

THE COMPOSITION AND DISTRIBUTION OF VASCULAR EPIPHYTES ALONG ALTITUDINAL GRADIENT IN GASHAKA GUMTI NATIONAL PARK, NIGERIA.

Aderopo Akinsoji

Department of Botany, University of Lagos, Lagos. Nigeria

E-mail <drpknsj@gmail.com>

(Received: 11th July, 2016; Accepted: 31st August, 2016)

ABSTRACT

A survey of epiphytes at four different altitudes in Gashaka Gumti National Park was carried out. A total of forty one species of epiphytes distributed in fifteen families were recorded from the four sites sampled. Fourteen species of epiphytes were recorded from the two lowland sites (<1000m, asl) and twenty eight samples were recorded from the two highland sites (1800-2410m asl). The epiphytic flora is dominated by the Family Orchidaceae with seventeen species. The number of epiphytes increased with altitude up to a point (1800m asl) and declined at higher altitude due to a drier and cooler environment, combined with less developed vegetation structure. Some epiphytes such as *Calyptrochilum* spp, *Platyserium* spp., *Nephrolepis biserrata* and *Aerangis biloba* were restricted to lowlands so they are called lowland epiphytes while those restricted to higher altitudes such as *Angraecopsis* sp., *Asplenium* spp, *Lycopodium brachystachys* and *Vittaria guineensis* are called highland epiphytes. The montane forests at mid altitudes (1800-2000m, asl) were dominated by pteridophytes because the environment was cooler, more moist and the canopy provided shaded habitats.

Keywords: epiphytes, GGNP, montane, pteridophytes, orchids

INTRODUCTION

Gashaka Gumti National Park (GGNP) is Nigeria's biggest National Park with an area of 6402 km² (Akinsoji, 1996). It lies between 6-8^o N latitude and 11-12^o E longitude. It comprises the northern Gumti sector which is located in Adamawa State and the Southern Gashaka Sector which is located in Taraba State. The vegetation of Gumti sector is savanna while the Gashaka sector is made up of a variety of vegetation types such as woodland savanna, lowland rain forest, montane forest and montane grassland (Akinsoji, 1996). The Gashaka sector has a rugged and mountainous terrain that is difficult to access. The terrain is traversed by a network of rivers and streams that originate from the mountain tops and flow down the mountain slopes and finally into River Taraba. As the rivers flow down the mountain sides, they provide enough moisture to support montane vegetation on the mountains and tropical rain forest at lower altitudes (Akinsoji, 2003). The moisture provided by the streams and rivers have also turned the grassland around Gashaka village into a woodland savanna. The montane vegetation occurs at altitudes above 1800m asl and comprises montane grassland on the mountain tops and montane forest in the valleys and along streams and rivers. The combination of the non-uniform topography, altitudinal differences, edaphic and climatic

factors has created a variety of habitats and microhabitats with a concomitant variety of vegetation types which have resulted in the high biodiversity of flora and fauna. One of the distinctive features of the flora is the epiphytic life form.

Epiphytes are plants that grow on other plants called phorophytes (Barkman, 1958) from which they derive mechanical support but no nourishment. They depend on small amounts of nutrients and moisture that they can get from the atmosphere and the bark of phorophytes. For survival, some have developed xeromorphic adaptations like thick cuticle, succulence, sunken stomata and physiological adaptation through CAM photosynthetic pathway (Akinsoji, 1990). Until recently, reports of studies on epiphytes in the tropics have been modicum in literature probably due to the wrong perception that their contribution to forest biomass is insignificant and their poor representation in the temperate regions of the world (Mabberley, 1984). However, they are significant in nutrient cycling (Nadkarni, 1984), provide nutrients for birds (Nadkarni, 1985). Gentry and Dodson (1987) have shown that they have large biomass in tropical and wet forests. The epiphytic mosses and other plants have created epiphytic loads on branches that are heavy enough to cause branch falls (Strong, 1977). Reports of

epiphytic studies in West Africa are few in literature compared with temperate regions. Although, Sanford (1968, 1969) and Akinsoji (1990, 1992, 2005) have reported about epiphytes in Nigeria, however, the composition and geographical distribution of epiphytes in the tropics are poorly known (Johansson, 1974, 1975). This study reports the composition and distribution of epiphytes along altitudinal gradient

in Gashaka Gumti National Park, Nigeria.

MATERIALS AND METHODS

Study Sites

The study was carried out at four different locations of varying altitudes in the Gashaka sector of GGNP (Fig. 1). These locations were Gashaka village environ, Gidan Kwano, Chabbal Hendu and Gangrewal.

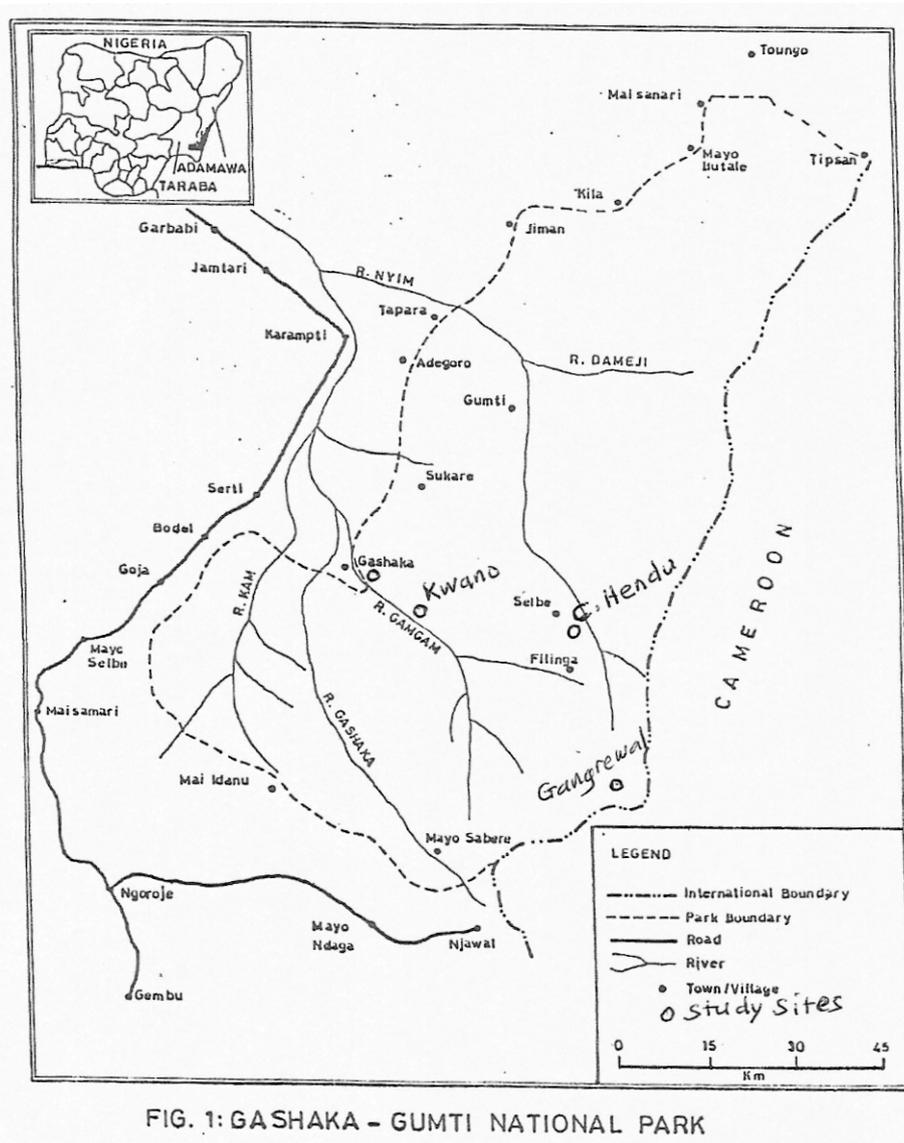


FIG. 1: GASHAKA - GUMTI NATIONAL PARK

Gashaka village environ is at an altitude of 350m asl. The vegetation is Guinea Savanna but because of the rivers that pass through the village, environs are covered by savanna woodland with species such as *Piliostigma thonningii*, *Terminalia* spp., *Crossosopteryx febrifuga* and *Detarium macrocarpum* scattered among grass species. The common grass species were *Andropogon gayanus*, *Andropogon*

tectorum, *Schizachryum brevifolium* and *Hyparrhenia rufa*. The trees provided suitable habitats for epiphytes.

Gidan Kwano is at an altitude of 549m asl. The vegetation comprises savanna woodland with forests along numerous rivers and streams. The common trees in the forest are *Khaya grandifoliola*,

Erythrophleum suaveolens, *Symphonia globulifera*, *Ceiba pentandra* and *Canarium schwenfurtii* while *Uapaca togoensis*, *Vitex donnniana*, *Sarcocephallus latifolius*, *Anogeissus lieocarpus* and *Lophira lanceolata* are common in the woodland.

Chabbal Hendu is at an altitude of 1800-2000 m asl. It has montane grassland on the mountain top and montane forest in the valleys of the streams. The forest canopy is open so the trees receive sunlight. Some of the common trees include *Albizia gummifera*, *Croton macrostachyus*, *Garcinia smeathmanii*, *Nuxia congesta* and *Pittosporum viridiflorum* and they bear epiphytes.

Gangrewal is the highest point in Nigeria (Akinsoji, 1996) at an altitude of 2149m asl. and it supports a distinctive flora. It bears grass on the top and forest in the stream valleys. The forest is less luxuriant than montane forests at lower altitudes. It has many afro-montane endemics (White, 1983) which include *Albizia gummifera*, *Lobelia columnaris*, *Hypericum revolutum*, *Schefflera* sp. and endangered species such as *Prunus africana*, *Ritchiea albersii* and *Pittosporum viridiflorum* (Dowset-Lemaire, 1992). *Prunus africana* is both endemic and endangered. Gangrewal also harbours two gymnosperms; *Podocarpus milianianus* and *Philipia manni*

At each location, 20 tenth-hectare strip quadrats (Whittaker and Niering, 1965) were sampled. Five parallel transects were marked within each quadrat and all the trees bearing epiphytes were identified. The epiphytes that occurred at the lower parts of

the stem were hand-picked but those higher up were collected by climbing the trees with an improvised ladder. The epiphytes were identified and then recorded. Some trees scattered on montane grasslands eg. *Entada abyssinica* supports mats of epiphytes on them. The mats were detached and sorted into cryptogamic and vascular epiphytes. Only the vascular epiphytes were recorded. Some of the epiphytes that could not be identified in the field were taken to the Forestry Research Institute of Nigeria Herbarium at Ibadan for identification. Specimens were deposited in the Gashaka herbarium.

Nomenclature follows Hutchinson and Dalziel, (1954; 1963)

RESULTS.

A total of 41 species of epiphytes distributed in 15 families were sampled. These comprise 13 species of pteridophytes and 28 species of angiosperms out of which 17 species were members of Family Orchidaceae.

Gashaka woodland

A total of eight epiphytic species distributed among five families were recorded from the Gashaka woodland. One species was a pteridophyte while seven were angiosperms. The Family Orchidaceae was dominant with four species while the other families had a species each (Table 1). *Calypstrochilum emarginatum* was the most frequent epiphyte, occurring on eight of the ten phorophyte species sampled. The ratio of Pteridophytes to Orchids was 1:4.

Table 1: EPIPHYTIC SPECIES OF THE WOODED SAVANNA NEAR GASHAKA VILLAGE (350m asl)

Species	Family	Phorophyte
Pteridophyte		
<i>Platyserium stemaria</i> (P. Beauv.) Desv.	Polypodiaceae	<i>Borassus aethiopicum</i> (t) <i>Parinari curatellifolia</i> (t) <i>Uapaca togoensis</i> (b, t) <i>Afzelia africana</i> (b, t)
Angiosperms		
<i>Aerangis biloba</i> (Lindl.) Schltr.	Orchidaceae	<i>Uapaca togoensis</i> (b, t)
<i>Aneilema beniniense</i> (P. Beauv.) Kunth.	Commelinaceae	<i>Terminalia avicennoides</i> (t), <i>Daniellia oliveri</i> (t), <i>Afzelia africana</i> (t)
<i>Angraecum subulatum</i> Lindl.	Orchidaceae	<i>Vitex donniiana</i> (c) <i>Hymenocardia acida</i> (t)
<i>Bulbophyllum</i> sp.	Orchidaceae	<i>Hymenocardia acida</i> (b)
<i>Calypstrochilum emarginatum</i> (Sw.) Schltr.	Orchidaceae	<i>Afzelia africana</i> (b), <i>Uapaca togoensis</i> (b) <i>Crossopteryx febrifuga</i> (b) <i>Daniellia oliveri</i> (b), <i>Vitex donniiana</i> (b) <i>Parinari curatellifolia</i> (t), <i>Pseudocedrella kotschyii</i> (t), <i>Terminalia avicennoides</i> (b)
<i>Ficus thonningii</i> Blume	Moraceae	<i>Borassus aethiopicum</i> (t), <i>Terminalia avicennoides</i> (t)
<i>Hyparrhenia rufa</i> (Nees) Stapf	Poaceae	<i>Crossopteryx febrifuga</i> (b)

Location of epiphyte on Phorophyte.

(b)- branch (>3m)

(c)- crown (>5m)

(t)- trunk (3-5m)

Gidan Kwano

A total of eleven epiphytic species distributed among five Families were recorded from Gidan Kwano. Three species belonging to two Families were pteridophytes while eight were angiosperms (three Families). The epiphytes were dominated by the family Orchidaceae with six species. Five of the epiphytes, *Nephrolepis biserrata*, *Platyserium*

angolense, *Culcasia scandens*, and *Ficus thonningii* were recorded from the forest while the others were recorded from the woodland (Table 2). Those recorded from the woodland were the same species recorded from Gashaka environ except *Aneilema beniniense* and *Hyparrhenia* sp. The ratio of Pteridophytes to Orchids is 1:2.

Table 2: EPIPHYTIC SPECIES OF GIDAN KWANO (550m asl)

Species	Family	Phorophyte
Pteridophyte		
<i>Nephrolepis biserrata</i> (Sw.) Schott	Davalliaceae	<i>Albizia glabberima</i> (b, t) <i>Aubrevillea kerstingii</i> (b)
<i>Platynerium angolense</i> Welw.ex.Hook	Polypodiaceae	<i>Antidesma</i> sp. (t) <i>Symphonia globulifera</i> (t)
<i>Platynerium stemaria</i> (P. Beauv.) Desv.	Polypodiaceae	<i>Uapaca togoensis</i> (t) <i>Daniellia oliveri</i> (t)
Angiosperms		
<i>Aerangis biloba</i> (Lindl.) Schltr	Orchidaceae	<i>Uapaca togoensis</i> (b) <i>Ptilostigma thonningii</i> (b)
<i>Angraecum subulatum</i> Lindl.	Orchidaceae	<i>Uapaca togoensis</i> (b)
<i>Calyptrochilum christyanum</i> (Rchb.f.) Summerh	Orchidaceae	<i>Afzelia africana</i> (b,t) <i>Uapaca togoensis</i> b)
<i>Calyptrochilum emarginatum</i> (Sw.) Schltr.	Orchidaceae	<i>Ptilostigma thonningii</i> (t) <i>Anogeissus lieocarpus</i> (t) <i>Uapaca togoensis</i> (b, t)
<i>Culcasia scandens</i> P. Beauv.	Araceae	<i>Tetrapleura tetrapetra</i> (t)
<i>Ficus thonningii</i> Blume	Moraceae	<i>Symphonia globulifera</i> (t) <i>Afzelia africana</i> (t)
<i>Polystachya dolichophylla</i> Schltr.	Orchidaceae	<i>Ptilostigma thonningii</i> (b) <i>Lophira lanceolata</i> (b)
<i>Rangaeris rhipsalisocia</i> (Rchb.f.) Summerh	Orchidaceae	<i>Albizia zygia</i> (t)

Location of epiphyte on Phorophyte

(b)- branch (>5m)

(t)- trunk (3-5m)

Chabbal Hendu.

A total of twenty five epiphytes were recorded from Chabbal Hendu (both forests and montane grassland) comprising eight pteridophytes and seventeen angiosperms. The forests had eight pteridophytes and seven angiosperms. The pteridophytes species were distributed in five Families (Table 3). The angiosperms were also distributed in five Families. The ratio of pteridophytes to orchids was 4:1. The montane

grassland had fourteen species; three pteridophytes distributed in two Families and eleven angiosperms distributed in four Families (Table 4). The angiosperm epiphytes were dominated by Orchids (8 species). The ratio of pteridophytes to Orchids is 3:8. Four species; *Asplenium theciferum*, *Drynaria volkensi*, *Pleopeltis macrocarpa* and *Ficus thonningii* were present in both forest and grassland.

Table 3: EPIPHYTIC SPECIES OF MONTANE FOREST IN CHABBAL HENDU (1800-200m asl)

Species	Family	Phorophyte
Pteridophytes		
<i>Arthropteris monocarpa</i> (Cordem.) C. Chr.	Davalliaceae	<i>Garcinia smeathmannii</i> (b) <i>Albizia gummifera</i> (b)
<i>Asplenium aethiopicum</i> (Burn.) Becherer	Aspleniaceae	<i>Albizia gummifera</i> (b) <i>Garcinia smeathmannii</i> (b)
<i>Asplenium dregeanum</i> Kunze	Aspleniaceae	<i>Symphonia globulifera</i> (b) <i>Campylospermum flavum</i> (b)
<i>Asplenium stublmannii</i> Heiron	Aspleniaceae	<i>Croton macrostachyus</i> (b) <i>Milletia conraui</i> (b)
<i>Drynaria volkensi</i> Hieron	Polypodiaceae	<i>Garcinia smeathmannii</i> (t) <i>Symphonia globulifera</i> (t) <i>Albizia gummifera</i> (t)
<i>Pleopeltis nicklesii</i> (Tard.) Alston	Polypodiaceae	<i>Garcinia smeathmannii</i> (c, t) <i>Symphonia globulifera</i> (c, t)
<i>Trichomanes mannii</i> Hook.	Hymenophyllaceae	<i>Syzygium guineense</i> (b, t) <i>Albizia gummifera</i> (b) <i>Croton macrostachyus</i> (b)
<i>Vittaria guineensis</i> Desv.	Vittariaceae	<i>Prunus africana</i> (b) <i>Vitex doniana</i> (b)
Angiosperms		
<i>Begonia</i> sp.	Begoniaceae	<i>Carapa procera</i> (c)
<i>Bulbophyllum becquartii</i> De. Wild.	Orchidaceae	<i>Symphonia globulifera</i> (c) <i>Garcinia smeathmannii</i> (c)
<i>Ficus leprieuri</i>	Moraceae	<i>Vitex doniana</i> (t)
<i>Peperomia fernandopoiana</i> C. DC.	Piperaceae	<i>Symphonia globulifera</i> (b, t)
<i>Peperomia reflexa</i> (Linn. f.) A. Dietr.	Piperaceae	<i>Garcinia smeathmannii</i> (b,t)
<i>Polystachya odorata</i> Lindl.	Orchidaceae	<i>Prunus africana</i> (c) <i>Syzygium guineense</i> (c)
<i>Schefflera abyssinica</i> (Hochst. Ex A. Rich.) Harms.	Araliaceae	<i>Prunus africana</i> (c, t)

Location of epiphytes on phorophytes.

(b)- base of stem (<1m).

(t)- trunk (1-5m).

(c)- crown (>5m)

Table 4: EPIPHYTIC SPECIES OF MONTANE GRASSLAND IN CHABBAL HENDU (1800-2000m asl)

Species	Family	Phorophyte
Pteridophytes		
<i>Asplenium stubmannii</i> Hieron	Aspleniaceae	<i>Entada abyssinica</i> (lb) <i>Combretum molle</i> (t)
<i>Drynaria volkensi</i> Hieron.	Polypodiaceae	<i>Entada africana</i> (lb) <i>Combretum molle</i> (t)
<i>Pleopeltis nicklesii</i> (Tard.) Alston	Polypodiaceae	<i>Entada abyssinica</i> (lb) <i>Cussonia arborea</i> (t)
Angiosperms		
<i>Ancistrorrynchus cephalotes</i> (Rchb. f.) Summerh	Orchidaceae	<i>Entada abyssinica</i> (lb)
<i>Angraecum subulatum</i> Lindl.	Orchidaceae	<i>Entada abyssinica</i> (lb)
<i>Bulbophyllum cochleatum</i> Lindl.	Orchidaceae	<i>Entada abyssinica</i> (lb)
<i>Ficus thonningii</i> Blume	Moraceae	<i>Syzygium guineense</i> (t) <i>Combretum molle</i> (t)
<i>Kalanchoe crenata</i> (Andr.) Haw	Crassulaceae	<i>Syzygium guineense</i> (b)
<i>Plectranthus caudatus</i> (Lindl.) Summerh.	Orchidaceae	<i>Entada abyssinica</i> (lb)
<i>Podangis dactyloceras</i> (Rchb. f.) Schltr.	Orchidaceae	<i>Entada abyssinica</i> (lb)
<i>Polystachya modesta</i> Rchb. f.	Orchidaceae	<i>Entada abyssinica</i> (lb) <i>Combretum molle</i> (t) <i>Cussonia arborea</i> (t)
<i>Polystachya stricta</i> Rolfe	Orchidaceae	<i>Entada abyssinica</i> (lb) <i>Combretum molle</i> (t)
<i>Tridactyle lepidota</i> (Rchb. f. ex Rolfe) Schltr.	Orchidaceae	<i>Entada abyssinica</i> (lb)
Unidentified grass	Poaceae	<i>Combretum molle</i> . (t)

Location of epiphytes on the phorophyte.

(b). base of stem (<1m)

(t). trunk of stem (1-5m)

(lb). upper surface of top lateral branches (2-3m) on *Entada abyssinica*

Table 5: EPIPHYTIC SPECIES OF GANGREWAL (2000-2419 asl)

Species	Family	Phorophyte
Pteridophytes		
<i>Asplenium dregeanum</i> Kunze	Aspleniaceae	<i>Prunus africana</i> (t) <i>Ilex mitis</i> (t)
<i>Asplenium preussi</i> Hieron ex Brause	Aspleniaceae	<i>Prunus africana</i> (t) <i>Pittosporum mannii</i> (c)
<i>Drynaria volkensi</i> Hieron	Polypodiaceae	<i>Prunus africana</i> (t)
<i>Lycopodium brachystachys</i> (Bak.) Alston	Lycopodiaceae	<i>Podocarpus milanjianus</i> (t) <i>Prunus africana</i> (t)
<i>Vittaria guineensis</i> Desv.	Vittariaceae	<i>Albizia gummifera</i> (t) <i>Garcinia smeathmannii</i> (c)
Angiosperms		
<i>Angraecopsis ischnopus</i> (Schltr.) Schltr.	Orchidaceae	<i>Syzygium guineense</i> (c) <i>Prunus africana</i> (c)
<i>Begonia</i> sp.	Begoniaceae	<i>Carapa procera</i> (t) <i>Philippia mannii</i> (c)
<i>Bulbophyllum bequaertii</i> De. Wild.	Orchidaceae	<i>Prunus africana</i> (c) <i>Nuxia congesta</i> (c)
<i>Polystachya stuedneri</i> Rchb. f	Orchidaceae	<i>Pittosporum mannii</i> (c) <i>Podocarpus milanjianus</i> (t)
<i>Schefflera abyssinica</i> (Hochst. ex A. Richb.) Hierns	Araliaceae	<i>Podocarpus milanjianus</i> (c,t) <i>Albizia gummifera</i> (c)

Location of epiphytes on the phorophyte.

© crown of trees (>5m) (t) trunk of trees (1-5m)

Gangrewal

A total of ten epiphytes distributed in six Families were recorded from Gangrewal (Table 5). There were five species of pteridophytes distributed in four Families and five species of angiosperms distributed in two Families. The angiosperms were dominated by the Family Orchidaceae with four species out of the five species.

DISCUSSION

Out of the eight epiphyte species found in Gashaka village environ *Aneilema beniniense* and *Hyparrhenia rufa* occurred as occasional epiphytes (sensu Oliver, 1930). They normally grow on the ground but in this case, their propagules accidentally fell on tree barks where they initiated germination on the phorophyte. According to Akinsoji (1990), their nutritional requirements would soon be higher than what the phorophytes can provide and they will die and fall off the phorophyte. *Ficus* is a strangler which encircles the phorophyte and strangles it to death after some time (Akinsoji, 2005). It then becomes free-living. The dry and open environment accounted for the poor representation of pteridophytes. The only pteridophyte found was *Platynerium stemaria* which tolerates open and relatively dry environments. The four orchid species present had xeromorphic characters like thick, succulent leaves and thick cuticle as observed by Akinsoji (1990) and Johansson (1974) in Nigeria and Sierra Leone respectively.

The similarity of the epiphytic flora of the Gashaka village environ and Kwano and the dominance by the Family Orchidaceae is due to the homogeneity of the vegetation of both sites. However, more pteridophytes were recorded in Kwano because the forest component of the vegetation provided cool, moist and shaded habitats. Akinsoji (2005) made a similar report for montane vegetation.

The preponderance of pteridophytes in the montane forests of Chabbal Hendu over the grassland can be attributed to the cool moist and shaded habitats provided by the forest canopy. The few orchids found in the forest were adapted to the conditions prevalent in the forest and were absent on the grassland. The grassland orchids showed the morphological characteristics to

survive in relatively dry environment such as succulence and other water-conserving structures. They also formed epiphytic mats on the barks and branches of phorophytes. These mats also contain cryptogamic epiphytes which form a spongy-like cushion for water retention. The three pteridophyte species found on the grassland also occurred in the forests but the ones found in the forest were robust and luxuriant due to the shade and cooler environment provided by the forest canopy.

Gangrewal recorded the least number of epiphytes (10). This is due to the poor development of the forests and the montane grassland had shrubs and not trees that could have provided habitats for epiphytes. The simple structure of the forest caused a reduction in potential habitats that epiphytes could have established. The maxim in epiphyte ecology that the composition of epiphytes increases with altitude is not totally supported by this study. In this study, the number of epiphytes increased with altitude up to a point (Chabbal Hendu, 1800-2000m asl.) and then declines at a higher altitude (Gangrewal, >2000m asl.). This may be due to the drier environment and poor development of the forest at that altitude. This study also revealed that some of the species are lowland epiphytes since their occurrence is limited to altitudes below 1000m asl. The lowland epiphytes are *Nephrolepis biserrata*, *Aeranges biloba*, *Calypstrochilum* spp., and *Platynerium* spp. Some species such as *Angraecopsis*, *Asplenium* spp., *Lycopodium brachystachys*, *Tridactyle lepidota*, *Vittaria guineensis* and *Peperomia* spp were recorded only from highlands hence they are highland epiphytes.

CONCLUSION.

The vascular epiphytic flora of GGNP is dominated by pteridophytes and orchids. Pteridophytes were more abundant in the forests where conditions were cool, moist and shaded while orchids preferred open and relatively drier habitats. The number of epiphytic species increased with altitude up to a point (1800-2000m asl.) above which it declined. Species such as *Nephrolepis biserrata*, *Aeranges biloba*, *Platynerium* spp. and *Calypstrochilum* spp. were restricted to lowlands while *Lycopodium brachystachys*, *Vittaria guineensis* and *Peperomia* spp. were highland or montane

species occurring only above 1000m asl.

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