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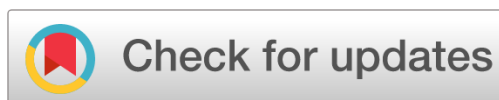

Marantaceae of the Tropical Rainforests of Central Africa: Multi-purpose Plants of Hidden Harvests

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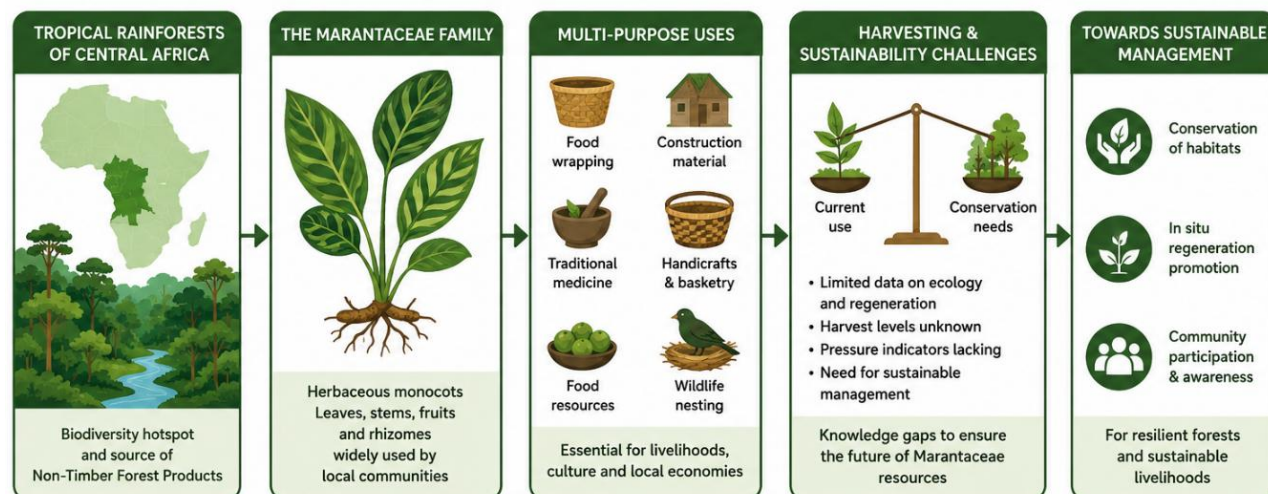
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Graphical Abstract

The tropical rainforests of Central Africa harbour highly valued Non-Timber Forest Products (NTFPs). Among these, the family Marantaceae is prominent because of the multiple uses of its leaves, stems, fruits and rhizomes by rural communities. This bibliographic synthesis summarizes the available knowledge on the geographical distribution, botanical and economic characteristics, and ethnobotanical importance of Marantaceae in Central Africa. It also highlights important knowledge gaps concerning the ecology, reproductive biology, harvesting pressure and regeneration potential of exploited species, emphasizing the need for further research to support their sustainable management.



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Abstract: The tropical rainforests of Central Africa harbour highly valued Non-Timber Forest Products (NTFPs) that are widely used by rural communities. These products are essential to the socio-economic, cultural and dietary life of households and represent an important source of income. Among these NTFPs, the family *Marantaceae* is prominent. It is a monocotyledonous botanical family belonging to the order *Zingiberales*, comprising 29–31 genera, whose leaves, stems, fruits and rhizomes are used for a wide range of purposes by rural communities in Central Africa. Research on the family *Marantaceae* is extensive. The present bibliographic synthesis summarizes all available information relating to geographical distribution, botanical and economic characteristics, as well as ethnobotanical aspects. This review has highlighted certain gaps concerning the ecology and reproductive modes of the harvested species, despite their importance to local communities. Furthermore, uncertainties about quantities of *Marantaceae* leaves harvested, actual pressures on these resources and their potential for in situ regeneration necessitate investigation to secure sustainable management.

Keywords: *Marantaceae*, botany, Ecology, Phenology, Ethnobotany.

Introduction

The forests of the Congo Basin cover more than 180 million hectares and constitute the second largest continuous tropical forest block after the Amazon [1]. They represent invaluable ecosystems in terms of biodiversity and play a crucial role by providing a wide range of ecosystem goods and services (provisioning, regulating and cultural services) [2]. These forests also provide numerous Non-Timber Forest Products (NTFPs), i.e. fruits and berries, nuts, young leaves, herbaceous plants, gums and saps, invertebrates (insects, snails) vertebrates (fish, birds, mammals, all, biological products derived from forests other than timber [3]. They include resources such as fruits, nuts, mushrooms, medicinal plants, resins, leaves, and other plant products. Furthermore, NTFPs contribute to the local economy and to the livelihoods of both rural and urban communities [4].

Among this wide range of NTFPs are the Marantaceae, which are regularly harvested in Central Africa for numerous purposes, including cassava wrapping, construction, traditional medicine, the provision of raw materials for basketry, food, and wildlife nesting [5-7]. Indeed, these are typical plants of equatorial forests [8]; the mature leaves are not edible but play an essential socio-economic role by ensuring both food security and improving the incomes of households harvesting them [9–12]. Consequently, knowledge and valorization of Marantaceae leaves are important in the sustainable management of forests in the countries of the Congo Basin [13] This article aims to provide a bibliographic synthesis of current knowledge on Marantaceae, highlighting all aspects that warrant further scientific investigation for the sustainable management of this resource for its main users. Specifically, geographical distribution, botanical, ecological and phenological characteristics, as well as ethnobotanical aspects, will be addressed. Finally, several research lines are identified with a view to improving the valorization of Marantaceae.

The literature review was conducted using search engines (Scopus and Google Scholar), complemented by various sources (theses, reports, etc.). Searches combining taxonomic and thematic terms, the Marantaceae value chain, and Non-Timber Forest Products were used, taking taxonomic synonyms into account. The inclusion criteria covered both empirical studies and review papers on Marantaceae in Central Africa, published between 1960 and 2025, in either French or English. Studies lacking a descriptive methodology were excluded. Particular attention was paid to articles dealing with Marantaceae in Central Africa.

Current State of Knowledge on Marantaceae

Taxonomy and geographical distribution

Marantaceae are monocotyledonous angiosperms belonging to the order *Zingiberales* and are considered to be the sister family of the *Cannaceae* [14]. Currently, eight families are recognized within the order *Zingiberales*, namely: the sister families *Zingiberaceae* and *Costaceae*; the sister families *Strelitziaceae* and *Lowiaceae*; the sister families *Cannaceae* and *Marantaceae*; and finally the *Heliconiaceae* and *Musaceae* [15]. The second most important family after the *Zingiberaceae*, it comprises 500–570 species distributed among 29–31 genera [16–19] (Table 1), as shown in Table 1.

Table 1. Classification of the Marantaceae family according to Prince and Kress [19]

Class Name	Include Genus	Geographical Distribution
CALATHEA Class	<i>Calathea p.p.</i>	America
	<i>Haumania</i>	Africa
	<i>Monotagma</i>	America
	<i>Pleiotachya</i>	America
DONAX Class	<i>Cominsia</i>	Asia
	<i>Donax</i>	Asia
	<i>Phrynium</i>	Asia
	<i>Phacelophrynium</i>	Asia
	<i>Schumannianthus dichotomus</i>	Asia
	<i>Thalia</i>	America
	<i>Ctenanthe</i>	America
MARANTA Class	<i>Halopegia</i>	Africa, Asia
	<i>Hylaeanthus</i>	America
	<i>Koernickanthus</i>	America
	<i>Maranta</i>	America
	<i>Myrosma</i>	America
	<i>Sarantus</i>	America
	<i>Schumannianthus virgatus</i>	Asia
	<i>Stromanthe</i>	America
STACHYPHRYNIIUM Class	<i>Afrocalathea</i>	Africa
	<i>Ataenidia</i>	Africa
	<i>Marantochloa</i>	Africa
	<i>Stachyphrynium</i>	Asia
SARCOPHRYNIIUM Class	<i>Hypselodelphys</i>	Africa
	<i>Megaphrynium</i>	Africa
	<i>Sarcophrynium</i>	Africa
	<i>Thaumatococcus</i>	Africa
	<i>Trachyphrynium</i>	Africa
Uncertain Affinity	<i>Monophrynium</i>	Asia
	<i>Monophyllanthus</i>	Asia
	<i>Sanblasia</i>	America

Essentially pantropical, this botanical family is distributed in warm temperate or subtropical regions and is found almost exclusively in tropical rainforests, humid gallery forests, dry forests, forest edges, clearings, cultivated fields, savannas, and sometimes in very high abundance in wetlands [17,20].

Furthermore, out of approximately 31 genera and 550 species, the Americas and Asia harbour about 14 and 8 genera, respectively, whereas the African flora, although rich in genera (10–12), remains relatively poor in species [19,21] (Fig. 1).

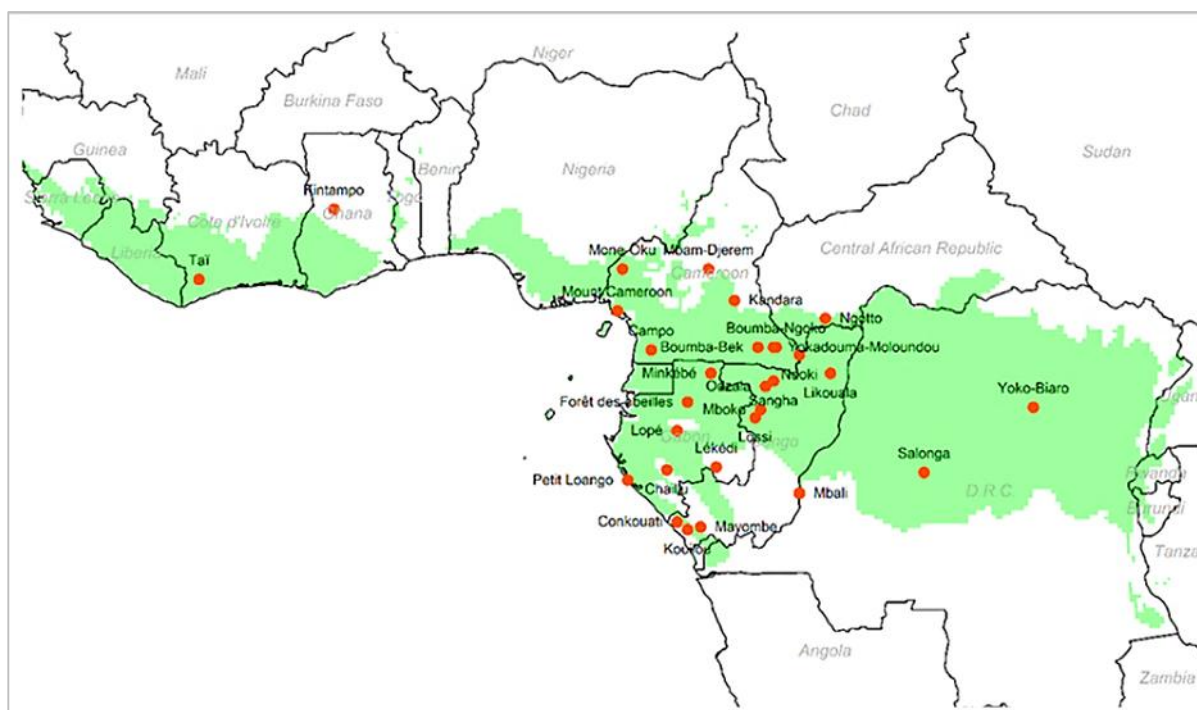


Figure 1. Geographic distribution of Marantaceae in the tropical rainforests of Central and West Africa (red dots indicate recorded occurrences; green shading represents the tropical rainforest biome) [22]

Botanical description

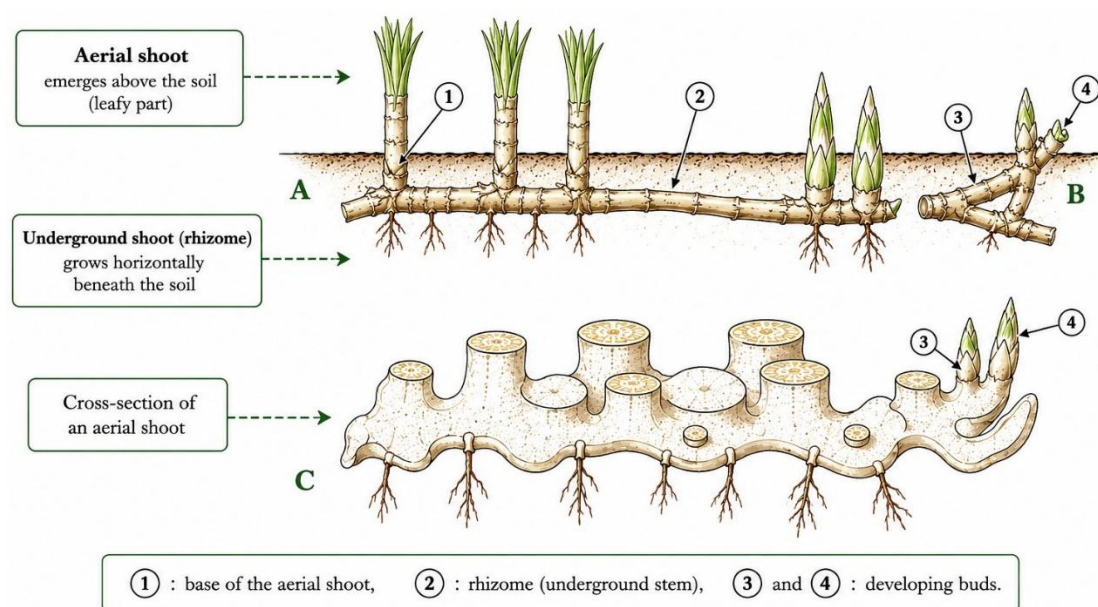
The morphological characteristics of the family *Marantaceae* are mainly based on the description of the vegetative and reproductive structures. The *Marantaceae* of tropical Africa, and of Gabon in particular, have been described respectively by Koechlin and Aubréville [23], Letouzey [8], and Dhetchuvi Matchu-Mandje [17].

Vegetative structure

Rhizome

Terrestrial herbs, glabrous or bearing variable indumentum, *Marantaceae* are perennial owing to their articulated underground rhizome (Fig. 2), which exhibits sympodial branching (apical degeneration of a bud resulting in zigzag growth). The rhizome, which varies in shape, may be swollen or fleshy (although not in

African species) and bears adventitious roots. Generally short (pachymorphous), it produces both subterranean and aerial shoots, each arising from the preceding shoot. At their bases, the aerial shoots form a bud destined to produce a new plant [17].



Rhizomes of *Afrocalthaea rhizantha* (A–B) and *Marantochloa mannii* (C).

Figure 2. Architecture of *Marantaceae* rhizomes [17]

Stem

Certain similarities make it possible to group species according to stem habit. The aerial shoots, which are variable in form, consist of stems (Fig. 3) that may be simple or branched, sometimes highly reduced or even absent. These stems may be greatly elongated, lianescent, provided at the base with aphyllous sheaths (bearing highly reduced leaves), and bear one or several alternate distichous leaves (arranged in parallel on the same plane) or occur in tufts [17].

Four main architectural types were defined by Letouzey [8]:

- The leaves of the plant are clustered in a tuft around the base of the stem: *Halopegia*, *Megaphrynium* and *Sarcophrynium*;
- The stem is lianescent, branched and leafy: *Haumania*;
- The stem is branched and bears oblique leafy branches (bamboo-like appearance): *Hypselodelphys* and *Trachyphrynium*;
- The stem is erect, branched and leafy: most species of *Marantochloa*.

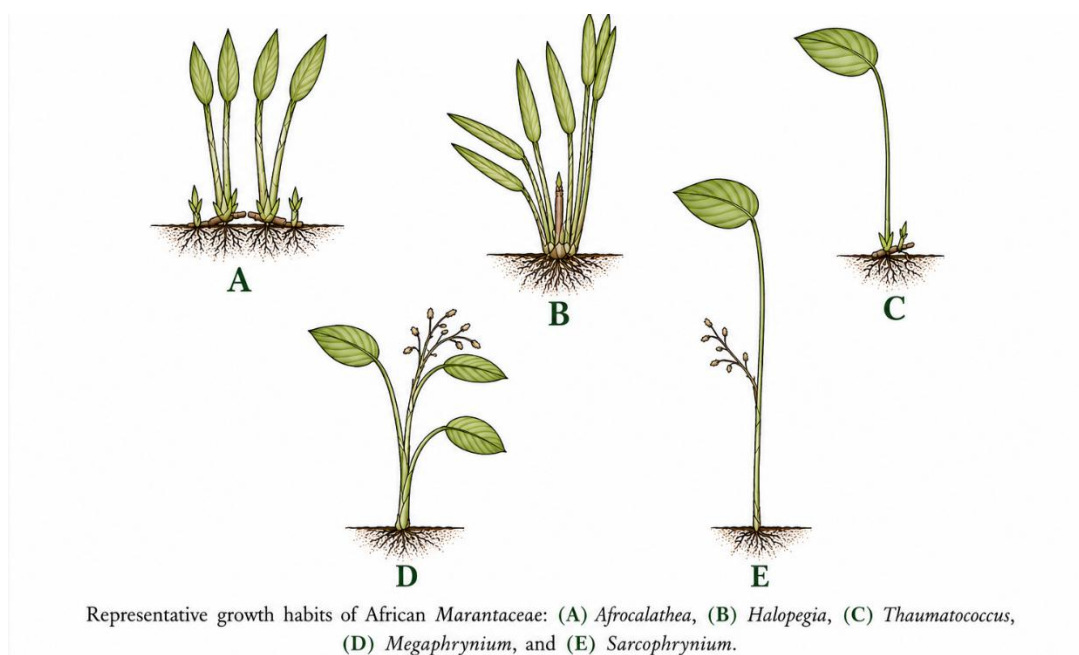


Figure 3. Representative growth habits of African Marantaceae [17]

Leaves

As shown in Figure 4, The leaves, with an open sheath, surround the stem and possess a cylindrical petiole whose apex is modified into a specialized structure known as a "callus". The entire lamina, ovate or elliptical in shape, is sometimes large and exhibits two asymmetrical halves relative to the midrib, with one margin convex and the other less curved or straight. The prominent midrib on the lower surface extends into oblique to arcuate parallel lateral venation, of variable density, reaching the margins of the lamina [8].

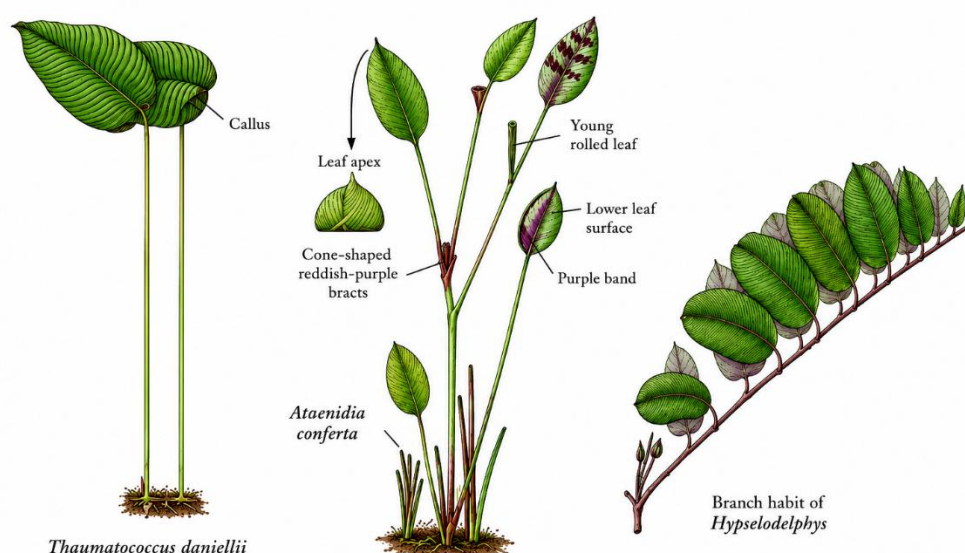


Figure 4. Representative leaf morphology of African Marantaceae [8]

a. Leaf systems : antitropy and homotropy

Two leaf systems are observed in *Marantaceae*, namely those in which two successive leaves of a species arranged opposite each other either overlap distinctly or do not. In the first case, the arrangement is referred to as homotropy (homotropic leaves), whereas in the second case it is referred to as antitropy (antitropic leaves) [17].

b. Shape of the lamina

The lamina generally exhibits one side that is more or less parallel to the midrib, but the other side is more curved. Consequently, the acumen is not located exactly along the extension axis of the midrib. This is the case in species of the genus *Marantochloa* and in *Ataenidia conferta*. In species belonging to the genera *Hypselodelphys* and *Trachypyrnium*, this organization is less pronounced. In other genera such as *Megaphrynium*, *Sarcophrynium*, *Thaumatococcus* and *Thalia*, both sides of the lamina are almost rounded [17].

Reproductive structure

Inflorescence

The inflorescences (Fig. 5) are terminal or lateral, basal or radical (arising from the root), arranged in racemes or in clusters of biflorous cymes. The peduncle is simple or branched from the base, and the articulated rachis bears at each node a spatheole subtending one or several biflorous cymes, each provided or not with a bract. The cyme, consisting of a common axis, bears at its apex two generally unequal pedicels, each terminating in a flower, and the pedicels may or may not bear one or two fleshy bracteoles [8].

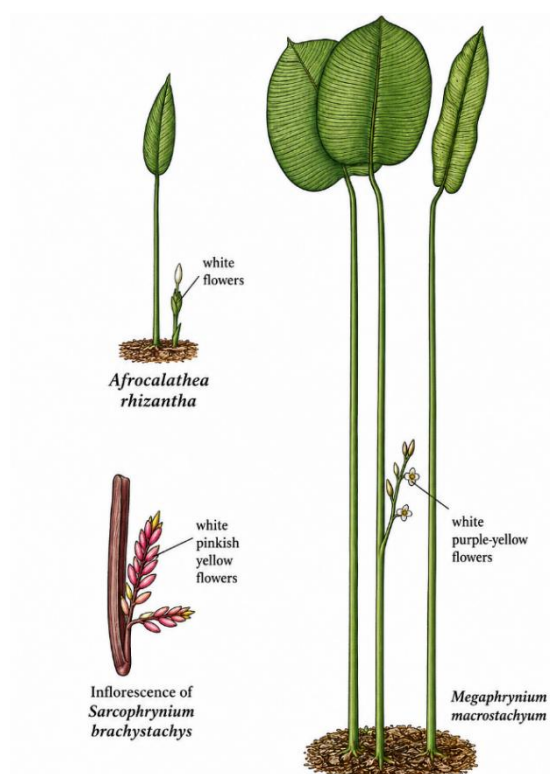


Figure 5. Representative inflorescences of African Marantaceae [8]

Flower and nectaries

The flowers, as shown in Fig. 6, are trimerous, zygomorphic and hermaphroditic. The free sepals are generally equal. The corolla, fused into a tube at the base, is divided into three free lobes. Theoretically, the flower possesses six stamens arranged in two whorls, with at least one stamen always absent from the outer whorl [24]. The androecium forms a complex structure, tubular at the base and largely petaloid. The outer whorl, composed of 0, 1 or 2 petaloid staminodes, is broad or acute, whereas the inner whorl comprises three structures, two of which are entirely staminodial: one hood-shaped, sometimes appendaged, and the other callose and thickened. The third is half-staminodial and half-fertile, bearing an anther. The inferior ovary is tricarpellate and trilocular, with one basal ovule per locule. The thick style is curved, initially enclosed within the hooded staminode and subsequently becoming free [8].

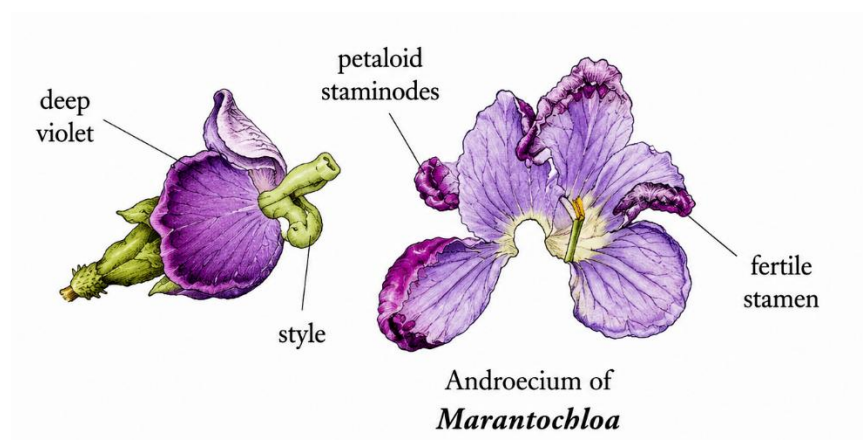


Figure 6. Flower morphology of *Marantochloa purpurea* [8]

Nectaries consist of glandular tissue secreting a sugar-containing fluid. Both floral and extrafloral nectaries occur. The latter are located on stems, petioles, stipules, leaf margins, etc., whereas the others are floral nectaries [17]. According to the same author, floral nectaries located on the bracts are found in the species *Hypselodelphys hirsuta*, *H. poggeana*, *H. violacea*, *Sarcophrynium brachystachium*, *S. pionogonium*, *S. schweinfurthianum*, *Megaphrynium macrostachyum* and *Thaumatococcus daniellii*. Extranectaries, on the other hand, are found in *Haumania liebrechtsiana* and *H. danckelmanniana* [17].

Fruit and seeds

The fruits illustrated in Figure 7 are either capsular or berry-like, and may be dry, dehiscent or indehiscent. The seeds are often either arillate or non-arillate, with either coriaceous or non-coriaceous seed coats, and possess either rudimentary or well-developed embryos, which may be straight or curved, with a variable perispermatic canal [8].

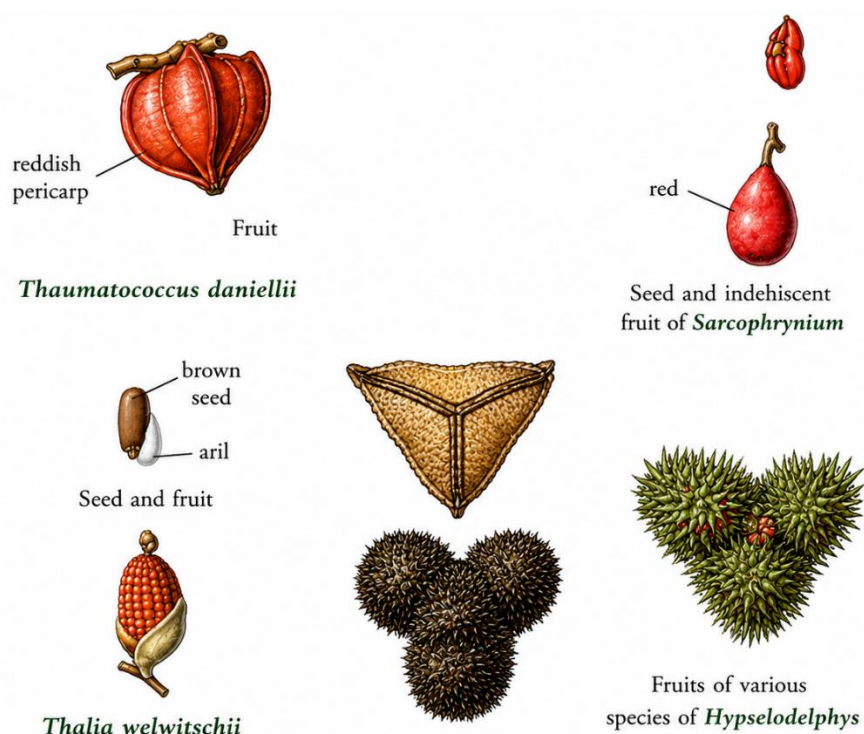


Figure 7. Representative fruits and seeds of African Marantaceae [8]

An aril is present in all African *Marantaceae* except in *Haumania*, *Hypselodelphys* and *Sarcophrynium*. Its form differs among genera. Indeed, the aril is bifid in *Ataenidia*, collar-shaped in *Halopegia*, convoluted in *Thalia*, lacinate in *Trachyphrynium* and *Megaphrynium*, and lamellar or entire in *Marantochloa* [17]. According to the same author, the genera possessing smooth, more or less soft seed coats are *Ataenidia*, *Halopegia*, *Haumania*, *Hypselodelphys*, *Marantochloa*, *Thalia* and *Trachyphrynium*, whereas those with hard seed coats and irregular surfaces are *Megaphrynium*, *Sarcophrynium* and *Thaumatooccus* [17].

Some Genera of the Family Marantaceae

Ataenidia Benth [17]

Herbs with a short, highly branched sympodial rhizome, producing erect, branched aerial shoots arranged in dense tufts. Leaves homotropic, with petioles sometimes very elongated, possessing a swollen callus; the transition from the petiole to the callus marked by an oblique ridge, with the apex on the ventral side and the base on the dorsal side; the transition from the callus to the midrib V-shaped on the upper surface. Lamina elliptical, markedly asymmetrical, with the acumen laterally displaced relative to the axis of the midrib. Dense axillary inflorescences, racemose, with few and very short internodes; spatheoles narrowly imbricate; bracts present; common axes of the cymes very short; floral pedicels also very short and subequal; bracteoles absent; two external

petaloid staminodes; internal hood-shaped staminode without appendages; ovary trilocular with one ovule per locule. Indehiscent fruits bearing seeds with a bifid basal aril.

This genus comprises two species, namely: *Ataenidia gagnepainii* Benth. and *Ataenidia conferta* (Benth.) Milne-Redh.

Halopegia azurea K. Schum [17]

Herb with a rhizome provided with numerous roots. Aerial shoots 0.7–2 m high, consisting of a stem 10–20 cm long, pubescent, with caducous hairs, swollen at the base, bearing a tuft of 2 to 10 leaves sheathing at the base and a final leaf at the apex. Leaves with a sheath approximately 50 cm long, with glabrous membranous margins, densely hairy externally, especially in the median and marginal zones, with tuberculate hairs; petiole 20–80 cm long, with caducous hairs; callus 3–6 cm long, with persistent hairs on the inner surface of the apex; lamina asymmetrical, rectangular to oblong, with the right side almost parallel to the midrib, cuneate at the base, long-acuminate at the apex, acumen approximately 5 cm long, situated along the extension of the midrib, 20–60 cm long and 8–13 cm wide, hairy on the upper surface along the midrib. Racemose inflorescence located inside or outside the sheath tuft, initially enclosed within the leaf sheath and becoming visible at maturity, approximately 60 cm long, repeatedly branched from the base; peduncle approximately 20 cm long, pubescent; rachis pubescent; lower pedicels approximately 4 cm long, the upper ones progressively shorter; spathes approximately 20 cm long, membranous at the margins, pubescent in the median zone, with woolly hairs; spatheoles approximately 6 cm long, with membranous margins, white; white bracts 4 cm long, with two hairy keels. Flowers with unequal sepals, small, white; petals white; three external petaloid staminodes, violet-blue, one of which is keeled and hardened; two internal staminodes with yellow apices, one larger and petaloid, with one yellowish theca; style white; ovary pubescent. Unilocular ellipsoid fruits, firm in texture, approximately 1.2 cm long and 0.5 cm wide, glabrous, smooth, white to brown, surmounted by the persistent calyx. Single seed, ellipsoid, with a collar-shaped aril at the base, with a thin seed coat, smooth externally; perispermatic canal straight; embryo straight, parallel to the perispermatic canal, approximately 1 cm long.

Haumania Leonard [17]

Rhizomatous herbs with climbing aerial shoots, internodes glabrous, hairy or spiny; branches provided at their base with 2 to 3 small aphyllous sheaths, 5 to 8 cm long, puberulent, with appressed hairs and ciliate margins. Leaves antitropic, more or less clustered, with elongated, imbricate sheaths; transition from petiole to callus continuous, transition from callus to midrib

marked by a prominent beak forming a V on the upper surface, but continuous on the lower surface; leaf sheath provided with a tuft of hairs on the inner surface of the apex; petiole with thickened hairs on the inner surface. Lamina ovate-oblong, broadly rounded at the base, more or less long-acuminate, symmetrical to slightly asymmetrical, hairy along the midrib on the lower surface; extrafloral nectaries visible at the junction between petiole and sheath and also in the median zone at the base of the sheath. Terminal inflorescences in clusters of cymes, supported at the base by long aphyllous sheaths; rachis zigzag-shaped, bearing at each node a large, more or less persistent spatheole enclosing a sickle-shaped group of 3 to 6 biflorous cymes, each subtended by a bract; common axes of cymes short; floral pedicels lacking bracteoles; perianth petaloid; corolla tubular at the base; staminodes petaloid; ovary trilocular with one ovule per locule, densely hairy. Capsules indehiscent and tuberculate. Seeds subspherical, with one flattened face, lacking an aril, with albumen differentiated into two zones, one external, thin and hardened, the other internal, broader and soft, surrounding the embryo; perispermatic canal U- or H-shaped in median transverse section. This genus comprises three species:

- *Haumania danckelmanniana* (J. Br. & K. Schum.) Milne-Redh.;
- *Haumania liebrechtsiana* (De Wild. & Th. Dur.) J. Leonard;
- *Haumania leonardiana* Evrard & Bamps.

Megaphrynium Milne-Redh [17]

Herbs with a linear and robust rhizome producing erect aerial shoots consisting of simple stems terminating in a leaf and an inflorescence; stem base surrounded by aphyllous sheaths or occasionally by complete leaves, with very long petioles. Lamina broadly elliptical to broadly ovate, rounded at the base and then attenuate just before insertion, acuminate at the apex, generally large; transition from petiole to callus continuous, and from callus to midrib continuous on the lower surface but marked by a V-shaped beak on the upper surface. Terminal panicle inflorescence, with racemes composed of clusters of cymes, sometimes with numerous segments; spatheoles rapidly caducous, subtending a single biflorous cyme; bicarinate bracts, rapidly caducous; common floral axis of variable length, bearing a single fleshy bracteole at the apex between the pedicels; pedicels subequal. Flowers with free sepals, $\pm$ adnate to the corolla; petals fused at the base; external staminodes narrowly linear or subulate, more often unequally trilobed; one of the internal staminodes appendaged; ovary trilocular with one ovule per locule. Capsules globose, slightly trilobed, with visible sutures, dehiscent, with a fleshy pericarp when fresh, glabrous. Seeds with a lacinate aril appressed against the seed coat and surrounded by abundant

clear to white mucilage, with a thick and hard seed coat of irregular surface; perispermatic canal flattened, narrow at the base and then broad.

The genus includes four species from the Guineo-Congolian region of Africa, namely: *Megaphrynium gabonense* Koechlin, *Megaphrynium trichogynum* Koechlin, *Megaphrynium macrostachyum* (Benth.) Milne-Redh., and *Megaphrynium velutinum* (Baker) J. Koechlin.

Sarcophrynium [17]

Herbs with a short rhizome, repeatedly branched, producing aerial shoots in tufts composed of a number of distichous leaves, with sheaths narrowly imbricated around a central stem bearing a leaf at its apex. Lamina asymmetrical, pleated along the lateral veins, elliptical, often slightly cordate at the base; transition from callus to petiole without articulation marked by a groove, transition to the lamina continuous on the lower surface but marked on the upper surface by a V-shaped notch. Terminal inflorescences spike-like or paniculate, branched from the base; rachis with zigzag segments, each node bearing a persistent spatheole subtending 4 to 10 biflorous cymes, each provided with its bract; common floral axes very elongated, longer than the spatheoles; pedicels markedly unequal, bearing one fleshy bracteole at their base and another at the apex of the longer pedicel. Flowers with free, obovate sepals; ovary trilocular with one ovule per locule, glabrous; two external petaloid staminodes, obovate. Berries indehiscent, with poorly marked sutures. Seeds crescent-shaped, with a roughly rhomboid or hexagonal cross-section, lacking an aril but embedded in colourless to white mucilage.

The genus comprises four species and three varieties, all restricted to the Guineo-Congolian region of Africa:

- *Sarcophrynium villosum* (Benth.) K. Schum.
- *Sarcophrynium brachystachyum* (Benth.) K. Schum.
 - *Sarcophrynium brachystachyum* var. *brachystachyum*
 - *Sarcophrynium brachystachyum* var. *puberulifolium* Koechlin
- *Sarcophrynium prionogonium* (K. Schum.) K. Schum.
 - *Sarcophrynium prionogonium* var. *prionogonium*
 - *Sarcophrynium prionogonium* var. *puberulifolium* Schnell
- *Sarcophrynium schweinfurthianum* (O. Kuntze) Milne-Redh.
 - *Sarcophrynium schweinfurthianum* var. *schweinfurthianum*
 - *Sarcophrynium schweinfurthianum* var. *puberulifolium* Koechlin

Ecology and Regeneration Dynamics of Marantaceae

African *Marantaceae* occur in forest formations that are more or less humid. Several habitat types have been recorded, including cultivated fields, clearings, gallery forests, heterogeneous forests, flooded and swamp forests, ombrophilous forests, disturbed forests, riparian and riverine forests, dry forests, secondary forests, semi-deciduous forests, forest edges, marshes and savannahs [17].

The distribution and abundance of plant species, as well as the grouping of vegetation types, are determined by certain key ecological factors such as soil type, nutrient availability and the amount of precipitation [25]. These plants, abundant in former clearings [8] and on abandoned cultivated lands in logged forests [26] with open canopies [27], generally emerge in the presence of light and are considered heliophilous, such as *Halopegia azurea*, *Marantochloa congensis* var. *congensis*, *Megaphrynium macrostachyum* and *Thalia geniculata*. Some taxa are sciaphilous, including *Haumania danckelmanniana* and *Haumania liebrechtsiana* (at a young age), *Afrocalathea rhizantha*, *Sarcophrynium schweinfurthianum* var. *schweinfurthianum*, *Sarcophrynium prionogonium* var. *prionogonium*, *Marantochloa conferta* and *Marantochloa congensis* var. *nitida* [17,28].

Most taxa occur in regions receiving more than 2,000 mm of rainfall annually. Regarding altitudinal distribution, most taxa are found between 0 and 1,000 m above sea level [17].

Marantaceae forests result from the progressive colonization of savannahs by forests [29,30], and canopy opening is important depending on the extent of the herbaceous layer [31]. The work of Gillet [28] proposes several hypotheses related to the expansion of the *Marantaceae* front, including the action of large mammals, gap dynamics (canopy opening following the fall of a large tree), low tree stand density and the near absence of woody regeneration, as well as spontaneous or repeated anthropogenic fires, which also favour the survival of these giant herbs through their underground rhizomes, usually little affected by fire. Furthermore, *Marantaceae* formations, owing to their large leaf area, would be favoured on yellow soils where water availability is continuous and non-limiting [28].

In Gabon, particularly in Moyabi, there is a strong proliferation of *Marantaceae* in landscapes surrounding dwellings, such that their collection by rural populations does not require travelling long distances. Harvesting of this plant, within the limits of the average exploited leaf area in this locality, amounts to 1,379 cm² [20].

Table 3 shows the morphological types of some African *Marantaceae* genera.

Table 3. Morphological types of some African *Marantaceae* genera [17,32].

Genera	Morphological Types	Sites	Habitats
<i>Afrocalathea</i>	Perennial herbaceous plant	Ma, MC	Ombrophilous forest
<i>Ataenidia</i>	Perennial herbaceous plant	Ma	Forest, terra firme forest, gallery forest, swamp forest, ombrophilous forest
<i>Halopegia</i>	Perennial herbaceous plant	Ma, MC	Swamp forest, swamp clearing, ombrophilous forest
<i>Haumania</i>	Liana	Ma, MC	Dense flooded forest, ombrophilous forest, forest edge
<i>Hypselodelphys</i>	Liana	Ma, MC, Si, Lo	Forest roadside, treefall gaps, secondary forest, gallery forest, forest edge
<i>Marantochloa</i>	Perennial herbaceous plant	Ma, MC, Si, MZ	Forest, ombrophilous forest, secondary forest, forest edge, terra firme forest, fallow land
<i>Megaphrynium</i>	Perennial herbaceous plant	Ma, MC, Si	Forest, secondary forest, gallery forest, swampy valley understorey, clearing
<i>Sarcophrynium</i>	Perennial herbaceous plant	Ma, MC	Open flooded forest, gallery forest, secondary forest, forest clearing, swamp
<i>Thalia</i>	Perennial herbaceous plant	MZ	Gallery forest, swamp forest, swamp in savanna
<i>Thaumatococcus</i>	Perennial herbaceous plant	Di, MC	Stream bank, secondary forest, ombrophilous forest, fallow land
<i>Trachyphrynium</i>	Liana	Ma, Lo	Forest clearing, gallery forest, secondary forest, forest edge and swamp

Di: Dibouka; **Ma:** Makokou; **MC:** Monts de Cristal; **Lo:** Lopé; **Si:** Sibang; **MZ:** German herbarium.

Phenology and Modes of Propagation of Marantaceae

In Marantaceae, flowering is reported to begin in October for 17 out of 42 taxa. But, no study has documented the onset of fruiting in all taxa, except for those observed in their natural environment, where anthesis occurs progressively and flowers remain open for two days. Young fruits can be observed after one week [17]. Thus, taxa such as *Haumania leonardiana*, *Hypselodelphys poggeana*, *H. scandens*, *Marantochloa filipes*, *Thalia geniculata* and *Trachyphrynium braunianum* are reported to produce flowers almost throughout the year, whereas with others this period varies from 3 to 6 months (*Ataenidia conferta*, *Halopegia azurea*, *Haumania liebrechtsiana*, *Hypselodelphys violacea*, etc.). Other taxa, such as *Marantochloa cordifolia*, *Sarcophrynium brachystachyum* var. *brachystachyum* and *Sarcophrynium prionogonium* var. *prionogonium*, are believed to have a short reproductive period and may even reproduce twice a year. Flowering beginning in October coincides with the peak rainfall period in the Guineo-Congolian region [17]. A recent study conducted in Cameroon on the phenology of *Megaphrynium macrostachyum*

showed the existence of two phenological phases: the flowering phase, which extends from May to June, and the fruiting phase, which lasts from June to August. The period from flowering to fruiting varies between 64 and 85 days, corresponding to approximately 2 to 3 months [33].

Single-visit pollination is a characteristic mechanism of *Marantaceae*, including protandry, secondary pollen presentation and an irreversible movement of the style [34–37]. The flowers are asymmetrical and attract their pollinators through conspicuous staminodes and nectar [38,39]. Moreover, as each flower has only one opportunity to be pollinated and to disperse its own pollen, it remains open for only a single day, since the explosive pollination mechanism cannot be reset [36,40].

Numerous authors [32,34,36,37,41–45] have recorded species of small, medium-sized and large bees belonging respectively to the families Halictidae (*Thrinchostoma* sp.) and Apidae (*Allodapula ornaticeps*), Apidae (*Amegilla vivida*) and Anthophoridae (*Xylocopa nigrita*, *Xylocopa varipes* and *Megachile* sp.), as well as birds belonging to the families Nectariniidae (*Cyanomitra olivaceus*) and Trochilidae (hummingbirds), as pollinators of *Marantaceae* in the New World, Asia and Central Africa, particularly in Gabon (Table 4). Foucault *et al.* [46] also reported pollination by zoogamy.

Above the herbaceous layer that inhibits woody regeneration, some lianescent and climbing *Marantaceae* encircle tree trunks or cover the crowns of the few shrubs present, thereby hindering their development and even their reproduction [29,47]. They may thus monopolize the acquired space for long periods and expand through adjacent gaps [48,49]. These large terrestrial and occasionally aquatic herbs develop very slowly from seeds because of competition; consequently, their preferred mode of propagation is vegetative, particularly through the spread of perennial underground stems or rhizomes [28,49,50].

Another form of clonality commonly observed in certain taxa is vivipary, particularly in *Costus lucanusianus* and *Ataenidia conferta*. The extremities of stems bearing old inflorescences produce a young plant; the stems bend through senescence and gravity, allowing the clone to take root [50,51]. Lianescent *Marantaceae* of the genus *Haumania* propagate by producing very long articulated stems, reaching up to 5 m in length and covered with aphyllous sheaths. These flagella branch when they come into contact with a support. The base of each node bends to attach itself to the support, while the internode swells and hardens on the opposite side in order to maintain the acquired position [52].

Table 4. Pollinators of some African Marantaceae species according to Ley and Claßen-Bockhoff [32].

Species	Pollinating bees			Birds
	Small	Medium	Large	
<i>Ataenidia confortata</i>	-	-	<i>Xylocopa</i> sp	<i>Cyanomitra olivaceus</i>
<i>Afrocalathea rhizantha</i>	-	-	-	<i>Cyanomitra olivaceus</i>
<i>Halopeia azurea</i>	<i>Thrinchostoma bicometes</i> -	-	-	-
<i>Haumania danckelmanniana</i>	-	-	<i>Xylocopa nigrita</i> ; <i>X.varipes</i> ; <i>Megachile</i> sp.2	
<i>Hypselodelphys</i> sp.	-	<i>Amegilla vivida</i>	-	-
<i>Marantochloa cordifolia</i>	<i>Thrinchostoma</i> sp	<i>Amegilla</i> sp.	-	-
<i>Marantochloa incertifolia</i>	<i>Thrinchostoma</i> sp	-	-	-
<i>Marantochloa monophylla</i>	<i>Allodapula ornaticeps</i>	-	-	-
<i>Marantochloa congensis</i>	<i>Thrinchostoma</i> sp	-	-	-
<i>Marantochloa filipes</i>	<i>Thrinchostoma</i> sp	-	-	-
<i>Marantochloa</i> sp.	-			<i>Cyanomitra olivaceus</i>
<i>Megaphrynium gabonense</i>	-	<i>Amegilla vivida</i>	<i>Xylocopa varipes</i> ; <i>Megachile</i> sp .	-
<i>Megaphrynium macrostachyum</i>	-	<i>Amegilla vivida</i>	-	-
<i>Megaphrynium trichogynum</i>	-	-	-	<i>Cyanomitra olivaceus</i>
<i>Sarcophrynium brachystachyum</i>	<i>Thrinchostoma</i> spp	-	-	-
<i>Sarcophrynium prionogonium</i>	<i>Thrinchostoma</i> spp	-	-	-

Importance of Marantaceae

Food Importance for Wildlife

The investigation conducted by White *et al.* [6] on the herbaceous vegetation of the different forest types in the Lopé Reserve (Gabon) revealed the influence of habitat on resource availability and the role of *Marantaceae* in wildlife feeding. Indeed, this study showed that plants such as *Halopegia azurea* K. Schum., *Haumania liebrechtsiana* (De Wild. & T. Durand) J. Léonard, *Hypselodelphys violacea* (Ridl.) Milne-Redh., and *Marantochloa cordifolia* (K. Schum.) Koechlin are consumed by gorillas (*Gorilla gorilla* Geoffroy), chimpanzees (*Pan troglodytes* (Blumenbach) L.), mandrills (*Mandrillus sphinx* L.), and elephants (*Loxodonta africana* Blumenbach) [6]. In

addition to serving as a food resource, *Marantaceae* are also used by great apes for nest construction [7].

Furthermore, several studies have highlighted the importance of habitat types and the impact of human activities on the distribution and population densities of western lowland gorillas in Cameroon [53]. Habitat disturbance and modification constitute major threats to animal populations in tropical forests [54]. In Lobéké National Park, Cameroon, *Marantaceae* forests are preferentially used by gorillas for nest construction. Indeed, 49% of gorilla nests are concentrated in these areas [53], and gorillas also use *Marantaceae* as a food resource.

Pharmacological Importance

This family of multipurpose plants provides considerable pharmacological benefits [13]. Indeed, a phytochemical study revealed the antibacterial properties of *Marantochloa cuspidata* (Roscoe) Milne-Redh. [55]. In another phytochemical study on the fruits of *Megaphrynium macrostachyum* (Benth.) Milne-Redh., Ondo *et al.* [56] demonstrated the presence of phenolic compounds capable of preventing the development of cardiovascular diseases and cancer.

Similarly, Njintang *et al.* [57] and Joly *et al.* [58] reported that the crushed stem of *Calathea warscewiczii* (L. Mathieu ex Planch.) Planch. & Linden, infused in lukewarm water, is consumed to treat rubella (a contagious viral infection) among the Guaymi Indians of western Panama. In India, the daily consumption of milk containing powdered rhizome of *Maranta arundinacea* L. is reported to treat asthma [59]. Among the Passa Pygmies in the Central African Republic, the fruits of *Trachypodium braunianum* (K. Schum.) Baker, consumed raw, are believed to have medicinal properties for the prevention of miscarriages [60].

According to Hattori [61], among Baka women in Cameroon, the root of *Haumania denckelmanniana* (J. Braun & K. Schum.) M.-Redh. is used medicinally for wound treatment, and the root of *Hypselodelphys scandens* Louis & Mullend. is used to relieve headaches. In addition, the flowers of *Ataenidia conferta* (Benth.) M.-Redh. are used as a protective charm during honey harvesting, and the root of *Trachypodium braunianum* (K. Schum.) Baker is used as a remedy for illnesses caused by *behe*, an unidentified fish species.

Socio-cultural Importance

In general, the broad leaves of *Marantaceae* are used for wrapping various food products; they may also be used in place of cooking utensils for preparing certain foods, such as meat or fish, by steaming. They are mainly employed for wrapping cassava products [5,9,11,52,62]. In Côte

d'Ivoire, wrapped foods are often associated with traditions of hospitality and conviviality and form part of the social customs of most families [63]. Indeed, offering food wrapped in leaves to an authority figure or a stranger is considered a sign of great respect [64].

As regards the stems, those of *Megaphrynium macrostachyum* and *Trachypodium braunianum* are used in basketry for making fish traps, fishing baskets, rat traps, and even the frameworks of huts among Pygmy communities in Gabon, the Democratic Republic of the Congo, and Cameroon [5,52,61,65]. Traditionally, it is Pygmy women who collect the leafy stems of *Marantaceae*. Furthermore, the pulp of the fruit of *M. macrostachyum* is edible [49,66]. Among the Baka Pygmies of Cameroon, the seeds of *Haumania denckelmanniana* (J. Braun & K. Schum.) M.-Redh. and *Trachypodium braunianum* (K. Schum.) Baker are roasted and eaten as snacks [61].

According to Terashima and Ichikawa [67], Central African hunter-gatherers use *Marantaceae* plants in many aspects of daily life, from the cradle—by giving birth on the leaves of *Megaphrynium macrostachyum* (Benth.) M.-Redh.—to the grave, by wrapping the bodies of the deceased in the leaves of *Ataenidia conferta* (Benth.) M.-Redh.

Walker and Sillans [68] reported that, among the Mitsogho initiated into the Nyèmbè or Ndjèmbè sect, *Marantaceae* possess mystical attributes and that their association with other plants serves as protection (fetishes) against logging accidents. The leaves of *Thalia welwitschii* Ridl., rolled into cones, are used as stoppers for bottles and gourds among the Mbuti Pygmies in the Democratic Republic of the Congo [65], whereas those of *Sarcophrynium brachystachyum* and *Megaphrynium macrostachyum* are used to wrap cassava sticks and to line the bottoms of cooking pots when preparing food (bananas, yams, taro, meat, and fish) in the forest [68].

The young shoots of *Megaphrynium macrostachyum*, known as "Mikungu" in the Democratic Republic of the Congo, are consumed as vegetables by certain tribal populations and in other African countries [69]. These young shoots, preserved by salting, ensure the year-round availability of this vegetable [70]. In the case of *Maranta arundinacea*, although arrowroot starch is obtained from its rhizomes and used to produce an edible flour in the Caribbean [71], in Gabon it is used solely as starch [68].

Economic Importance

Marantaceae are NTFPs with commercial value and contribute to local economies. Indeed, the genus *Calathea* G. Mey., which is selected and cultivated in Florida for commercial purposes [72], is also found in horticultural stations in Togo [73]. In the Republic of the Congo, the most commercialized species are *Marantochloa congensis*, *Marantochloa purpurea*, *Megaphrynium*

macrostachyum, *Sarcophrynium brachystachyum* and *Thaumatococcus daniellii*, and these are sold in more than 76% of the markets in Kisangani, dominating the various markets with a substantial estimated daily value [10,74,75].

In the same region, Loubelo [9] observed that intensive annual exploitation of this natural resource (*Marantaceae*) by local populations could contribute to its regeneration through the exclusive harvesting of mature leaves for commercial purposes. This resource contributes to food security within the agri-food sector through its use as plant-based packaging [76]. *Marantaceae* are considered to be the second most widely sold NTFP in the Republic of the Congo after *Gnetum* sp. (*Gnetaceae*), with an estimated annual value of 142,248,000 FCFA for approximately 3,500,000 bundles of leaves displayed in urban markets [9]. According to the same author, bundles of *Marantaceae* leaves purchased in villages at unit prices of 50, 75 or 100 FCFA are resold at retail markets in Brazzaville for 150, 200 or even 250 FCFA, generating a monthly income of 520,000 FCFA per vendor. Nevertheless, a vehicle in good condition may undertake two to three trips per week, transporting between 90,000 and 120,000 kg per month. The sale of these quantities corresponds to a gross net income ranging from 4,000,000 to 7,000,000 FCFA per month at prices of 200 to 250 FCFA per bundle. These prices fluctuate according to market conditions [9]. Consequently, the trade in *Marantaceae* leaves undoubtedly constitutes a significant source of income capable of alleviating the daily economic hardship experienced by Congolese populations [10,75].

In Gabon, *Marantaceae* leaves (*Megaphrynium macrostachyum* and *Sarcophrynium brachystachyum*) are regularly sold in markets located in urban centres. Weekly quantities collected range from 1,000 to 5,000 leaves per village, whereas the quantities sold vary between 2,000 and 4,000 leaves [11]. This demonstrates that the quantities of *Marantaceae* leaves marketed reflect the ever-increasing pressure exerted on this resource by local populations [77].

Conclusion and Perspectives

The current state of knowledge on *Marantaceae* highlights their importance for numerous rural populations in Central Africa. The family appears to be well documented in terms of botanical, anatomical and ethnobotanical descriptions. Indeed, *Marantaceae* comprise numerous genera and species that are commonly harvested and marketed by local communities, thereby providing them with significant employment opportunities and income.

Further investigation is desirable in order to propose sustainable resource management measures. New studies are required to:

- ✓ Complete ecological data on regularly used species, their modes of regeneration and population dynamics, in order to provide essential information for the development of resource management strategies;
- ✓ Quantify the levels of *Marantaceae* leaf harvesting by local populations, based, for example, on factors such as harvested species, quantities collected and exploited leaf areas;
- ✓ Assess the modalities and impacts of *Marantaceae* exploitation as indicators of pressure on resource availability in forests;
- ✓ Evaluate the domestication potential of the most frequently harvested species with a view to integrating *Marantaceae* into local agroforestry systems;
- ✓ Estimate the actual or potential contribution of *Marantaceae* to household and local economies through the identification of marketing chains.

The simultaneous consideration of these five research dimensions should provide the basic elements required to envisage the sustainable exploitation of this resource. Consequently, improving the tools used to assess these **resources better** and gaining greater control over the socio-economic factors leading to their overexploitation is **necessary and should be expedited**.

References

- [1] Eba'a Atyi, R., Hiol Hiol, F., Lescuyer, G., Mayaux, P., Defourny, P., Bayol, N., Saracco, F., Pokem, D., Sufo Kankeu, R., & Nasi, R. (Eds.), 2022, *Les forêts du bassin du Congo : État des Forêts 2021*. Bogor : Center for International Forestry Research, 442. <https://doi.org/10.17528/cifor/008565>
- [2] Gibson, L., Lee, T.M., Koh, L.P., Brook, B.W., Gardner, T.A., Barlow, J., & Sodhi, N.S., 2011, Primary forests are irreplaceable of sustaining tropical biodiversity. *Nature* **478** (7369), 378-381. <https://doi.org/10.1038/nature10425>
- [3] FAO, 1995, Non-wood forest products for rural income and sustainable forestry. (Rome: Fao). <https://www.fao.org/4/v9480e/v9480e.pdf>
- [4] Moupela, C., 2013, Ecologie, dynamique des populations et intérêts économiques du noisetier d'Afrique (*Coula edulis* Baill.) au Gabon. Thèse de Doctorat, Université de Liège - Gembloux Agro-Bio Tech, 144 p. <https://orbi.uliege.be/bitstream/2268/157875/1/doctorat%20de%20C.%20Moupela.pdf>
- [5] Raponda-Walker, A., & Sillans, R. (1961). Les Plantes Utiles du Gabon. *Quarterly Journal of Crude Drug Research* **1**(1), 27. <https://doi.org/10.3109/13880206109066644>
- [6] White, L. J. T., Rogers, M. E., Tutin, C. E., Williamson, E. A., & Fernandez, M., 1995, Herbaceous vegetation in different forest types in the Lopé Reserve, Gabon: implications for keystone food availability. *African Journal of Ecology* **33**, 124-141. <https://doi.org/10.1111/j.1365-2028.1995.tb00788.x>

- [7] Djoufack, S. D., Nkongmeneck, B. A., Dupain, J., Bekah, S., Bombome, K. K., Epanda, M. A., & Van Elsacker, L. (Eds.), 2007, *Manuel d'identification des fruits consommés par les gorilles et les chimpanzés des basses terres de l'Ouest : Espèces de l'écosystème du Dja (Cameroun)*. Antwerp, (Belgium: Royal Zoological Society of Antwerp)
- [8] Letouzey, R., 1982, *Manuel de botanique forestière : Afrique tropicale. Tome 1. Botanique générale*. Nogent-sur-Marne, (France : Centre Technique Forestier Tropical)
- [9] Loubelo, E., 2012, *Impact des produits forestiers non ligneux (PFNL) sur l'économie des ménages et la sécurité alimentaire : cas de la République du Congo. Thèse de doctorat*, Université de Rennes 2. <https://theses.hal.science/tel-00713758v1/document>
- [10] Sah, M. R., Hakizimana, J., & Ronald Onounga, D. D., 2021, Effects of the Diversification of Nontimber Forest Products on Human Development in Congo: The Case of Gnetum, Marantaceae and Rattan. *Modern Economy* **12**(5), 764–781. <https://doi.org/10.4236/me.2021.125047>
- [11] Ndoutoumou Nguema, P., Boussiengui Boussiengui, G., Ntsame Affane, A. L., Ignanga Mouyombi, C.K., & Ella Missang, C., 2022, Identification and marketing of Marantaceae in the Ndjolé area, in central Gabon, *International Journal of Agronomy and Agricultural Research* **20** (2), 40-46. <https://innspub.net/identification-and-marketing-of-marantaceae-in-the-ndjole-area-in-central-gabon/>
- [12] Limala, E. P., Ntsomboh, N. G., Likeng-Li-Ngue, B. C., Nyouma, A., & Bell, J. M., 2023, Smallholders' Perceptions and Socio-Economic Importance of *Megaphrynium macrostachyum* (Benth.) Leaves in the Central and Littoral Regions of Cameroon. *International Journal of Economy, Energy and Environment* **8**(2), 17-22. <https://doi.org/10.11648/j.ijeee.20230802.11>
- [13] Ingram V., Ndoeye O., Midoko Iponga D., Chupezi Tieguhong J., & Nasi R., 2012. *Les produits forestiers non ligneux : contribution aux économies nationales et stratégies pour une gestion durable*. In : De Wasseige C., De Marcken P., Bayol N., Hiol Hiol F., Mayaux P., Desclée B., Nasi R., Billand A., Defourny P., et Eba'a R. (Eds.) *Les forêts du bassin du Congo - Etat des Forêts 2010*. Office des publications de l'Union Européenne, Luxembourg, 137-154. https://www.researchgate.net/publication/290860499_Produit_forestier_non_ligneux_contribution_aux_economies_nationales_et_strategies_pour_developpement_durable/
- [14] Andersson, L., & Chase, M. W., 2001, Phylogeny and classification of *Marantaceae*. *Botanical Journal of the Linnean Society*, **135**(3), 275–287. <https://doi.org/10.1111/j.1095-8339.2001.tb01097.x>
- [15] Kress, W. J., Prince, L. M., Hahn, W. J., & Zimmer, E. A., 2001, Unraveling the evolutionary radiation of the families of the Zingiberales using morphological and molecular evidence. *Systematic Biology* **50**(6), 926–944. <https://doi.org/10.1080/106351501753462885>
- [16] Thorne, R. F., 1992, Classification and geography of the flowering plants. *The botanical review*, **58** (3), 225-327. <https://dx.doi.org/10.1007/BF02858611>
- [17] Dhetchuvi Matchu-Mandje, J.B., 1996, Taxonomie et phytogéographie des Marantaceae et des zingiberaceae de l'Afrique centrale (Gabon, Congo, Zaïre, Rwanda et Burundi). *Thèse de doctorat*, Université Libre de Bruxelles, 459.

<https://dipot.ulb.ac.be/dspace/bitstream/2013/212401/3/aaa599be-b03c-4adf-97df-d8503135fda3.txt>

- [18] Christenhusz, M. J., & Byng, J. W., 2016, The number of known plants species in the world and its annual increase. *Phytotaxa* **261**(3),201-217. <https://doi.org/10.11646/phytotaxa.261.3.1>
- [19] Prince, L. M., & Kress, W. J., 2006, Phlogeny and Biogeography of the Prayer Plant Family. *Aliso: A Journal of Systematic and Evolutionary Botany* **22** (1), 645-659. <https://scholarship.claremont.edu/aliso/vol22/iss1/51>
- [20] Moupela, C., Beyeme, A. M. M., Ognalaga, M., Rendembwot, T. M., Tagg, N., & Lepengue, A. N., 2021, Population structure, growth dynamics, leaf production and soil conditions of *Megaphrynium macrostachyum*, a key non-wood forest product in Central Africa. *International Journal of Plant & Soil Science* **33**(18), 124–135. <https://doi.org/10.9734/ijpss/2021/v33i1830583>
- [21] Cabezas, F. J., De la Estrella, M., Aedo, C., & Velayos, M., 2005, Marantaceae of Equatorial Guinea. *Annales Botanici Fennici* **42**(3), 173-184. <http://www.jstor.org/stable/23727236>
- [22] Pouteau, R., Picard, J., Doumenge, C., Brncic, T., Gillet, J.-F., J.-L., Doucet, Gourlet-Fleury, S., Kimpouni, V., Loumeto, J.-J., Péliissier, R., & Rejoue-Méchain, M., 2024, The puzzling ecology of African Marantaceae forests. *American Journal of Botany* e16320. <https://doi.org/10.1002/ajb2.16320>
- [23] Koechlin, J., 1964, *Flore du Gabon. Vol. 9: Scitaminales: Musacées, Strélitziacées, Zingibéracées, Cannacées, Marantacées.* (Paris : Muséum national d'Histoire naturelle)
- [24] Gagnepain, F., 1930, Un cas remarquable d'évolution : la famille des Marantaceae. *Bulletin de la Société Botanique de France* **77**(2), 190-191. <https://doi.org/10.1080/00378941.1930.10833713>
- [25] Campbell, P., Rivera, P., Thomas, D., Bourobou-Bourobou, H., Nzabi, T., Alonso, A., & Dallmeier, F., 2006, Structure, composition et diversité floristiques d'une forêt équatoriale du Gabon. Gamba, Gabon: Biodiversité d'une forêt équatoriale africaine, *Bulletin of the Biological Society of Washington* **12**, 29-52.
- [26] Van Gemerden, B. S., Shu, G. N., & Olff, H., 2003, Recovery of conservation values in Central African rain forest after logging and shifting cultivation, *Biodiversity & Conservation* **12**, 1553-1570. <https://doi.org/10.1023/A:1023603813163>
- [27] Yongo, O. D., 2003, Contribution aux études floristique, phytogéographique et phytosociologique de la forêt de Ngotto (République Centrafricaine). *Acta Botanica Gallica* **150** (1), 119-124. <https://doi:10.1080/12538078.2003.10515992>
- [28] Gillet, J. F., 2013. Les forêts à Marantaceae au sein de la mosaïque forestière du Nord de la République du Congo : origines et modalités de gestion. *Thèse de Doctorat*, Faculté universitaire des sciences agronomiques de Gembloux, Belgique, 192. <https://orbi.uliege.be/handle/2268/155570>
- [29] De Foresta, H., 1990. Origine et évolution des savanes intramayombiennes (RP du Congo). II. Apports de la botanique forestière, In R. Lanfranchi & D. Schwartz (Eds) *Paysages*

- quaternaires de l'Afrique centrale atlantique*, (Paris: ORSTOM), 326-335. https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers11-10/34796.pdf
- [30] Kouka, L. A., 2004, Régénération des espèces ligneuses en forêt du Parc national d'Odzala (Congo-Brazzaville). *Acta botanica gallica* **151** (3), 293-309. <https://doi.org/10.1080/12538078.2004.10515431>
- [31] Van Leeuwen, H. I. L. D., & Gauthier-Hion, A. N. N. I., 1998, Forest elephant paths and movements at the Odzala National Park, Congo: the role of clearings and Marantaceae forests. *African Journal of Ecology* **36** (2), 174-182. <https://doi.org/10.1046/j.1365-2028.1998.00123.x>
- [32] Ley, A. C., & Claßen-Bockhoff, R. (2009). Pollination syndromes in African *Marantaceae*. *Annals of Botany*, 104(1), 41–56. <https://doi.org/10.1093/aob/mcp106>
- [33] Limala, E.P., Ntsefong, G.N., Likeng-Li-Ngue B.C., Mbo Nkoulou, L.F., Akoa Fouman, J.F.V., & Bell, J. M., 2025, Caractérisation de la phénologie reproductive de *Megaphrynium macrostachyum* ((Benth.) Milne-Readh. (Marantaceae) en zones forestières monomodale et bimodale du Cameroun. *Cameroon Journal of Biological and Biochemical Sciences* **33**, 91-101. <https://doi.org/10.63342/cjbbs2025.33.008.fr>
- [34] Classen-Bockhoff, R., 1991, Untersuchungen zur Konstruktion des Bestäubungsapparates von *Thalia geniculata* (Marantaceen). *Botanica Acta* **104**(3), 183–193. <https://doi.org/10.1111/j.1438-8677.1991.tb00215.x>
- [35] Yeo, P., 1993, Secondary pollen presentation, in form, function and evolution, Suppl (Eds) *Plant Systematics and Evolution*, (Vienna: Springer) **6**, 1–268. <https://doi.org/10.1007/978-3-7091-6670-3>
- [36] Kennedy, H., 2000, Diversification in pollination mechanisms in Marantaceae. In K. L. Wilson & D. A. Morrison (Eds.), *Monocots: Systematics and evolution* (pp. 335–343). (Melbourne : CSIRO Publishing).
- [37] Locatelli, E., Machado, I.C., & Medeiros, P., 2004, *Saranthe klotzschiana* (Koer.) Eichl. (Marantaceae) e seu mecanismo explosivo de polinizacao. *Revista Brasileira de botanica* **27**(4), 757–765, <https://doi.org/10.1590/S0100-84042004000400014>.
- [38] Kennedy, H., 1978, Systematics and pollination of the “closed-flowered” species of *Calathea* (Marantaceae). (Berkeley : University of California Press).
- [39] Classen-Bockhoff, R., & Heller, A., 2008a, Floral synorganisation and secondary pollen presentation in four Marantaceae from Costa Rica. *International Journal of Plant Science* **169**, 745–760. <https://doi.org/10.1086/588069>
- [40] Kunze, H., 1984, Vergleichende Studien an Cannaceen - und Marantaceenblü- ten. *Flora*, **175**(5), 301–318, [https://doi.org/10.1016/S0367-2530\(17\)31453-6](https://doi.org/10.1016/S0367-2530(17)31453-6)
- [41] Kato, M., 1996, Plant–pollinator interactions in the understorey of a lowland mixed dipterocarp forest in Sarawak. *American Journal of Botany* **8**(6), 732–743. <https://doi.org/10.1002/j.1537-2197.1996.tb12762.x>
- [42] Momose, K., Yumoto, T., & Nagamitsu, T., 1998, Pollination biology in a lowland dipterocarp forest in Sarawak, Malaysia. I. Characteristics of the plant–pollinator community

- in a lowland dipterocarp forest. *American Journal of Botany* **85** (10), 1477–1501. <https://doi.org/10.2307/2446404>
- [43] Clausager, K., & Borchsenius, F., 2003, The Marantaceae of Sabah, northern Borneo, *Kew Bulletin* **58** (3), 647–678. <https://doi.org/10.2307/4111147>
- [44] Leite, A.V., & Machado, I.C., 2007, Reproductive phenology, floral biology and pollinators of two sympatric species of Marantaceae from an Atlantic forest fragment, northeastern Brazil. *Revista Brasileira de Botanica* **30** (2), 221–231. <https://doi.org/10.1590/S0100-84042007000200007>
- [45] Classen-Bockhoff, R., Heller, A., 2008b, Style release experiments in four Marantaceae from the Golfo Dulce area in Costa Rica. *Stapfia* **88** (80), 557–571. https://www.zobodat.at/pdf/STAPFIA_0088_0557-0571.pdf
- [46] Foucault, B., Batawila, K., Wala, K., & Akpagana, K., 2011, Une formation végétale méconnue pour l'Afrique tropicale, la mégaphorbiaie ; le cas du *Marantochloa-anubiadetum* giganteae du Togo. *Acta Botanica Gallica* **158** (3), 409-423. <http://doi.org/10.1080/12538078.2011.10516283>
- [47] Hecketsweiler, P., Doumenge, C., & Ikonga, J.M., 1991, Le parc national d'Odzala, Congo. International Union for the Conservation of Nature, Gland, Switzerland and Cambridge, UK. <https://portals.iucn.org/library/node/6480>
- [48] Gibert, G., 1984, La masse forestière congolaise : son implantation, ses divers faciès. *Bois et Forêts des Tropiques* **204**, 3–19. <https://doi.org/10.19182/bft1984.204.a19505>
- [49] Brncic, T., 2003, Ecology and patch dynamics of *Megaphrynium macrostachyum* (Benth.) Milne-Redh. (Marantaceae) in the south-west Central African Republic. Ph.D. dissertation, University of Oxford, Oxford, UK. <https://hal.science/tel-04413152>
- [50] Vande Weghe, J.-P., 2004, *Forêts d'Afrique centrale : La nature et l'homme*. (Tielt : Lannoo).
- [51] Aweke, G. (2007). *Costus lucanusianus* J. Braun & K. Schum. In G. H. Schmelzer & A. Gurib-Fakim (Eds.), *PROTA (Plant Resources of Tropical Africa/Ressources végétales de l'Afrique tropicale)*. (Wageningen, The Netherlands: PROTA Foundation)
- [52] Dhetchuvi, M. M. (1993). Biologie et usage de quelques espèces de *Marantaceae* au Zaïre. *Belgian Journal of Botany* **126**(2), 209–216. <http://www.jstor.org/stable/20794309>
- [53] Tsakem, S. C., Tchamba, M., & Weladji, R. B. (2015). Les gorilles du Parc National de Lobéké (Cameroun): Interactions avec les populations locales et implications pour la conservation. *International Journal of Biological and Chemical Sciences* **9**(1), 270–280. <https://doi.org/10.4314/ijbcs.v9i1.24>
- [54] Walsh, P.D., Abernethy, K.A., Bermejo, M., Beyers, R., De Wachter, P., Akou, M.E., Huijbregts, B., Idiata Mambounga, D., Kamdem Toham, A., Kilbourn, A.M., Lahm, S.A., Latour S., Maisels, F., Mbina, C., Mihindou, Y., Ndong Obiang, S., Ntsame Effa, E., Starkey, M.P., Telfer, P., Thibault, M., Tutin, C.E.G., White, L.J.T., & Wilkie, D.S., 2003, Catastrophic ape decline in western equatorial Africa. *Nature* **422**(6932), 611-614, <http://doi.org/10.1038/nature01566>

- [55] Igboasoiiyi, A. C., Ajibola, D., & Bassey, A. E., 2015, Phytochemistry, Antimicrobial Potential and Proximate Evaluation of *Marantochloa Cuspidata* (Marantaceae). *International Journal of Innovative Research and Development* 4 (9), 135-138. https://www.internationaljournalcorner.com/index.php/ijird_ojs/article/view/135745/94867
- [56] Ondo, J.P., Obame, L.C., Andzi Barhé, T., Nsi Akoue, G., Nsi Emvo, E., & Lebibi, J., 2013, Phytochemical screening, total phenolic content and antiradical activity of *Asplenium africanum* (Aspleniaceae) and fruit of *Megaphrynium macrostachyum* (Marantaceae). *Journal of Applied Pharmaceutical Science* 3 (08), 092-096. <https://doi.org/10.7324/JAPS.2013.3816>
- [57] Njintang, Y.N., Tatsadjieu Ngoune, L., Ngakou, A., Danra, D., & Tchuenguem-Fohouo, F.N., 2012, Antiradical activity and polyphenol content of ethanolic extracts of Propolis. *International Journal of Biosciences* 2(4), 56-63. <https://innspub.net/Antiradical-activity-and-polyphenol-content-of-ethanolic-extracts-of-Propolis/>
- [58] Joly, L. G., Guerra, S., Septimo, R., Solís, P. N., Gupta, M. P., Levy S., & Perera, P., 1990, Ethnobotanical inventory of medicinal plants used by the Guaymi Indians in Western Panama. Part II. *Journal of Ethnopharmacology* 28(2), 191-206. [https://doi.org/10.1016/0378-8741\(90\)90029-S](https://doi.org/10.1016/0378-8741(90)90029-S)
- [59] Dogra, K. S., Chauhan, S., & Jalal, J. S., 2015, Assessment of Indian medicinal plants for the treatment of asthma. *Journal of Medicinal Plants Research* 9(32), 851-862. <https://doi.org/10.5897/JMPR2015.5890>
- [60] Touckia, G. I., Kosh-Komba, E., & Yongo, O. D., 2014, Plantes alimentaires d'intérêt médicinaux utilisées par les Pygmées de la commune de Pissa (République Centrafricaine). *International Journal of Biological and Chemical Sciences* 8(2), 517-527. <http://dx.doi.org/10.4314/ijbcs.v8i2.11>
- [61] Hattori, S., 2006, Utilization of Marantaceae plants by the Baka hunter-gatherers in southeastern Cameroon. *African Study Monographs, Supplementary Issue* 33, 29-48. <https://doi.org/10.14989/68476>
- [62] Mingoh Mbapah, E., Fuashi Nkwatoh, A., Tchakonte, S., Longonje Ngomba, S., Nasako Noto Penda, & Uta-Rein Lekah, A., 2025, Commercialisation and Market Margins of Marantaceae Species in Cameroon, *International Journal of Agricultural Economics*, 10(6), 376-386. <https://doi.org/10.11648/j.ijae.20251006.14>
- [63] Onzo, F.C., Aka, S., Azokpota, P., Benie, C.K.D., Dje, K.M., & Bonfoh, B., 2015, Diversité des denrées alimentaires traditionnelles conditionnées dans les emballages des feuilles de plantes en Côte d'Ivoire. *Agronomie Africaine* 27(2), 155-172. <https://doi.org/10.4314/aga.v27i>
- [64] Onzo, F.C., Aka, S., Azokpota, P., Dje, K.M., & Bonfoh, B., 2015, Cartographie des espèces de feuilles végétales utilisées comme emballages alimentaires en Côte d'Ivoire. *Journal de la Recherche Scientifique de l'Université de Lomé, Série A* 16(2), 19-36. <https://doi.org/10.4314/jrsul.v16i2>
- [65] Kahindo, M., Lejoly, J., & Mate, M., 2001, Plantes sauvages à usages artisanaux chez les pygmées « Mbuti » de la forêt de l'Ituri (République démocratique du Congo). *Tropicultura* 19(1), 28-33. <https://agris.fao.org/search/en/providers/122397/records/64723832e17b74d2224ee36b>

- [66] Koechlin, J. (1964). *Flore du Gabon*. Vol. 9: Scitaminales: Musacées, Stréltiziacées, Zingibéracées, Cannacées, Marantacées. (Paris : Muséum national d'Histoire naturelle)
- [67] Terashima, H., & Ichikawa, M., 2003, A comparative ethnobotany of the Mbuti and Efe hunter-gatherers in the Ituri forest, Democratic Republic of Congo. *African Study Monographs* **24**(1–2), 1–168. <https://doi.org/10.14989/68220>
- [68] Walker, A., & Sillans, R., 1961, *Les plantes utiles du Gabon. Essai d'inventaire et de concordance des noms vernaculaires et scientifiques*. (Paris : Paul Lechevalier)
- [69] Lubini, A., 1994, Utilisation de plantes par les Yansi de l'entre Kwilu-Kasaï (Zaïre). In *Proceedings XIIIth Plenary Meeting of AETFAT, Zomba, Malawi*, edited by J. H. Seyani and A. C. Chikuni, 53–74. (Lilongwe: National Herbarium and Botanic Gardens of Malawi).
- [70] Indjasa Langan, R., Umba di Mbalu, J., Pwema Kiamfu, V., & Munganga Kilingwa, C., 2025, Contribution à l'étude de la conservation des jeunes feuilles de *Megaphrynium macrostachyum* pour l'alimentation humaine en saison défavorable. *Revue-IRS* **3**(2). <https://doi.org/10.5281/zenodo.15275686>
- [71] Chevalier, A., 1943, Les plantes coloniales utiles que l'on peut cultiver en France. *Revue de Botanique Appliquée et d'Agriculture Coloniale* **23**(263), 177–196. <https://doi.org/10.3406/jatba.1943.1766>
- [72] Chen, J., Henny, R. J., & McConnell, D. B. (2002). Development of new foliage plant cultivars. In J. Janick & A. Whipkey (Eds.), *Trends in New Crops and New Uses* (pp. 446–452). (Alexandria, VA: ASHS Press)
- [73] Radji, R., Kokou, K., & Akpagana, K., 2010, Étude diagnostique de la flore ornementale togolaise. *International Journal of Biological and Chemical Sciences* **4**(2), 491–508. <https://doi.org/10.4314/ijbcs.v4i2.58159>
- [74] Tchatat, M., Ndoeye, O., & Nasi, R., 1999, Produits forestiers autres que le bois d'œuvre (PFAB) : place dans l'aménagement durable des forêts denses humides d'Afrique centrale. (Montpellier : CIRAD-Forêt), Série FORAFRI, 18. <https://cgspace.cgiar.org/items/c07de1fa-a240-4a52-8cb4-f483295cd784>
- [75] Sah, M., 2018, Valorisation des produits forestiers non ligneux sur le revenu des ménages au Congo : cas des Marantaceae. *Annales de l'Université Marien N'GOUABI, Sciences Économiques et de Gestion* **18**(2), 385–396. <https://hdl.handle.net/20.500.12177/2663>
- [76] Onzo, F.C., Azokpota, P., Akissoe, N., & Agbani, O.P., 2013, Biodiversité des emballages-feuilles végétales utilisées dans l'artisanat agroalimentaire au Sud du Bénin. *Journal of Applied Biosciences* **72**(1), 5810–5821. <https://doi.org/10.4314/jab.v72i1.99666>
- [77] Priso, R. J., Nnanga, J. F., Etame, J., Din, N., & Amougou Akoa, A., 2011, Les produits forestiers non ligneux d'origine végétale : valeur et importance dans quelques marchés de la région du Littoral-Cameroun. *Journal of Applied Bioscience* **40**, 2715-2726. <https://m.elewa.org/JABS/2011/40/6.pdf>