Inventory of Endogenous Knowledge and Ethnobotanical Use of Orchid's in the Southern Zone of the Togo Mountains

***Sodjinou[1] K. Edjèdu, Adjonou[1] Kossi, Etse[1] K. Djidjolé, Johnson[1] Benziwa N., Gueye[2] Mathieu, Radji[1] A. Raoufou, Quashie[1] A. Marie-luce, Kokou[1] Kouami**

1- Forestry Research Laboratory (LRF), Faculty of Sciences, University of Lomé, BP: 1515 Lomé-Togo, West Africa

2- Botany Laboratory, UMI 3189, Environment, Health and Society, Institut Fondamental d'Afrique Noire, Université Cheikh Anta Diop, Dakar, Senegal

Corresponding author:* sodjinouedjedu@gmail.com

Key words: Orchids, ethnobotany, medicinal plant, endogenous knowledge, Togo

Submitted 30/01/2025, Published online on 30th April 2025 in the *Journal of Animal and Plant Sciences (J. Anim. Plant Sci.) ISSN 2071 – 7024*

1 ABSTRACT

In Togo, wild orchids are constantly harvested in an unregulated way for local traditional medicine, medicinal magic and for horticulture. The present study aims to identify the diversity of wild orchid species used in traditional medicine, and then capitalize on endogenous knowledge for a better valorisation and sustainable management of Orchidaceae in the southern zone of the Togo Mountains. An ethnobotanical survey by direct interviews based on a semi-structured questionnaire was carried out in 18 villages of the zone, with 152 traditional healers and herbalists. 12 species of orchids used in traditional medicine in the forest zone were reported. 80% of the ethnic groups surveyed use Orchidaceae in traditional medicine, medicinal-magical, cultural, as ornamental plants and for veterinary use. The treatment of malaria, rheumatism, anaemia, headache, hallucinations, protection are among other areas of recurrent use. The parts used in the preparations range from leaves (24%) to the whole plant (57%). *Calyptrochilum christyanum* is the most used orchid with a usual value, VU = 0,28. This work widens the perspectives of research on molecules and active principles contained in Orchidaceae with proven pharmacological values.

2 INTRODUCTION

Orchidaceae is one of the most diverse plant families in the Angiosperms (Chase *et al.*, 2015; Willis 2017; Michael 2018). This family is among the most prized ornamental plants in the world. Apart from their known ornamental character, Orchidaceae are also sought after for their medicinal use. Indeed, in traditional medicine systems, several species of this family are reported as aphrodisiac plants (Nayak *et al.,* 2005; Wilson, 2007; Hossain, 2011) and several authors note the presence of alkaloids, flavonoids, stilbenoids and triterpenoids that are highly sought after in phytochemistry and pharmacology (Simmler *et al.*, 2010; Ramos *et al.* 2012; Chen *et al.,* 2013; Cakova, 2013). Several studies from around the world have documented the therapeutic role played by Orchidaceae (Bulpitt, 2005; Jalal *et al.,* 2008; Singh *et al.,* 2009, Acharya, 2010; Hossain, 2011; Menzepoh, 2011; Tiwari *et al.* , 2012; Pant, 2013; Subedi *et al.*, 2013; Assédé *et al.,* 2017). With the goal of enhancing the valorization and sustainable management of natural resources in Togo, numerous studies have been conducted on medicinal plants (Gbogbo *et al.,* 2006; Karou *et al.,* 2011; Koudouvo *et al.*, 2011; Tchacondo *et al.,* 2012;

Hoekou *et al.*, 2013; Titikpina *et al.*, 2013; Gbekley *et al.*, 2015; Afanyibo *et al.*, 2018). In horticultural and cosmetic plants (Radji, 2010; Péréki *et al.*, 2012; Radji *et al.*, 2014), as well as wild vegetables and food plants (Batawila *et al.,* 2007; Akpavi *et al.,* 2008; Akpavi *et al.*, 2011). However, Orchidaceae with medicinal values have not been sufficiently explored and the literature remains silent regarding medicinal Orchidaceae from the southern zone of the Togo Mountains. Yet, this area is the most prolific in terms of Orchidaceae diversity in Togo (Sodjinou *et al.,* 2019b). Therefore, this study aims to contribute to an inventory of indigenous knowledge and the sustainable management of medicinal orchids in the southern region of the Togo Mountains.

3 MATERIALS AND METHODS

3.1 Geographic scope of the study :

Designated by Ern (1979) as Ecological Zone IV (EZ4), the area of the present study is located in the southern part of the Togo Mountains between 6°15 and 8°20 North latitude and 0°30 and 1°00 East longitude. With an area of 4620 km2 (Figure 1), it is bounded to the south and east by Ecological Zone III (Central Plains Zone), to the north by Ecological Zone II (Northern Mountains Zone), and to the west by Ghana. Figure 1: Geographic setting of the study and locations surveyed

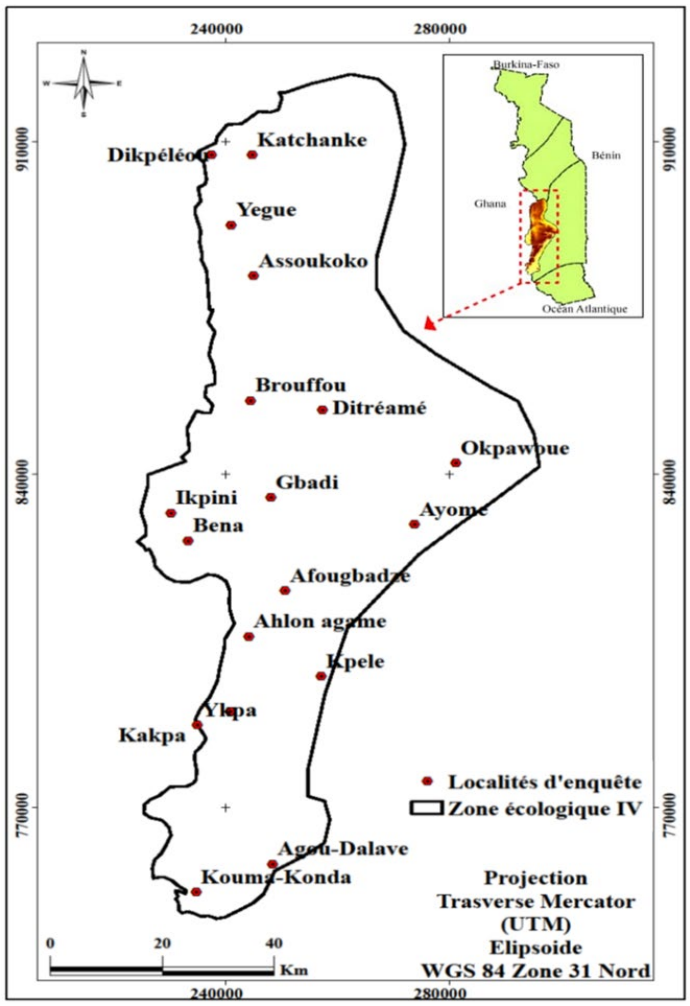

Figure 1 : Location of the study area and prospected locations

3.2 Ethnobotanical data collection : From March 2019 to December 2020 an ethnobotanical survey was conducted among 152 traditional healers, in 18 villages in the southern zone of the Togo Mountains through direct interviews using a semi-structured questionnaire and by focus group (Figure 2). First, the objective of the study was explained to local authorities in order to obtain their agreement in principle (Uprety *et al.*, 2012). Thus, with the help of the local authorities, a sample was selected in which only traditional healers, medicine men or herbalists with specific knowledge were intentionally selected to provide information on the uses of Orchidaceae. The selected traditional healers or herbalists are then informed about the objectives of the study and the importance of the information they are asked to provide. This approach is used to obtain their consent to participate in the study (Gbekley *et al.,* 2015). The information collected concerns: a) the identity of the respondents (age, gender, ethnicity), b) the specific diversity of Orchidaceae used, c) the local names of these species and the organs used for treatment; d) the diseases treated with Orchidaceae or other forms of use of this plant family in the locality. To facilitate species recognition and obtain the above information, and to avoid errors and confusion of species names, a list of samples accompanied by their herbarium from the collections in the study area is presented to the respondents.

Figure 2: Ethnobotanical focus group surveys

3.3 Species identification : Samples of collected species are stored at the national herbarium of the University of Lomé and their identification was done by comparison with the specimens available in this institution. Taxonomy was confirmed using data available on the International Plant Names Index (IPNI) website http://www.ipni.org/; GBIF (www.gbif.org) and www.orchid-africa.net

3.4 Data analysis and processing : The data collected through the ethnobotanical survey was entered and processed in Excel 2016 which provided standardized data on the uses attributed to each species mentioned, the parts used, local names as well as the frequency of use. The assessment of ethnobotanical knowledge was based on the calculations of use value indices (Adjéya *et al.,*2015, Gbekley *et al.,*2015, Garba *et al.,*2019) which are:

- The number of reported uses for plant part (RUplant part);
- The total number of reported uses for the plant (RU) is equal to the sum of reported uses per plant part RU = Σ RUplant part.
- The usual value (VU) according to the following formula. VU= RU/n Where n = total number of registered receipts.

The species composition of Orchidaceae was determined by counting the number of species and genera recorded.

4 RESULTS

4.1 Socio-demographic data of traditional healers: The present study was conducted among 152 traditional healers and healers, 109 (71.7%) of whom were male and 43 (28.3%) female. Their average age was 47.72±13.97 years, with a minimum of 23 years and a maximum of 85 years, distributed among 10 ethnic groups. The ethnic groups surveyed were, in descending order, the Ewe (24%), the Akébou (17%), the Akposso (13%), the Tèm (11.7%) and the Kabyè (11%). Table 1 presents the sociodemographic profile of the respondents. The respondents were divided into three age groups, the majority of whom were in the 50 to 75 age group. This age group, together with that of 75 years and over, account for nearly 60% of the respondents.

Table 1: Socio-demographic data of respondents

Variables	Workforce	Proportions %
Ethnic		
Adélè	14	9,10%
Agnaga	10	6,49%
Akébou	26	16,88%
Akposso	20	12,98%
Ashanti	1	0,65%
Bassar	4	2,60%
Ewe	37	24,03%
Kabyè	17	11,04%
Moba	7	4,54%
Tèm	18	11,69%
Age group		
< 50	61	40,13%
50 - 75	82	53,95%
75 <	9	5,92%
Gender		
Female	43	28,30%
Male	109	71,70%

4.2 Diversity of species used : Twelve (12) species of Orchidaceae were recorded in this study. They belong to 9 genera. The genera *Ancistrorhynchus, Cyrtorchis* and *Eulophia* are the most represented with two species each. The other 6 genera are represented with only one species (Figure 3). These species are: *Ancistrorhynchus cephalotes* (Rchb. f.) Summerh., *Ancistrorhynchus clandestinus* (Lindl.) Schltr., *Angraecum distichum* Lindl., *Bulbophyllum maximum* (Lindl.) Rchb. f., *Calyptrochilum christyanum* (Rchb.) Summerh, *Cyrtorchis arcuata* subsp. *arcuata, Cyrtorchis arcuata* subsp. *whytei* (Rolfe) Summerh, *Diaphananthe pellucida* (Lindl.) Schltr, *Eulophia cristata* (Sw.) Steud, *Eulophia guineensis* Lindl, *Habenaria cirrhata* (Lindl.) Rchb.f. *Plectrelminthus caudatus* (Lindl.) Summerh. 75% of these species are epiphytes and 25% are terrestrial.

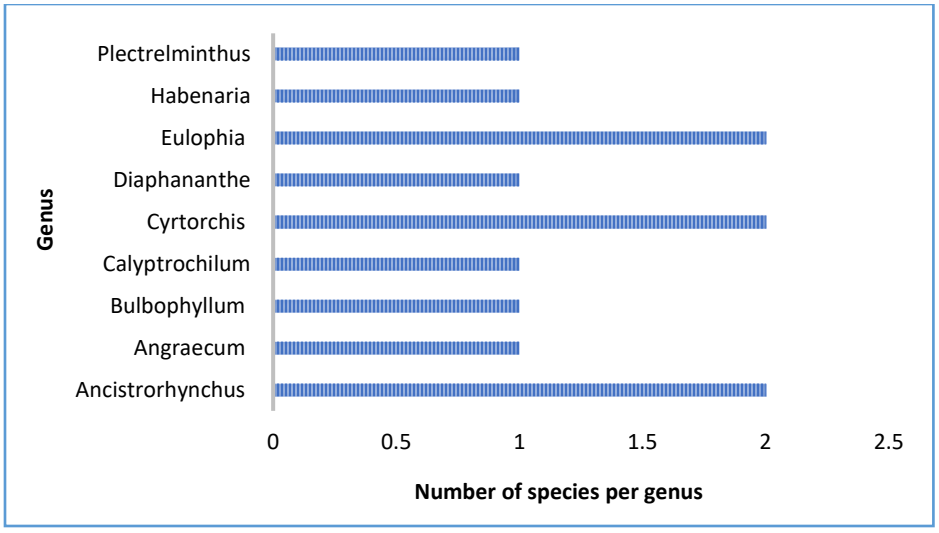

Figure 3: Distribution of species within the identified genera.

4.3 Organs used : Analysis of the survey results shows that local people use all parts of the Orchidaceae identified. 24% of respondents use leaves, 5% use bulbs or pseudobulbs, 14% use the flower and 57% use the whole plant including the roots (figure 4; A). Five categories of use are reported, namely medicinal (50%), medicinal-magical (29%), cultural (12%), ornamental (6%) and 3% for veterinary use (figure 4, B).

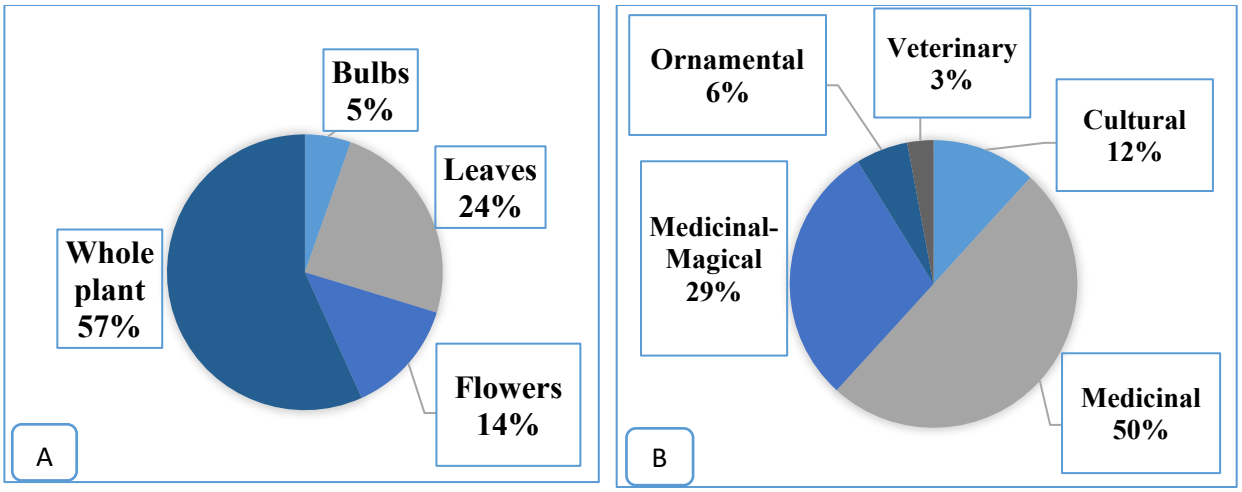

Figure 4: A-Proportion of parts used; B- Proportions of use categories

The calculation of RU and VU allowed determining the most used species of Orchidaceae in ethnobotany in the ecological zone IV of Togo. Indeed, the species with the highest VU indicate those, which are the most, solicited. Thus, *Calyptrochilum christyanum* is the most used species with a total reported use, RU = 12 followed by *Cyrtorchis arcuata* subsp. *arcuata* whose RU = 6; *Bulbophyllum maximum* and *Diaphananthe pellucida* have respectively RU = 4 each. These four species have a usual value higher than 0.09 (VU>0.09). Table 2 shows the RU and VU values of the 12 species of Orchidaceae recorded.

Table 2: Use indices and usual values (RU plant part, RU and VU) of Orchids species

	Leaves	stem	Bulb	Flowers	Whole Plant	RU	VU
Ancistrorhynchus cephalotes	0	0	0	0	3	3	0.07142857
Ancistrorhynchus clandestinus	1	0	0	0	0	1	0.02380952
Angraecum distichum	0	0	0	0	3	3	0.07142857
Bulbophyllum maximum	1	0	1	0	2	4	0.0952381
Calyptrochilum christyanum	3	0	0	0	9	12	0.28571429
Cyrtorchis arcuata subsp. arcuata.	2	0	0	0	4	6	0.14285714
Cyrtorchis arcuata subsp. whytei	0	0	0	0	1	1	0.02380952
Diaphananthe pellucida	2	0	0	2	0	4	0.0952381
Eulophia cristata	1	0	0	2	0	3	0.07142857
Eulophia guineensis	1	0	1	0	0	2	0.04761905
Habenaria cirrhata	0	0	0	2	0	2	0.04761905
Plectrelminthus caudatus	0	0	0	0	1	1	0.02380952

4.4 Endogenous Knowledge Orchids use in Ethnobotany: Respondents mainly use Orchidaceae species for the treatment of malaria (11%), rheumatism (8.33%), and anaemia (5.55%) and for protection from witch doctors, weapons of war and accidents (11%). The use in the mystical field is very marked among the respondents. These orchids are used to strengthen love ties, to protect against bewitchments or accidents (Figure 5). The figure illustrates in A, the divinity (Voodoo) of protection against accidents and weapons of war, and in B, the divinity of protection against bewitchments. The effectiveness of these two divinities is ensured by the survival and proliferation of *C. christyanum* on a plant of *Newbouldia laevis* (P. Beauv.) Stem. Thus these two species (*C. christyanum* and *N. laevis*) are introduced on the day the deities are erected.

Figure 5: *Calyptrochilum christyanum* on a vine of *Newbouldia laevis* (P. Beauv.) Stem. in association with Voodoo

Orchids are also used for the treatment of headache and fever, lung and eye diseases, hallucinations, elephantiasis, hematitis, kidney, prostate and urinary tract infections, incurable wounds. Very few of these species are used locally for decoration. These are *Eulophia cristata* and *Habenaria cirrhata* which are used as ornamental or as toys for children. Only *C. christyanum* has been mentioned as a veterinary treatment. The juice of the leaves of this species is said to cure colds in goats and sheep. The following table (Table 3) summarizes the list of uses of Orchids by category of use, ethnic group, parts used and local names.

Table 3: List of Orchid uses by category of use, ethnic group, parts used and local names

Species	**Use categories**	**Local names**	**Ethnic groups**	**Parts used**	**Indications (Areas of use)**
Ancistrorhynchus clandestinus	Cultural	Arayou	Akébou	*Leaves*	Used to bury old
Calyptrochilum christyanum		Kpety	Akposso	*whole plant*	Protection against weapons
Eulophia cristata		Tapèrè	Akébou	*Flowers*	Children's toy
Habenaria cirrhata		Guéplo	Agnaga	*Flowers*	Children's toy
Eulophia cristata	Medicinal		Adèlé	*Leaves*	Bewitchment
Ancistrorhynchus cephalotes		Dilontchè	Adèlè	*whole plant*	Malaria and Anemia
Angraecum distichum		Varuiran	Akébou	*whole plant*	Treatment of joint problems (osteoarthritis)
		Gnépé ou Tchomfa	Adèlè	*whole plant*	Swelling of feet and hands
Bulbophyllum maximum		Dairaphéré	Akébou	*bulbs and Leaves*	Treats rheumatism
		Ditchipkang	Adèlè	*whole plant*	Hip problems (Arthrosis)
		Ditchipkang	Adèlè	*whole plant*	Hematuria
Calyptrochilum christyanum		Agnymoyo	Kabyè	*whole plant*	Malaria
		Srahagodé égbémakou makou	Ewe	*Leaves*	For coughs
		Maramara	Adèlè	*whole plant*	Belly bloating
		Kpety	Akposso	*Leaves*	Treatment of hematitis
		Tchinaoyissou	Agnaga	*whole plant*	Malaria
		Tchéréou	Tem	*whole plant*	Malaria
Diaphananthe pellucida		Tchéréou	Tem	*Leaves, Flowers*	Headache, fever (Cephalalgia)
Plectrelminthus caudatus		Kpotou	Akposso	*whole plant*	Treatment of elephantiasis
Cyrtorchis arcuata subsp. arcuata.		Touyotchayou	Kabyè	*whole plant*	Anemia
Eulophia guineensis			Akébou	*Leaves and Bulbs*	Incurable wounds
Ancistrorhynchus cephalotes	Medicomagic	Dékounouré marounou outchigba	Akébou	*whole plant*	Against wizards

Calyptrochilum christyanum		Lém maléwo	Ewe	*whole plant*	Protection against spells
		Hégba	Ewe	*whole plant*	Love affections
		Kpety	Ashanti	*whole plant*	Protection against accidents
		Maramara	Adèlè	*whole plant*	Strengthening children's joints
Cyrtorchis arcuata subsp. arcuata.		Dikpénalii	Adèlè	*Leaves*	Eye pain or discharge (eye conditions)
		Dikpénalii	Adèlè	*whole plant*	Onset of madness, hallucinations
		Touyotchayou	Kabyè	*whole plant*	Protection against witches
		Kékléfou	Ewe	*whole plant*	Protection, Against wizards
Cyrtorchis arcuata subsp. whytei		Tataourigbé	Akébou	*whole plant*	Protection, Against wizards
Eulophia cristata	Ornamental	Tapèrè	Akébou	*Flowers*	Decoration
Habenaria cirrhata		Guéplo	Agnaga	*Flowers*	Decoration
Calyptrochilum christyanum	Veterinarian	Srahagodé, égbémakou makou	Ewe	*Leaves*	Goat and sheep colds

5 DISCUSSION

The profile of respondents drawn up in three classes during this study shows a high number of people over 50 years of age. This high representation of people over 50 years of age (60%) is sufficient proof that endogenous knowledge about the uses of medicinal plants remains dependent on the elderly. Several authors who confirm that the practice of traditional medicine is the prerogative of men of mature age (Aburjai *et al.*, 2007, Gbekley *et al.,* 2015) share this observation on the profile of the respondents. In terms of diversity of species of Orchidaceae of ethnobotanical value, other authors have mentioned several of these species in similar works. These are: Assédé *et al* (2017), in Benin mentioned 12 species of Orchidaceae with ethnobotanical value of which 33% are cited in the case of this study. With the exception of *Eulophia horsfallii* (Bateman) Summerh., *Habenaria filicornis* Lindl., and *Platycoryne paludosa* (Lindl.) Rolfe, all other species are present in the study area, but are not reported in this study area for the same ethnobotanical values as in Benin. Fonge *et al.* (2019) in Cameroon recorded 23 species of Orchidaceae with ethnobotanical value of which only 4% are cited in this study. 52.17% of these species are present in the study area, but were not reported for these same ethnobotanical values as in Cameroon. In fact, the very high proportion of use of the whole plant (57%) would be justified initially by the fact that these parts are the site of storage of secondary metabolites responsible for the biological properties of the plant (Bigendako-Polygenis and Lejoly, 1990). In addition, this observation can be linked to the fact that epiphytes are the most solicited. These are plants that are easily pulled out of their substrate; in addition, some do not have a significant root development. The high proportion of leaves (24%) would be justified particularly by the fact that they are the seat of photosynthesis (Bigendako-Polygenis and Lejoly, 1990). It is therefore likely that recipe efficiency and accessibility are the vector for the high use of the whole plant or leaves. These results are in agreement with those of Bitsindou (1986), who explains this finding by the ease and speed of

harvesting these organs or plant parts. Other studies have also revealed that leaves or accessible parts are the most used (Salhi *et al.,* 2010, Jusu *et al.,* 2013, Gbékley *et al.,* 2015, Randriamiharisoa *et al.,* 2015). However, the 57% of whole plant removed in this study, represents a danger to the survival and sustainable management of Orchidaceae in this area. Sodjinou *et al.* (2019a); Mapunda, (2007) have shown the particular and fragile ecological conditions of development and proliferation of Orchidaceae especially the case of epiphytes. Thus, the domestication of these species is strongly recommended for the safeguard, valorization and sustainable management of this resource in the study area. The difference in use category as well as the parts used observed between ethnicities is likely related to the endogenous culture and knowledge inherited or acquired by the respondents rather than the collegial skills of ethnicities in terms of knowledge and natural resource valuation. However, the work of De Caluwé *et al* (2009) and Adjéya *et al* (2015), recognizes that ethnicity is one of the factors of difference in the endogenous uses and knowledge of indigenous plants. However, it should be noted that several species of Orchidaceae with medicinal uses are found in several ethnic groups at the same time. This is the case of *Calyptrochilum christyanum*, used by the Agnaga, the Kabyè and the Tem to treat malaria. The Akebou and the Adélé to treat joint problems use *Bulbophyllum maximum*. In Togo, Adjanohoun *et al.* (1986) reported *Calyptrochilum christyanum* and *Eulophia guineensis* as medicinal plants used in the treatment of otitis and in the treatment of wounds and abscesses respectively. Several authors have reported on the ethnobotanical use of orchid species found in the study area. Dash *et al.* (2008) and Teoh (2016) reported the use of *Polystachya concreta* for healing arthritis. In the case of this study, rather *A. distichum*; *B. maximum* and *C. christyanum* provide this function. Tubers of the genus *Habenaria,* widely represented in the area, have been reported by other authors in the treatment of leprosy, as a tonic plant and for blood purification; similarly, *Liparis sp.* would have beneficial effects on the treatment of burns and cancerous ulcers (Linthoingambi *et al.* (2013), Subedi *et al.* (2013); Pant (2013)). This present work therefore expands the horizons of known treatments of orchid species in Togo and offers the prospects of research on molecules and active principles with pharmacological values. The medicinal and magical use of Orchidaceae is not new to science. The medicinal or mystical use of Orchidaceae in the forest zone of Togo results from the belief or culture of the respondents. Other authors have also revealed the mystical uses of Orchidaceae, ranging from protection, purification to luck, (Hulme, 1954; Watt and Breyer-Brandwijk ,1962; Assédé *et al.* , 2017). The use of *Cyrtorchis arcuata* confers the power of charms, friendship, or allows one to be loved (Fonge *et al.* (2019). Unlike the work of *Assedé et al.* (2017) and Menzepoh (2011), the present study does not report any food use of the species surveyed. However, these same species are consumed in Benin and Cameroon. This finding may be related to the biophysical setting of the respondents. Indeed, this study was conducted in the forest zone of Togo. The permanent availability of greenery and pick-your-own vegetables may restrict eating habits. The work of Batawila *et al* (2007) showed that in Togo, ecological zones I, II and III have a greater diversity of vegetables and fruits than the forest zone. This is due to the succession of lean periods and abundance of these vegetables in relation to the biophysical characteristics of these zones. It is therefore important to carry out a further study on the food orchids of the zone, or even of the entire country.

6 CONCLUSION

This study resulted in a list of 12 species of Orchidaceae with ethnobotanical use in the southern zone of the Togo Mountains. The use of these species covers the fields of traditional medicine, cultural and ornamental as well as mysticism and 75% of the species used are epiphytes and the whole plant is used up to 57% in treatments. The diseases treated are mainly malaria (11%), rheumatism (8.33%), and anemia (5.55%). In terms of mysticism, Orchidaceae are more solicited for spiritual protection (11%). eight ethnic groups share the endogenous knowledge of these Orchids in the study area. This work constitutes a basis and deserves to be extended to the other ecological zones of the country in order to draw up an exhaustive list of Orchidaceae with ethnobotanical use in Togo. In addition, this work widens the horizons of treatments based on Orchidaceae species in Togo and in the sub-region, and offers the perspectives of research on molecules and active principles with pharmacological values.

7 ACKNOWLEDGEMENTS

The authors would like to thank the traditional practitioners, healers and herbalists who shared their knowledge, especially Mr. Djagli-gnagli, Jean-Pierre Egona and all the traditional authorities of the villages surveyed.

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