

TAXONOMY AND BIODIVERSITY CONSERVATION IN CENTRAL AFRICA

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The evaluation of the biodiversity studies carried out during 7
years by Ecofac program (Conservation and rational
utilization of forests ecosystems in Central Africa, E.C.) is
presented for six countries from Central Africa: Cameroon,
Central African Republic, Congo-Brazzaville, Equatorial
Guinea, Gabon, São Tomé and Príncipe.

Key words: Biodiversity, taxonomy, Central Africa,
conservation.

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A avaliação dos estudos de biodiversidade levada a cabo
durante 7 anos pelo programa Ecofac (Conservação e
utilização racional de ecossistemas florestais na África
Central, E.C.) é apresentada para seis países da África
Central: Camarões, República Centro-Africana, Congo-
-Brazavile, Guiné Equatorial, Gabão e São Tomé e Príncipe.

Palavras chave: Biodiversidade, taxonomia, África Central,
conservação.

INTRODUCTION

The western part of Central Africa has a high level of biodiversity. During the last decades, very few collections were carried out and its Flora is not well known. For this reason, a multidisciplinary program (Ecofac: Conservation and rational utilization of forest ecosystems in Central Africa) was undertaken by the European Union in 6 countries of Central Africa (Fig. 1 and Table 1). The main objective of this paper is to present the progress in the study of plant biodiversity in connection with Ecofac program since 1993.



Fig. 1 and Table 1: The six sites studied in Ecofac Program . (The site of Rep. Dem. Congo has not been studied until now).

Country	Site	Area (km ²)
São Tomé and Príncipe	Obo National Park	295
Equatorial Guinea	Monte Alen National Park 1	600
Gabon	Lope Reserve	5 360
Cameroun	Dja Fauna Reserve	5 260
Congo-Brazzaville	Odzala National Park	2 800
Central Africa Republic	Ngotto forests	2 683

METHODS

The methods used for plant biodiversity surveys are the followings: constitution of herbaria collections and data banks, creation of the first national herbarium for 3 countries (Central African Republic, Equatorial Guinea and São Tomé and Príncipe), installation of transects with the main tree species labelled, updating of local checklists and building of special green houses for orchids.

The tree species may be difficult to identify because the flowers and fruits are often not easily available. For the survey, line transects crossing different forest types were established. Along the transects, all trees from 10 to 70 cm in a 5 m wide band and over 70 cm in a 50 m wide band were measured for diameter at breast height (dbh at 1.30 m above ground level) and labelled. Furthermore, this transect method allows by permanent monitoring and by coming back each month to verify the identification of a great part of the trees occurring on the transect.

The same difficulty appears with orchids. It was necessary to collect living sterile specimens and to transplant them in special greenhouses. During the following year it was possible to collect flowers and make an accurate identification.

RESULTS

1. DESCRIPTION OF NEW SPECIES

Thanks to the Ecofac program, three new species were described from the Odzala National Park in North of Congo-Brazzaville: *Habenaria lisowskii* SZLACHETKO (1995) Orchidaceae, was collected in savanna on sandy soils near the rain forest. *Diospyros whitei* DOWSETT-LEMAIRE & PANNELL (1996) is one of the biggest tree known at present in the family Ebenaceae; it is very common in the Odzala National Park, mainly in the Marantaceae forests. *Zeuxine odzalaensis* GEERINCK & LEJOLY (1997), a small terrestrial orchid was collected for the first time in December 1996 on the great escarpment at the western border of the Odzala National Park.

Four new species were described from Rio Muni, the continental part of Equatorial Guinea: *Polyscias aequatoguineensis* LEJOLY & LISOWSKI (1999a), a shrub of the Araliaceae with compound leaves is located on the lower edge of two inselbergs (Asoc and Dumu) from the East of Rio Muni. *Dischistocalyx champluvieranus* LEJOLY & LISOWSKI (1999a) an herbaceous undershrub (Acanthaceae) is growing on rocks along shady streams in the rain forests from the South West of Rio Muni. *Heterotis obamae* LEJOLY & LISOWSKI (1999b) is a small Melastomataceae from the coastal grasslands of Rio Muni. *Lobelia sylvicola* LEJOLY & LISOWSKI (in press) is a small perennial Lobeliaceae living in the rain forest.

Four new species of orchids were identified from São Tomé and Príncipe: *Liparis rosseelii* Stévant, small epiphyte in mountain forest; *Bulbophyllum luciphilum* Stévant, epiphyte on the high twigs of trees at the elevation of 1000 m; *Calanthe sylvatica* var. *geerinckiana* Stévant, terrestrial in secondary forest; *Polystachya albescens* subsp. *principensis* Stévant, epiphyte, endemic from Príncipe Island (STEVART & GEERINCK in press).

2. NEW LOCALITIES FOR RARE SPECIES

In the Orchidaceae family, *Zeuxine occidentalis* (Summerh.) Geerinck and *Z. stammeri* Schltr. were recorded for the first time from Odzala National Park and for Congo-Brazzaville (LEJOLY & LISOWSKI 1999a).

In Rubiaceae, *Ecpoma hiernianum* (Wernh.) N. & F. Hallé, *Pentaloncha humilis* Hook. f., *Sherbournia ailarama* N. Hallé, *Virectaria belingana* N. Hallé, are cited for the first time from Rio Muni.

In Gentianaceae, two rare species, *Oreonesion testui* A. Raynal growing on the inselbergs and *Neurotheca corymbosa* Hua growing in the coastal grasslands are also cited for the first time from Rio Muni (LEJOLY & LISOWSKI 1999a).

3. TAXONOMIC DIVERSITY OF TREES ALONG TRANSECTS

The most abundant big trees, for a typical transect in each Ecofac site, with dbh > 70 cm and with more than 0.5 stem per ha are mentioned in Table 2. The density of big trees varies from 4.8 to 16.4 trunks per ha. The Marantaceae forest is characterized by a low density ie the half that in forests from other sites. The absence of the Okoume (*Aucoumea klaineana* Pierre, Burseraceae), very common in the Lope Reserve, is responsible for the strong difference between Lope Reserve and Odzala. In the Odzala N.P., no other pioneer species is able to grow so quickly and to reach so big diameters.

The most abundant trees with dbh of at least 10 cm and with more than 10 stems per ha are listed in Table 3. In the Obo N.P. (São Tomé) and in the Marantaceae forest from Lope Reserve, there is each time one species with gregarious behaviour. In São Tomé, *Tabernaemontana stenosphon* Stapf (endemic Apocynaceae) reaches 84 stems/ha; in Lope Reserve, *Cola lizae* N. Hallé reaches 75 stems/ha in a pioneer forest colonizing savanna.

On the contrary, the Marantaceae forest from the Odzala N.P. is much more heterogeneous: the most abundant species are at a low stem density: *Santiria trimera* (Oliv.) Aubrév., Burseraceae (23 stems/ha), *Camptostylus mannii* (Oliv.) Gilg, Flacourtiaceae (21) and *Diospyros polystemon* Gürke, Ebenaceae (13).

It is remarkable that very few species are equally abundant over the different sites:

- *Santiria trimera* (Oliv.) Aubrév. (Burseraceae) with 22 to 30 stems/ha from Monte Alen to Lope and Odzala.
- *Coelocaryon preussii* Warb. Myristicaceae with 15 stems/ha in Monte Alen and Odzala.
- *Diospyros polystemon* Gürke (Ebenaceae) with 13 stems/ha inventoried in the Marantaceae forests from Lope and Odzala.

All other species framed in Table 3 can be considered as local characteristic trees for one given site.

Concerning the relative abundance for the families of trees with dbh > 70 cm (Table 4) it appears that the big trees belonging to Fabales show the highest

densities in 4 sites with the exception of São Tomé and Ngotto. They reach frequencies from 27% (Odzala) to 58% in the “Forêt des Abeilles” in Gabon at the East of the Lope Reserve. The dominant Caesalpiniaceae are different from one site to another:

- *Daniellia klainei* Pierre ex A. Chev. and *Prioria joveri* (Normand ex Aubrév. in Monte Alen N.P) Breteler;
- *Paraberlinia bifoliolata* Pellegr. in the “Forêt des Abeilles” (Gabon);
- *Gilbertiodendron dewevrei* (De Wild.) J. Léonard in the Dja Fauna Reserve;
- *Erythrophleum suaveolens* (Guill. & Perr.) Brenan in the Odzala N.P.

The big trees belonging to Fabaceae (like *Pterocarpus soyauxii* Taub.) and to Mimosaceae (like *Pentaclethra macrophylla* Benth.) are more spread all over the place and have a wide distribution.

The Ngotto Forest is easily characterized by a high value of relative abundance for Meliaceae (4 species of the genus *Entandrophragma*) and Sapotaceae (3 species of *Gambeya* and *Manilkara mabokeensis* Aubrév.).

The study of the relative abundance of tree families with stems having dbh > 10 cm shows remarkable features (Table 5).

The montane forests of São Tomé have no Leguminosae. The most abundant families are Euphorbiaceae [mainly *Pseudagrystachys africana* (Müll. Arg.) Pax & Hoffm. and the endemic *Discoclaoxylon occidentale* Pax & K. Hoffm., Apocynaceae (mainly *Tabernaemontana stenosiphon* Stapf, endemic) and Rubiaceae (*Rothmannia urcelliformis* (Hiern) Robyns].

In the Monte Alen National Park, the Euphorbiaceae are also very abundant but with other species like *Dichostemma glaucescens* Pierre and *Drypetes* ssp. The 2 other families with 9 to 12 % of relative abundance are respectively Caesalpiniaceae (with *Hylodendron gabunense* Taub.) and Burseraceae (with *Santiria trimera* (Oliv.) Aubrév.).

In the South West of the Odzala N.P., small trees belonging to Annonaceae are more abundant: *Polyalthia suaveolens* Engl. & Diels, *Annonidium mannii* (Oliv.) Engl. & Diels, *Isolona hexaloba* (Pierre) Engl. & Diels, *Polyceratocarpus pellegrinii* Le Thomas, *Xylopia parviflora* (A. Rich.) Benth..

Lastly, in Central African Republic, the Ngotto Forest is characterized by high relative abundance of Meliaceae [*Carapa procera* DC., *Trichilia monadelphica* (Thonn.) De Wild.], Sapotaceae [*Synsepalum stipulatum* (Radlk.) Engl.], Sapindaceae [*Pancovia laurentii* (De Wild.) Gilg ex De Wild.], Clusiaceae (*Garcinia punctata* Oliv.) and Myristicaceae (*Staudtia kamerunensis* Warb.). In this mid-stratum there are no species similar to the species from the upper stratum.

Table 2. Most common trees in Ecofac sites with dbh > 70 cm (stems/ha)

Ecofac sites (see table 3)	1	2	3	4	5	6	
Studied area (ha)	13.5	22.5	50	25	25	22.5	25
Total number of stems/ha	9.4	11.2	-	-	16.4	4.8	10.7
Species number	18	6	-	-	80	41	64
Abundant trees in Obo NP (1)							
<i>Homalium henriquesii</i>	2.3	-	-	-	-	-	-
<i>Croton stellulifer</i>	2.3	-	-	-	-	-	-
<i>Ficus chlamydocarpa</i> subsp. <i>fernandesiana</i>	1.3	-	-	-	-	-	-
<i>Sapium ellipticum</i>	0.9	-	-	-	-	-	-
Abundant trees in monte Alen NP (2)							
<i>Daniellia klainei</i>	-	0.5	<0.	<0.	-	-	-
<i>Prioria joveri</i>	-	0.5	-	-	-	-	-
<i>Pterocarpus soyauxii</i>	-	0.5	0.7	0.2	0.3	0.1	0.2
<i>Uapaca guineensis</i>	-	0.5	0.1	-	-	-	-
Abundant trees in Lopé Reserve (3)							
<i>Aucoumea klaineana</i>	-	2.3	5.7	3.1	-	-	-
<i>Dacryodes buettneri</i>	-	0.3	0.7	2.7	-	-	-
<i>Scyphocephalum ochocoa</i>	-	-	0.1	1.7	-	-	-
<i>Pycnanthus angolensis</i>	-	0.4	0.4	0.3	0.3	0.1	0.4
Abundant trees in Dja FR (4)							
<i>Gilbertiodendron dewevrei</i>	-	-	-	-	2	-	-
<i>Musanga cecropioides</i>	-	-	-	-	1.4	-	-
<i>Pentaclethra macrophylla</i>	-	0.1	0.4	0.4	0.8	0.1	-
<i>Triplochiton scleroxylon</i>	-	-	-	-	0.8	-	-
<i>Alstonia boonei</i>	-	0.2	-	-	0.7	-	0.2
<i>Desbordesia glaucescens</i>	-	0.4	0.1	0.4	0.7	-	-
Abundant trees in Odzala NP (5)							
<i>Erythrophleum suaveolens</i>	-	-	-	<0.	1	0.2	0.2
<i>Maranthes glabra</i>	-	-	-	0.7	0.3	0.4	-
<i>Pycnanthus marchalianus</i>	-	-	-	-	-	0.3	-
Abundant trees in Ngotto Forests (6)							
<i>Entandrophragma cylindricum</i>	-	-	-	-	0.1	-	1
<i>Petersianthus macrocarpus</i>	-	0.3	-	0.1	0.6	0.2	1
<i>Ricinodendron heudelotii</i>	-	-	-	-	0.2	-	0.5
<i>Manilkara mabokeensis</i>	-	-	-	-	-	-	0.4

Table 3. Most common trees in Ecofac sites with dbh > 10 cm (stems/ha)

1: São Tomé and Príncipe 2: Rio Muni, Equatorial Guinea 3: Gabon							
4: Cameroon		5: Congo-Brazzaville		6: Central African Republic			
Country	1	2	3	4	5	6	
Studied area (ha)	1.35	2.25	5	2.5	2.5	2.25	2.5
Total number of stems/ha	563	590	-	-	513	295	549
Species number	54	239	129	146	197	106	146
Abundant trees in Obo National Park (1)							
<i>Tabernaemontana stenosphon</i>	84	-	-	-	-	-	-
<i>Pseudagrostistachys africana</i>	61	-	-	-	-	-	-
<i>Homalium henriquesii</i>	59	-	-	-	-	-	-
<i>Rothmannia urcelliformis</i>	43	-	-	-	-	-	-
<i>Trichilia grandifolia</i>	42	-	-	-	-	-	-
<i>Discoclaoxylon occidentale</i>	36	-	-	-	-	-	-
<i>Pauridiantha floribunda</i>	29	-	1	1	-	-	-
<i>Allophylus africanus</i>	26	-	-	-	2	<1	-
<i>Croton stellulifer</i>	13	-	-	-	-	-	-
<i>Rauvolfia vomitoria</i>	13	-	-	-	-	-	-
Abundant trees in Monte Alen National Park (2)							
<i>Santiria trimera</i>	2	30	<1	22	10	23	6
<i>Dichostemma glaucescens</i>	-	26	-	-	5	8	-
<i>Heisteria parvifolia</i>	4	23	1	2	-	2	-
<i>Hylodendron gabunense</i>	-	15	3	-	4	-	-
<i>Voacanga bracteata</i>	-	14	-	-	-	-	-
Abundant trees in Lopé Reserve (3)							
<i>Cola lizae</i>	-	-	75	-	-	-	-
<i>Aucoumea klaineana</i>	-	6	31	6	-	-	-
<i>Xylopia quintasii</i>	-	2	27	2	3	-	-
<i>Diospyros dendo</i>	-	-	11	2	-	-	-
<i>Strombosia zenkeri</i>	-	-	-	27	-	-	-
<i>Corynanthe mayumbensis</i>	-	-	3	22	-	-	-
<i>Strombosiopsis tetrandra</i>	-	4	1	20	9	3	3
<i>Augouardia letestui</i>	-	-	-	16	-	-	-
<i>Xylopia aethiopica</i>	3	1	5	14	1	<1	2
<i>Dacryodes buettneri</i>	-	4	5	12	-	-	-
<i>Dialium soyauxii</i>	-	-	-	12	-	<1	-
<i>Maprounea membranacea</i>	-	1	5	10	<1	-	-
Abundant trees in Dja Fauna Reserve (4)							

<i>Plagiostyles africana</i>	-	15	1	7	34	2	-
<i>Tabernaemontana crassa</i>	-	-	-	-	23	-	4
<i>Gilbertiodendron dewevrei</i>	-	-	-	-	20	-	-
<i>Coelocaryon preussii</i>	-	15	-	4	15	<1	11
<i>Petersianthus macrocarpus</i>	-	11	-	2	14	<1	14
<i>Uapaca guineensis</i>	-	-	<1	-	12	-	-
<i>Trichilia rubescens</i>	-	-	-	-	10	-	<1
<i>Heisteria zimmereri</i>	-	-	-	-	10	-	-
Abundant trees in Odzala National Park (5)							
<i>Camptostylus mannii</i>	-	-	1	2	-	21	-
<i>Diospyros polystemon</i>	-	-	13	1	-	13	-
<i>Chaetocarpus africanus</i>	-	-	-	-	-	11	-
<i>Pausinystalia macroceras</i>	-	-	<1	-	<1	11	4
<i>Polyalthia suaveolens</i>	-	10	-	-	11	11	-
Abundant trees in Ngotto Forests (6)							
<i>Staudtia kamerunensis</i>	-	4	-	-	7	1	44
<i>Garcinia punctata</i>	-	5	-	-	-	-	37
<i>Carapa procera</i>	4	8	1	6	2	-	22
<i>Synsepalum stipulatum</i>	-	-	-	-	-	-	22
<i>Celtis mildbraedii</i>	1	-	-	-	-	-	18
<i>Pancovia laurentii</i>	-	-	-	-	-	-	16
<i>Strombosia grandifolia</i>	-	1	-	-	4	<1	16
<i>Trichilia monadelpha</i>	-	-	<1	-	4	-	13
<i>Diospyros iturensis</i>	-	-	-	-	-	<1	12

The data for Lopé Reserve (Gabon) are from TUTIN & al. (1994).

DISCUSSION AND CONCLUSIONS

Many species remain to discover in Equatorial Guinea, North of Congo-Brazzaville and Central African Republic which are countries with very few herbaria collections until now.

New species can be found in families like Orchidaceae by cultivating sterile specimens collected in the field. For this family the conservation ex situ is a prerequisite.

New species can also be found in marginal habitats like inselbergs, coastal grasslands and rocky mountains where peculiar environments must have facilitated speciation or welcomed as a rare relict species refuge from past climates. These biotopes deserve to be conserved in priority.

The transect method is very useful to identify the rare tree species. The transect band can be considered as a botanical arboretum where it is possible to compare the phenology and the morphology of very similar species.

Table 4. Relative abundance (%) for some families, for different Ecofac sites, stems with dbh > 70 cm

Country	S.Tomé	Eq. Guin.	Gabon	Camer.	Congo	CAR
Nber ha	13.5	22.5	7.5	25	23	25
Total nber stems/ha	9.4	11.3	13.1	16.4	4.8	10.7
Nber of species	18	62	28	80	41	64
Nber of families	12	25	11	31	22	25
Euphorbiaceae	24.4	6.3	-	2.7	0.9	6
Flacourtiaceae	24.4	-	-	0.2	-	-
Moraceae	17.3	-	-	9.2	3.7	4.1
Burseraceae	3.2	24.8	29.8	-	7.3	0.4
Caesalpiniaceae	-	20.5	49.6	17.5	15.6	6
Irvingiaceae	-	6.3	0.4	9.5	3.7	2.2
Mimosaceae	-	8.3	5.3	9	5.5	4.5
Chrysobalanaceae	-	-	-	1.9	12.8	0.4
Meliaceae	3.2	0.8	-	1.7	10.1	18.3
Sapotaceae	-	-	0.8	1.2	0.9	11.6
Sub Total (10 families)	72.5	67	85.9	52.9	60.5	53.5
Other families	27.5	33	14.1	47.1	39.5	46.5
Total Leguminoseae	0	33.5	58	29.2	26.6	12.7

Table 5. Relative abundance (%), stems with dbh > 10 cm

	S.Tomé	Eq. Guin.	Gabon	Camer.	Congo	CAR
Apocynaceae	17.2	2.9	-	5.3	0.2	1.5
Rubiaceae	12.2	3.7	5.4	4.5	8.6	1.2
Flacourtiaceae	10.4	3.2	0.6	0.8	7.7	0.9
Euphorbiaceae	21.9	15.6	5.4	20.1	9.5	7.1
Burseraceae	0.4	11.9	17.2	2.3	9.4	1.3
Caesalpiniaceae	-	9.2	24.6	7	10.4	0.5
Ebenaceae	-	0.9	8.6	0.7	6.9	4.1
Annonaceae	0.5	3.2	1.6	5	11.9	4.7
Meliaceae	8.6	4.5	0.3	5.5	0.9	12.5
Sapotaceae	1.3	0.3	-	1.2	0.3	11.7
Myristicaceae	-	5	1	5	1.1	11.4
Clusiaceae	1.2	2.9	4.5	1.9	0.2	9.2
Sapindaceae	4.6	2	3.2	2.7	0.8	7.1
Sub Total (13 families)	78.3	65.3	72.4	62	67.9	73.2
Other families	21.7	34.7	27.6	38	32.1	26.8
Number of families	26	41	29	43	39	34

The monitoring of the transect is also a way to analyse the dynamic and the mortality of rare trees. Furthermore, along the transect it is easy to analyse regeneration of the emergent trees. It can also be used for an early warning in case of threats of important biodiversity reduction.

In conclusion the transect method is an efficient tool for biodiversity studies and subsequently conservation management.

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