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Research Article

Preliminary Conservation Checklist of Orchid of Gashaka Gumti National Park, Nigeria

George I. Nodza*, Temitope O. Onuminya, Oluwatoyin T. Ogundipe

Molecular Systematics Laboratory, Department of Botany, University of Lagos, Akoka, Lagos State, Nigeria.

***Corresponding author:** nodzageorge@yahoo.com; gnodza@unilag.edu.ng
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ABSTRACT

A preliminary checklist of the Orchidaceae of Gashaka Gumti National Park (GGNP) is presented, based on previous reports on the flora of GGNP and recent botanical explorations. The results from this study recorded 80 orchid species in 38 genera. The collection consists of 84% epiphytes and 16% terrestrial orchids. The genera with highest number of species are the *Bulbophyllum* (16 species) and *Polystachya* (11 species), while *Habenaria* is the richest terrestrial genus with five species. *Afropectinariella gabonensis*, *Bulbophyllum renkinianum* and *Rhipidoglossum polydactylum* are newly recorded for Nigeria. Other noteworthy taxa include *Angraecopsis elliptica*, *Bulbophyllum calvum*, *Holothrix aphylla* and *Tridactyle tridentata* which are some of the rarest orchid species in Nigeria. The highest species number was recorded in the lowland forest of the southern sector, particularly Kwano, with 42 species, followed by 29 species in the montane forest, five species in the savanna woodland, and four taxa in the lowland gallery forest. Our study identified recent transhumance to the enclave of the park (leading to grazing), and illegal logging of *Pterocarpus erinaceous* and *Afzelia africana* as the major noticeable threats to the continued existence of orchid species in GGNP. Therefore, further inventories with rigorous techniques such as the tree climbing technique are warranted for an exhaustive inventory and effective conservation of the orchid flora of GGNP.

Keywords: Chabbal Hendu, Kwano, Montane vegetation, Gumti sector, Orchidaceae

Introduction

Nigeria flora has been better explored and documented than most other West African countries, particularly the Orchidaceae (Sanford, 1971). Of the 401 species of orchids recorded in West Africa, 157 species are recorded in Nigeria (Sanford, 1969a). After that, Segerbäck (1983) recorded 104 species. Recently there has been comparatively less botanical research on orchids in Nigeria. This lack of interest could be due to a lack of experts working in the group or due to

the morphological complexity of orchids. Consequently, this has halted the utilization of orchid species for scientific and aesthetic research in the country (Folorunso & Jayeola, 2009). Eventhough research on orchids from Nigeria spans well over several decades, certain areas of the country's botanical areas were less explored or not sampled. Also, there is no accurate checklist nor conservation notes on the orchids of Nigeria hence the published investigations of Summerhayes (1968), Sanford (1968, 1969 & 1971), are used as the only reference guides for the orchids of the country. With exception to the reports of Chapman & Chapman (2001), Akinsoji (1996, 2005 & 2016) and Umar et al. (2019), the available reports on orchids of Nigeria do not mention the orchids of Gashaka Gumti National Park (GGNP) thus this area remains poorly documented and the orchid there are less known.

In recent times, orchid in GGNP is threatened by disturbances resulting from several anthropogenic activities leading to habitat loss. Floristic studies are the primary means by which the plant diversity of an area can be understood (Harris et al., 2012). Obtaining information on distribution patterns of threatened species like orchids and compiling these in the form of a checklist is pivotal for conservation planning (Shaheen et al., 2016). Also, providing an updated checklist will help contribute to forthcoming research into taxonomy and other aspects of Nigerian orchids (Lehnebach, 2003). Therefore, the study aimed to provide a comprehensive preliminary account of Orchidaceae occurring in GGNP, to inform conservation strategies and management decisions for better management of the national park flora diversity.

Material and Methods

Vegetation types of the study area

Gashaka-Gumti National Park (6,731 km^2; 06° 55' N, 11° 13'E) is the largest protected area within Nigeria, established through a federal decree in 1991 by the merging of two previously existing forest reserves (Sommer & Ross, 2011; Gumnior & Sommer, 2011). This park is managed by Nigeria National Park Service (NPS) Authority, under the Federal Ministry of Environment of Nigeria. The Park consists of two sectors: the northern sector, which is completely flat, and the southern sector, which is mountainous. The southern sector (Gashaka) varies in elevation from 300 m to 2,467 m and consists of mixed rugged terrain, with steep slopes, deep plunging valleys, precipitatious escarpments, and swiftly flowing rivers (Sommer & Ross 2011; Dunn, 1993). The highest mountain in Nigeria, Chabbal Wadde with a height of 2,647 m above sea level is located in the Southeast of the park adjoining the Nigerian-Cameroon border (Sommer

& Gumnior, 2011). The climatic conditions of the park support forest vegetation, with a maximum annual rainfall of 1,977 mm, mean minimum temperature of 20.9 °C, and mean maximum temperature of 31.9 °C (Mucunguzi, 2007; Malhi et al., 2013). Although the soils within the park have not been systematically examined, Dunn (1999) and Chapman & Chapman (2001) reported humic ferrisols and lithosols as the soil types occurring at higher altitudes. Ferruginous tropical soils on crystalline acid rocks are found at lower elevation and alluvial soils in broad river valleys (Dunn, 1993). The park consists of seven habitat types: lowland gallery forest, riverine or riparian forest, montane forest, derived savanna, southern and northern Guinea savanna, and montane grassland. Access to this park by local communities is illegal. Therefore, hunting, fishing, timber, firewood, and other non-timber products' collection is illegal. Seasonal bush fires in the savanna area are common especially from December to January. Sometimes this fire enters some forests causing damage especially to the understorey species of plants. See **Figure 1** for map of study area.

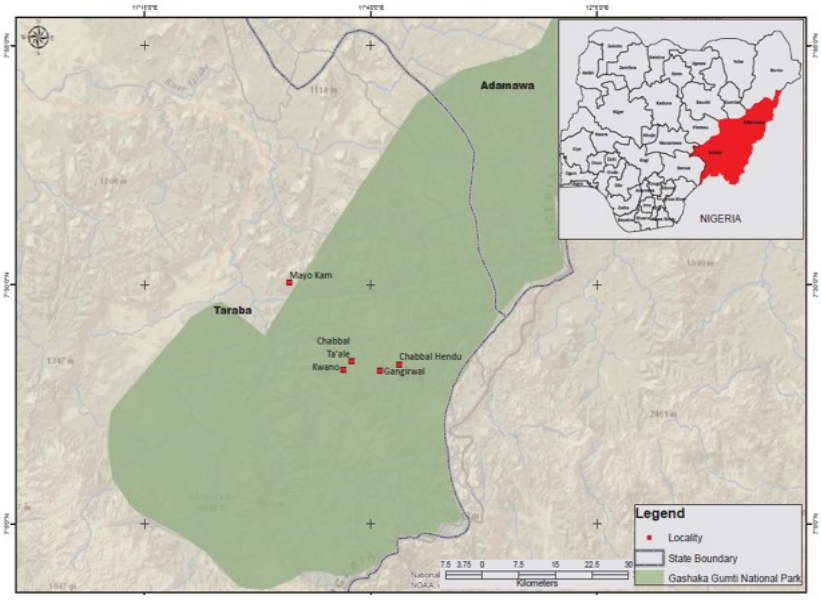

Figure 1. Map of GGNP showing main sampling areas.

For this study, orchids were collected from the following vegetation types within GGNP:

The Lowland Forest: Kwano (7°20´N, 11°35´E)

The vegetation at Kwano consists of a mosaic of derived savanna in the old human settlement and a block of typical rainforest down Mayo Ngiti, which is probably the only remnant intact rainforest in northeastern Nigeria, with little or no human interference. The emergent trees grow up to a height of about 35–40 m, forming large buttresses as in *Ceiba pentandra* (L.) Gaertn, (Malvaceae) *Entandrophragma angolense* (Welw.) C.D.C. (Meliaceae), *Spondias microcarpa* A. Rich. (Anacardiaceae) and *Khaya grandifoliola* C.D.C. (Meliaceae). Further east, towards the Selbe footpath, there exist several gallery forests characterized by several lianas such as *Acacia pentagona* (Schumach.) Hook. f, (Fabaceae), *Landolphia owariensis* P. Beauv**,** **(**Apocynaceae**),** *Chasmanthera dependens* Hochst, (Menispermaceae) *Psychotria vogeliana* **(**Benth.) (Rubiaceae) amongst others. The transition between the lowland forest and the montane forest is around Tonga, an old settlement that extends to a hill called "Hitler" by the locals. A mosaic of rainforest exists here with most vegetation completely open and dominated by the invasive species *Chromolaena odorata* L (Asteraceae) forming a thicket at the edge of the forest.

Submontane and montane area (1,500–2,000 m asl)

Chabbal Hendu: 7°21´N, 11°44´E, 2,000m asl

The montane and submontane areas visited are Chabbal Ta'ale (7°22´N, 11°36´E), Chabbal Hendu (7°22´N, 11°36´E7°21´N, and 11° 44´E) and Gangirwal located at (°7°21´N, 11°41´E).

True montane vegetation in Nigeria is only found at Chabbal Hendu (Akinsoji, 1996; 2005), and Gangirwal which is an extension of Chabbal Hendu (CH), 32 km to the north (Chapman & Chapman, 2001). These are the two highest peaks in Nigeria, located at an altitude ranging from 2,000 to 2,467 m asl. Most forest at CH is located along streams, maintaining constant water year-round. The forest is characterized by luxuriant vegetation, strewn with ferns and orchid species. While the vegetation of Gangirwal is similar to that of CH, most of the forest is located at the escarpment and therefore is not easily accessible. The Nigeria-Cameroon frontier passes through the highest part of Gangirwal (Chapman & Chapman, 2001; Ezukanma et al., 2017). The montane vegetation is characterized Grasslands in Gangirwal by elevated montane grassland and a typical montane forest along the valleys dominated by *Loudetia simplex* (Nees) C. E. Hubbard, (Poaceae) *Elionurus argenteus* Nees (Poaceae) and *Rhytachne*

rottboellioides Desv. (Poaceae) (Chapman & Chapman, 2001). Trees here do not form a canopy, with the emergent species not exceeding 35 m in height. They include *Entandrophragma angolense* C.D.C. (Meliaceae) and *Newtonia buchananii* (Baker) G.C.C. Gilbert & Boutique (Fabaceae), with *Pouteria altissima* (A. Chev.) Baehni, (Fabaceae) as the most commonly distributed (Chapman et al., 2004). Other tree species are *Albizia gummifera* C.A.Sm. (Fabaceae), *Ixora foliosa* Hiern, (Rubiaceae) *Warneckea acutifolia* (De Wild.) Jacq.-Fél., (Melastomataceae) *Pterygota mildbraedii* Engl., (Sterculiaceae) *Prunus africana* (Hook.f.) Kalkman, (Rosaceae) *Schefflera abyssinica* Harms, (Araliaceae) and *Syzygium guineense* subsp. *bamendae* F. White in the family Fabaceae, (see Chapman & Chapman, 2001 for a complete description of Northeastern Nigerian montane forest). Although farming activities seem to be completely absent from some locations (e.g., Gangirwal), vegetation deterioration is at an alarming rate due to fire damage from seasonal bush burning and cattle grazing, which is now posing a major concern for the continual existence of local plant diversity. These often result in erosion surfaces on the underlying basement complex (Chapman & Chapman 2001). In turn, CH is probably the largest grazing enclave within GGNP. Cattle graze the montane grass throughout the year and graze along the streams in the dry seasons. This is the most obvious threat to the montane forest. Cattle grazing is very evident everywhere on montane vegetation with most of the vegetation trampled, thereby reducing the rate of regeneration (Chapman & Chapman, 2001). Slash-and-burn farming is also expected to increase due to the migration of people into the montane region.

For the submontane vegetation, we surveyed Mayo Sabere (920 m asl), Filinga (1,200 m asl), and Ta'ale (1,400 m asl). Ta'ale is about 3–4 km further east of Kwano (Gashaka Biodiversity Project Camp). It is the continuous extension of Chabbal Hendu enclave located at altitudes of 1,650 m asl. The vegetation here is predominantly grassland, with scattered trees that do not form a canopy. The emergent trees do not exceed 25 m; they include *Combretum molle* R.Br. ex G. Don, (Combretaceae), *Entada abyssinica* Steud. ex A. Rich. (Fabaceae), *Psorospermum febrifugum* Spach (Hypericaceae), *Syzygium guineense*, (Wild.) D.C. (Fabaceae), *Croton macrostachyus* Hochst. ex Del. (Combretaceae) and *Harungana madagascariensis* Lam. ex Poir. (Hypericaceae). The vegetation here is progressively experiencing slash-and-burn farming from its inhabitants. To the north of Chabbal Ta'ale, there is the rocky former settlement of Tonga Hill, which is the transition between lowland forest and montane forest. There is human settlement here; this area is

experiencing slash-and-burn farming, with rapid expansion and a bush fallow farming system.

Savanna woodland (500m) *(7°25'N, 11°31'E)*
This vegetation type is predominantly distributed at the lowest elevations of the park. It is dominated by tall coarse grasses reaching a height of about 2 m (*Andropogon gayanus* Kunth family Poaceae) and some trees. *Uapaca togoensis* Pax (Euphorbiaceae) seems to be the dominant woody species. Other abundant tree species include *Afzelia africana* Sm., *Annona senegalensis* Pers (Annonaceae), *Crossopteryx febrifuga* Rubiaceae (G.Don) Benth, *Daniellia oliveri* (Rolfe) Hutch. & Dalziel, (Fabaceae) *Nauclea latifolia* Sm (Rubiaceae), *Piliostigma thonningii* (Schum.) Milne-Redhead (Fabaceae), *Prosopis africana* (Guill. & Pen.) Taub., (Fabaceae), *Parkia biglobosa (*Jacq.) Benth (Fabaceae), *Vitellaria paradoxa* C. F. Gaertn (Sapotaceae) and *Terminalia* spp (Combretaceae), while *Brachystegia eurycoma Harms* (Fabaceae) is the dominant tree along the rivers. This vegetation is considerably degraded and affected by humans. For example, *Pterocarpus erinaceus* Poir (Fabaceae) and *Afzelia africana* Pers. are often pollarded to feed cattle and their bark is collected for medicinal purposes (Akinsoji, 1996 & Sommer & Ross, 2011).

Sample collection and identification
Several field campaigns took place between 2012 and 2019, during which living plants and herbarium specimens were collected. Identification of the samples was carried out using detailed comparison with herbarium reference specimens from the National Herbarium Yaoundé (YA) and Forest Herbarium Ibadan (FHI). The keys from Hutchinson and Dalziel (1954), Summerhayes (1968), Szlachetko & Olszewski (2001a, 2001b) were used for identification. We deposited samples at the Lagos University Herbarium (LUH), at the University of Lagos. Plants that were not fertile at the time of collection were cultivated and monitored in the shade house in the University of Lagos until they produced flowers, which enabled accurate identification following Sanford (1970a) and Stévart et al., (2010).

Results and Discussion

Distribution and floristic composition of the orchid flora in GGNP
Results from the survey within the study area recorded a total of 80 taxa belonging to 37 genera (**Table 1**). *Bulbophyllum* Thouars (16 taxa) and *Polystachya* Hook. (11 taxa) are the most species-rich genera of epiphytic

orchids in GGNP while *Habenaria* represents the richest terrestrial genus with five species. These number of species recorded from GGNP alone represents about 26% of the combined orchid flora of Nigeria recorded by Sanford (1968, 1969a & 1971) approximately 157 species, Segerbäck (1983) illustrating 104 species, and Govaerts et al. (2018) 305 species compiled from the World Checklist of Monocots of the Royal Botanic Gardens Kew (Droissart et al., 2019). Of all the species recorded, three represent new national records, *Afropectinariella gabonensis* (Summerh.) M. Simo & Stévart, *Bulbophyllum renkinianum* Laurent (De Wild.), and *Rhipidoglossum polydactylum* (Kraenzl.) Garay. In addition, four of the rarest orchid species in the country, viz. *Angraecopsis elliptica* Summerh, *Bulbophyllum calvum* Summerh, *Holothrix aphylla* (Forssk.) Rchb.f., and *Tridactyle tridentata* Schltr., were recollected after 58 years from the same vegetation belt. The highest number of species was recorded in the lowland forest (42 species), followed by the montane forest (29 species), the savanna woodland (five species) and the lowland gallery forest (four species) (**Figure 2)**. With regard to growth form, most orchids (84 %) were epiphytic, while only 16 % were terrestrial, recorded mostly in the savanna woodland of the study area.

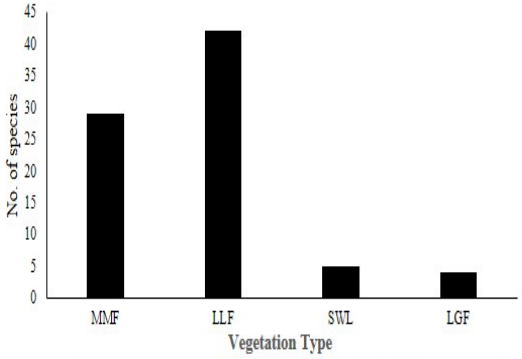

Figure 2. Distribution of orchids of GGNP in different vegetation types.

The majority of the species recorded in GGNP are epiphytic (84 %), which agrees with the general pattern found in most tropical orchid floras (Swartz & Dixon 2009, Zhang et al., 2016). The epiphytic orchids with most species belonged to *Bulbophyllum* and *Polystachya*, which are the two most-species epiphytic orchid genera in tropical Africa. Species richness in these genera is consistent with the

report of Kurzweil (1992) on the orchid flora of Mt Mulanje in Malawi, Szlachetko (2008), in his study of the Orchidaceae of Ivory Coast, and Simo et al., (2009), who recorded the highest number of species from these genera from Mbam Mikon hills in Cameroon. We recorded the highest number of species (45 taxa) from the lowland forest around Kwano. This area is highly protected, with minimal anthropogenic interference. In the northern sector of GGNP, we recorded four taxa only. This area is dominated by savanna woodland and have been highly impacted by cattle grazing and consistent annual fire burning (Gumnior & Sommer, 2011). This comparative high species richness in the mountainous region of GGNP is possibly due to the heterogeneity of mountains habitats, which provide different habitats for the survival of several species and climatic variables (temperature and precipitation) provide a good potential explanation for orchid species richness along the mountainous areas (Acharya et al., 2011 & Zhang et al., 2016). However, orchid species richness could be influenced by the level of habitat disturbance, climatic conditions such as temperature, moisture availability, humidity, precipitation (length of the dry season), and amount of rainfall and availability of undisturbed sites (Blanchard & Runkle 2006, Sanford 1970a).

Conservation threats

Undoubtedly, orchids are among the most threatened flowering plants (Zhao et al. 2021). Major threats highlighted to be facing orchids include habitat destruction, unsustainable harvest for horticulture, food, or medicine and exacerbated by climate change (IUCN/SSC Orchid Group 1996; Swarts & Dixon 2009; Zhang et al., 2015; Kull et al., 2016; Fay 2018). These result from deforestation, logging, fire, road construction, and the expansion of forest plantations and agricultural activities (Simo et al., 2009; Gale et al., 2018). In this study area, despite being a protected area; the orchid species here are jeopardized by illegal recent transhumance into the enclave of GGNP, which leads to illegal grazing in the national park. This livestock grazing negatively affects plant growth, community structure, ecosystem functioning, and services especially in the grasslands (Kirk et al., 2019; Rahmanian et al., 2019), and changes the floristic composition and the structure of herbaceous orchids species (Sonne et al., 2014). During grazing, most herdsmen looped branches of *Afzelia africana* Sm, where the leaves are used as forage for livestock. Similarly, several species are illegally harvested as fuel woods especially the *Uapca togoensis* Pax which is regarded as a softwood by the locals. This selective logging activities result in significant changes in forest structure, composition and function. It affects the epiphytic orchids by reducing the available habitat for the species and also alters the microclimate in the forest thereby leading to

species loss (Padmawathe et al., 2004). Together, these activities are leading to sharp forest fragmentation and habitat loss. In turn, one of the major noticeable threats, especially in the savanna woodland of the park and the lowland gallery forest vegetation, is phorophyte destruction around the enclave of GGNP, the greatly been decimated species of Pterocarpus erinaceous, Afzelia africana have and locally extinct at the buffer zones of the park. Recently, interest has been shifted to logging of *Erythrophleum suaveolens* (Guill. & Perr.) Brenan (Fabaceae) *Brachystegia eurycoma* Harms (Fabaceae), *Pseudospondias microcarpa* (A. Rich.) Engl., (Fabaceae) and several other large trees for timber exportation. To this day almost all the proximate ancestral vegetation in GGNP has been destroyed through livestock grazing and incessant logging. Regrettably, attention has been shifted away from the national park, and illegal logging has taken place in the park. Most of the species logged are phorophytes for orchids in the study area. For example, *Afzelia africana* Sm and *Uapca togoensis* Pax have been reported as one of the phorophytes for epiphytic orchids and other epiphytes in the park (Akinsoji 2016). These activities are capable of causing drastic changes in the forest structure and subsequently affect the growth and diversity of the epiphytic species in particular (Jalal, 2012). Cattle grazing has a significant detrimental impact on the growth and survival of terrestrial plants (Narantsetseg et al., 2018), a result of trampling. Often, the cattle are capable of eating not only young flowering buds but also whole orchid plants (Jalal, 2012). Grazing and trampling, together, can influence the composition of the diversity of the terrestrial orchid.

In recent years, gold mining has rapidly increased across the southern sector of the park, especially along the riverbank, which contributes to deforestation in some locations. Most of the forest loss within the riverbank of the park is caused by artisanal miners. The mining activities leave in their wake extensive soil erosion, and rivers and streams full of soil from the mining sites. This gold mining usually results in the felling of trees, mostly *Brachystegia eurycoma* which are the dominant species of the riverbank. This species is an important phorophyte of many orchid species in this study area (Akinsoji 2005). Considering all these threats, the very survival of some of the orchid species in this area are in peril, given the fact that protected areas are no longer spared from anthropogenic activities.

Plate 1: A-J= *Aerangis biloba, Tridactyle tridentata, Bulbophyllum falcatum var. bufo, B. lupulinum, B. intertextum, Calyptrochilum christyanum, Diaphananthe vesicata, Cyrtorchis arcuata, Cyrtorchis aschersonii*

Plate 2: J-R= *Habenaria zambesina, Eulophia cucullata, Habenaria malacophylla, Plectrelminthus caudatus, Eulophia horsfallii, Eulophia cristata, Tridactyle anthomaniaca, Rhipidoglossum polydactylum, Polystachya laxiflora*

Conclusion

With the number of species recorded and the new taxa first recorded for Nigeria in this study, it is possible that knowledge of the orchid flora of GGNP is far from complete. We can ascertain this study area is a haven for orchid diversity in Nigeria given the number of species recorded. Unfortunately, however, there are looming threats facing this area, with the montane vegetation appearing to be more vulnerable, predominantly from grazing and constant annual burning by inhabitants of the enclave. Therefore, further inventories are warranted to further our knowledge of the regional orchid flora and guarantee its conservation.

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Competing interests: The authors declare that they have no competing interests.

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Table 1. List of the orchid taxa collected at GGNP during the survey, including their habitats.

S/N	Species	Habit	Savanna	Lowland gallery forest	Lowland rainforest	Montane forest
1	*Aerangis biloba* (Lindl.) Schltr.	E	X	X	X	
2	*Aerangis kotschyana* (Rchb.f.) Schltr.	E			X	
10	*Afropectinariella gabonensis** (Summerh.) M. Simo & Stévart	E				X
11	*Afropectinariella pungens* (Schltr.) M.Simo & Stévart	E			X	
3	*Ancistrorhynchus capitatus* (Lindl.) Summerh.	E		X	X	
4	*Ancistrorhynchus clandestinus* (Lindl.) Schltr.	E		X	X	
5	*Ancistrorhynchus recurvus* Finet	E			X	
6	*Angraecopsis elliptica* Summerh.	E				X
18	*B. falcatum* var. *velutinum* (Lindl.) J.J.Verm.	E			X	
12	*Bolusiella zenkeri* (Kraenzl.) Schltr.	E		X		
15	*Bulbophyllum calvum* Summerh.	E				X
16	*Bulbophyllum cochleatum* Lindl.	E			X	
26	*Bulbophyllum cochleatum var. tenuicaule* (Lindl.) J.J.Verm.	E				X
17	*Bulbophyllum falcatum Var. falcatum* (Lindl.) Rchb.f.	E				
14	*Bulbophyllum falcatum* var. *bufo* (Lindl.) Govaerts	E		X		
13	*Bulbophyllum imbricatum* Lindl.,	E				X
19	*Bulbophyllum intertextum* Lindl.	E			X	
20	*Bulbophyllum lupulinum* Lindl.	E		X	X	
21	*Bulbophyllum oreonastes* Rchb.f.	E			X	X
22	*Bulbophyllum oxychilum* Schltr.	E		X		X
23	*Bulbophyllum pumilum* (Sw.) Lindl.	E			X	X
24	*Bulbophyllum renkinianum** (Laurent) De Wild.	E			X	
25	*Bulbophyllum schimperianum* Kraenzl.	E			X	
27	*Bulbophyllum* sp	E	X		X	

28	*Bulbophyllum winkleri* Schltr.	E			X	
29	*Calyptrochilum christyanum* (Rchb.f.) Summerh.	E	X	X	X	X
30	*Calyptrochilum emarginatum* (Afzel. ex Sw.) Schltr.	E	X	X	X	
33	*Corymborkis corymbis* Thouars	E			X	
35	*Cyrtorchis arcuata* (Lindl.) Schltr.	E		X	X	
36	*Cyrtorchis aschersonii (*Kraenzl.) Schltr.	E			X	
37	*Cyrtorchis chailluana* (Hook.f.) Schltr.	E		X	X	
38	*Cyrtorchis ringens* (Rchb.f.) Summerh.	E				X
39	*Diaphananthe bidens* (Afzel. ex Sw.) Schltr.	E		X	X	
31	*Diaphananthe odoratissima* (Rchb. f.) P.J.Cribb & Carlsward	E		X	X	
40	*Diaphananthe pellucida* (Lindl.) Schltr.	E				X
32	*Diaphananthe vesicata* (Lindl.) P.J.Cribb & Carlsward	E			X	
41	*Disa equestris* Rchb.f.	T				X
42	*Disa welwitschii Rchb.f.*	T			X	
7	*Dolabrifolia aporoides* (Summerh.) M.Simo & Stévart	E				X
8	*Dolabrifolia disticha* (Lindl.) M. Simo & Stévart	E			X	
9	*Eichlerangraecum eichlerianum* (Kraenzl.) Szlach., Mytnik & Grochocka	E			X	
43	*Eulophia cristata* (Afzel. ex Sw.) Steud.	T	X			
44	*Eulophia cucullata* (Afzel. ex Sw.) Steud.	T	X			
45	*Eulophia horsfallii* (Batem.) Summerh.	T	X			
46	*Graphorkis lurida* (Sw.) O. Kuntze	T			X	
47	*Habenaria longirostris* Summerh.	T			X	
48	*Habenaria malacophylla* Rchb.f.	T		X	X	
49	*Habenaria mannii* Hook.f.	T			X	
50	*Habenaria procera* (Sw.) Lindl.	T			X	
51	*Habenaria zambesina* Rchb.f.	T			X	
52	*Holothrix aphylla* (Forssk.) Rchb.f.,	T				X
53	*Liparis nervosa* (Thunb.) Lindl.	T				X
54	*Malaxis chevalieri* Summerh,	T				X
55	*Nervilia* sp.	T				X
56	*Oeceoclades maculata* (Lindl.) Lindl	T			X	
57	*Plectrelminthus caudatus* (Lindl.) Summerh.	E	X		X	
58	*Podangis dactyloceras* (Rchb. f.) Schltr.	E			X	
59	*Podangis rhipsalisocia* (Rchb.f.) P.J.Cribb & Carlsward	E				X

60	*Polystachya alpina* Lindl.	E				X
61	*Polystachya bennettiana* Rchb.f.	E				X
62	*Polystachya cooperi* Summerh.	E				X
63	*Polystachya dolichophyla* Schltr.	E		X	X	X
64	*Polystachya elegans* Rchb.f.	E				X
65	*Polystachya laxiflora* Lindl.	E			X	X
66	*Polystachya modesta* Rchb.f.	E		X		X
67	*Polystachya odorata* Lindl.	E		X	X	X
68	*Polystachya paniculata* (Sw.) Rolfe	E				X
69	*Polystachya* sp.	E	X	X		
70	*Polystachya tessellata* Lindl.	E			X	X
71	*Rangaeris rhipsalisocia* (Rchb.f.) Summerh.	E			X	X
34	*Rhipidoglossum brachyceras* (Summerh.) Farminhão & Stévart	E				X
72	*Rhipidoglossum kamerunense* (Schltr.) Garay	E				X
73	*Rhipidoglossum polydactylum* (*Kraenzl.) Garay	E				X
74	*Solenangis clavata* (Rolfe) Schltr.	T				X
75	*Stolzia sp* .	E	X		X	
78	*Tridactyle tridactylites* (Rolfe) Schltr.	E	X		X	
76	*Tridactyle anthomaniaca* (Rchb.f.) Summerh.	E	X		X	
77	*Tridactyle bicaudata* (Lindl.) Schltr.	E			X	X
79	*Tridactyle tridentata** (Harv.) Schltr.	E	X		X	
80	*Vanilla* sp.	T			X	

The species marked with an asterisk (*) are being reported for the first time from the park.