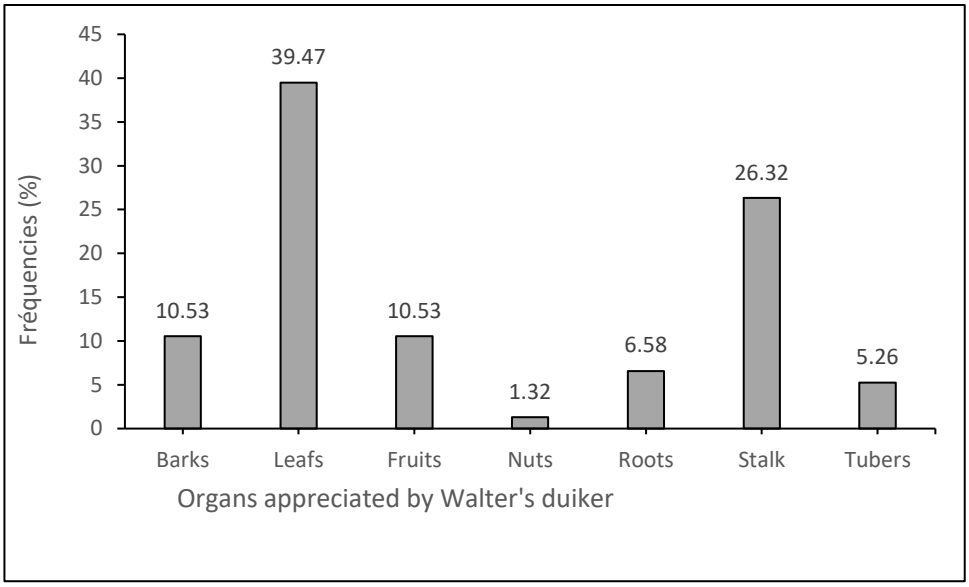

Figure 12. Relative proportions of organs appreciated by Walter's duiker

Source: Survey results and laboratory work, 2021 and 2022

From this figure, it appears that the leaves are the most consumed parts with 39.47%, they are followed by the stems (26.32%), the barks, and the fruits (10.53%). Next, come roots and tubers with a proportion of less than 7%. Note that seeds (corn, and beans, are cited with a proportion of less than 0.5%).

Discussion

Walter's duikers are small mammals found in Benin. Twenty-nine (29) species of plants are palatable by Walter's duiker in the forests of southern Benin during this research. These 29 species have been divided into twenty-nine (29) genera and twenty (20) families. These forest species, fields, and plantations are, however, the main wild plant species constituting the food resources of Walter's duikers in the study area. These results are similar to those of Offio (2018) who, by assessing the diversity of mammalian fauna in southern Benin, also found that antelopes eat a diversity of plant species including field species, crop species, and forest species. Walter's duiker is a species of antelope found in southern Benin. She has a rich and diverse diet. This diet varies from season to season depending on the availability and quality of food (Massemin, 1992). It consumes dicots as well as monocots but its diet is dominated by dicots (Hymenocardi acida), *Culcasia scandes, Collocacia esculenta Dembolia pinata* etc). These results confirm those of Kidjo, 2011 who study the diet of antelopes (*Tragelaphus spekei*) in the Sitatunga valley, which showed that *Tragelaphus spekei* consumes both monocotyledonous and dicotyledonous species. However, broadleaf weeds are the most palatable to antelopes (*Tragelaphus spekei*).

Walter's duiker is an ungulate present in the forest of southern Benin. Its diet consists of Eight (8) types of plant organs for all 29 plant species consumed. It is mainly dominated by the leaves (29 species or 100%), the bark (72%), the fruits (27%), the stems (24%) which constitute the most palatable organs. Next come roots (i.e. 13%), tubers (13%), roots, seeds and nuts respectively (i.e. 6%) and (i.e. 3%) which constitute the type of organ least consumed. by the *Philantomba walteri*. These results corroborate those of Djègo-Djossou, 2013 who, by assessing the diet of *Colobus vellerossus* in the sacred forest of Kikélé, identified a diversity of items, namely leaves, fruits, seeds, flowers, buds, petioles, bark, the stems belonging to several plant species. Leaves and fruits contributed over 90% of the species' diet while buds, stems, flowers, petioles, seeds and bark accounted for less than 10%.

Clearly, observations in the forests of southern Benin and interviews in the localities bordering the forests made it possible to appreciate the diversity and variability of the diet of the Walter's Duiker in the forests. The Walter's duiker feed on forest species, field species, plantation species, and field crops. Twenty-nine (29) plant species divided into twenty genera and twenty-nine families have been identified. The most represented family is the Euphorbiaceae with 5 species including (*Mallotus oppositiformis, Hymenocardia acida, Manihot esculenta*). The diet of Walter's duiker from the forests of southern Benin consists of plant organs for all 29 plant species consumed. It is dominated mainly by the leaves (29 species), the barks, the fruits, and the stems which constitute the most palatable organs. Then come the roots, the tubers, the roots, the seeds and the nuts which constitute the most palatable type of organ less consumed by Walter's duiker. Moreover, Walter's duiker attracts several life forms. Mesophanerophytes are the most represented life forms. They are followed by therophytes, Nanophanerophytes, Chamephytes, Hemi cryptophytes and finally geophytes.

Regarding the chorology of palatable species, taxa from the Guinean-Congolese (GC) regions are the most palatable. The walter's duiker has a rich and diversified diet. This diet varies from season to season depending on the availability and quality of food. They consume dicots as well as monocots, but their diet is dominated by dicots (*Hymenocardi acida*), *Culcasia scandes, Collocacia esculenta Dembolia pinata,* etc. These forest species are, however, the main wild plant species constituting the food resources of Walter's duikers in the southern Benin zone. The conservation of this still little-known mammal (Walter's duiker) therefore requires the implementation of a conservation program for better protection of the species. For this, it is necessary: to deepen the present study in order to better assess the conservation of Walter's duiker, through the axes of strategies based on regular monitoring of their habitat, to carry out a

study of the droppings of this newly described endemic species in order to restore habitats in perpetual fragmentation, raising awareness on the protection of the species and a dashboard of indicators such as: the size of the population, the variation in threats, its distribution over the next ten years (2022/2032); Carry out the count at least once a year in order to monitor the dynamics of Walter's duiker in the forests of southern Benin. This will undoubtedly guide choices for the conservation and protection of the species; Create activities for hunters to reduce their dependence on hunting; strengthen surveillance in the preferred areas (dense habitat) of Walter's duiker by creating surveillance teams within localities bordering forests. These teams will be trained by those responsible for monitoring biodiversity with whom it is necessary to define transition periods to verify the effectiveness and efficiency of the actions. ; Consider breeding water bushbuck in captivity for future reintroduction into the wild.

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References

Boko, M. (1993). Le Bénin. Edition du flamboyant, Cotonou, 95 p.

Colyn, M., Hulselmans, J., Sonet, G., Oudé, P., Winter, J., Natta, A., Nagy, Z., & Verheyen, E. (2010). Discovery of a new duiker species (Bovidae: Cephalophinae) from the Dahomey Gap, West Africa. Zootaxa, **2637**, 1-30.

Dagnelie P. (2011). Statistique théorique et appliquée : Inférence statistique à une et à deux dimensions. Tome 2. De Boek, Belgium.

FAO (2010). Prise en compte de la biodiversité dans les concessions forestières d'Afrique centrale. Document de travail sur la biodiversité forestière, n°1. Rome

Fargeot, C (2013). La chasse commerciale en Afrique centrale : une menace pour la biodiversité ou une activité économique durable ? Le cas de la république centrafricaine. Thèse de doctorat : Université Paul Valéry, Montpellier (France).

Giotto, N. (2011). Eco-éthologie et conservation du beira (*Dorcatragus megalotis*) en république de Djibouti. Thèse de doctorat, Ecologie, Biodiversité et Evolution, Université de Toulouse III.

Grande-Vega, M., Farfán, MA, Ondo, A., & Fa, J. (2016). The decline in hunter offtake of blue duikers in Bioko Island, Equatorial Guinea. Afr. J. Ecol., 54, 49-58.

Houngbégnon, F. (2018). État des connaissances sur les céphalophes (genres *Cephalophus* et *Philantomba*) des forêts denses humides d'Afrique centrale (synthèse bibliographique). *Biotechnol. Agron. Soc. Environ.,* 23 (2), 1-21.

INSAE (2013). Recensement Général de la Population et de l'Habitat.

Kidjo, C., Lougbegnon, T., Djossa, B., Oumoroum, Codjia, JC & Sinsin, B. (2011). Caractérisation phyto-écologique de l'habitat du *Tragelaphus spekei gratus* (Sclater, 1864), sitatunga, dans la partie méridionale du Bénin. *Int. J. Biol. Chem. Sci*. 5(4): 1603-1618.

Kidjo, C., Djossa, B., Houngbedji, M., Lougbegnon, T., Codjia, JC & Sinsin, B. (2011). Ecologie alimentaire du Sitatunga (*Tragelaphus speckei*, Sclater, 1864) dans les sites Ramsar du Sud-Bénin. *Int. J. Biol. Chem. Sci.* 5(2): 603-617.

Kidjo FC (2011). Distribution, Ecologie et Stratégies de Conservation du Sitatunga (*Tragelaphus spekei*, Sclater, 1864) au SUD-BENIN (Thèse de doctorat. Abomey-Calavi, FLASH – UAC).

Mallon, DP, Hoffmann, M., Grainger, MJ, Hibert, F., van Vliet, N., & McGowan, PJK (2015). Analyse de situation de l'UICN concernant la faune terrestre et d'eau douce en Afrique centrale et de l'Ouest. Document occasionnel de la Commission de la sauvegarde des espèces de l'UICN nº 54. Gland, Suisse et Cambridge, Royaume-Uni : UICN.

Offio, P. (2018). Forêts et communautés : Diversité biologigue au niveau des forêts communautaire de la vallée de Sitatunga. Mémoire de Master, Université d'Abomey-Calavi, Bénin, 75p.

Poulsen, JR, Clark, CJ, Mavah, G. & Elkan, PW (2009). Bushmeat supply and consumption in a tropical logging concession in Northern Congo. *Conserv. Biol*., 23, 1597-1608.

Sinsin, B. & Kampmann, D. (eds). (2010). Atlas de la Biodiversité de l'Afrique de l'Ouest. Tome I: Bénin, Cotonou & Frankfurt/Main.

Soké, G. (2015). Etude diagnostique du Centre Régional de Recherche et d'Education pour un Développement Intégré et cartographie de la répartition du *Philantomba walteri* (Bovidae, Colyn) dans la Vallée du Sitatunga. Mémoire de Licence Professionnelle en Sciences Agronomiques, (ENSTA /Kétou).