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## Angiosperms of Senegal: Key to the families of the class dicotyledons

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### Abstract

The Angiosperms are the best known and most diversified group in Senegal. However, even if a lot of work has been done on this group, more needs to be done. The main objective of this work is to contribute to a better knowledge of the biodiversity of dicotyledons in Senegal. More specifically, this work seeks to propose a determination key for the families of dicotyledons in order to facilitate their identification. Based on bibliographical research, a rough table and a summary table listing the different characters of the vegetative and reproductive systems of the families of the Dicotyledons of Senegal have been drawn up. These tables were used to propose dichotomous keys.

This work made it possible to propose determination keys essentially based on the stable characters of the vegetative and reproductive systems of these families.

**Keywords:** Angiosperms; Monocotyledons; Dicotyledons; Families; Identification key

### 1. Introduction

In the flora of Senegal, Angiosperms constitute the most diverse group. Previous studies [2] have shown that Dicotyledons are largely more represented than Monocotyledons in Senegal. Thus, in this West African country, flowering plants, which are relatively well known, comprise about 2500 species [13]; [2].

However, even if most of the flora is known, some geographical areas remain to be surveyed. However, in West Africa, the identification of plant species presents particular difficulties as floras are often lacking. In addition, the plants do not flower synchronously and the collected material is often sterile, which makes a complete determination of the specific alpha-diversity almost impossible during a short mission [20]. Thus, in poorly surveyed areas, only a family specialist can guarantee an accurate determination of the species [20]. Indeed, the main work of the botanist in the field is to identify the material up to the family level, as specialists generally work at this level and it is to them that the material should be sent for a definitive determination [20]. In the case of Senegal, although Berhaut [4] proposed a species determination key, a family key is not yet available. The main objective of this work is to contribute to a better knowledge of the biodiversity of Senegal. More specifically, this work seeks to propose a determination key for families belonging to the class of dicotyledons.

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## 2. Material and methods

This work was carried out at the Botany and Biodiversity Laboratory (LBB) of the Cheikh Anta Diop University of Dakar (UCAD). The sources of information are: the University Library (BU), the Dakar herbarium and the Botanical Garden.

This work was carried out using:

- Flora [1] ; [5] ; [7] ; [6] ; [4] ; [3] ; [12] ; [8] ; [10].
- The results of the work of the Botany and Biodiversity Laboratory [15]; [14]; [18]; [2]; [11]; [19] and those of Poilecot [16]; [17].
- Observations made in the herbarium and the Botanical Garden.

For the elaboration of the determination key of the families, we have listed in rough tables the different vegetative and reproductive characters for all families of the classes Monocotyledons and Dicotyledons.

The following vegetative and reproductive characters have been used because of their easy observation, and their high taxonomic value.

For the vegetative apparatus, these are the following characters

- The habit: the type of habit, the size, the appearance...
- The trunk: bark, hairiness, colour, latex, trunk shape, etc.
- Leaves: types of leaves, arrangement of leaves, length, width, petiole, blade, stipules, venation...
- Leaflets: rachis, petioles, number of leaflets, arrangement of leaflets, pilosity, shape of leaflets, length, width, base, apex, margin...

For the reproductive characteristics, the observations were made on the following organs

- Inflorescence: type of inflorescence, length of inflorescence, etc.
- Flower: nature, shape, colour, length, width, size, seed coat, calyx, corolla, sepals, stamens, gynoecium, peduncle, pedicels...
- The fruit: shape, colour, size, hairiness, length, width, apex, peduncle, pedicel, type of fruit, number of valves...
- The seed: shape, size, number, colour...

From these raw tables, we have established summary tables in which, for each family, the different characters are either present and noted + or absent and noted - .

These summary tables make it possible to obtain tables that are neither too condensed nor too detailed, to group similar families together and to separate families.

The key proposed in this work is a dichotomous key, proposed essentially on the basis of the stable characters of the vegetative and reproductive apparatus, which are those that can be observed most frequently, in nature or on herbarium specimens [9].

The principle of the key is to oppose two contradictory possibilities. We have tried to construct a key that first takes into account macroscopic morphological characters, giving preference to dichotomous character pairs such as herbs/woody, erect/rampant habit, opposite/alternate leaves or simple/composite leaves, presence/absence of latex, or stipules, through the relevance of perianth or ovary characters. In many cases, these characters allow to unambiguously and quickly arrive at a family.

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## 3. Results and discussion

The results concern the analysis of the diversity of Dicotyledons. These are rich in 137 families. These allowed us to propose two keys based on the presence and absence of leaves.

### 3.1. Series 2 Dicotyledons

Dicotyledons are plants with branched venation and pentamerous flowers, plantlets with 2 cotyledons, main root usually persistent, liberulinos bundles usually arranged in a cycle and provided with cambium.

1 - Families with leafless or deciduous plants..... **Key n°1**

1' - Families of plants with developed leaves..... **Key n°2**

**Key n°1:** plants without leaves or leaves reduced to spines or scales.

1 - woody plants; leaves reduced to small scales, 8-10 whorled; about 1mm long; fruit is an ovoid samara; peduncle 10-20mm long and 10-15mm wide; fruit sometimes in the form of small cones with small winged seeds.....*Casuarinaceae*

1' - herbaceous, leafless or deciduous plants

2 - succulent plants; spiny, sometimes large (candle), or epiphytic; vegetative structure highly variable: cushioned, cylindrical, flattened, segmented; stem bearing numerous areoles (small depressions, from which the branches and flowers arise), often surrounded by spines or glochids (long spines armed with hooks whose tips are curved backwards); leaves generally absent or vestigial, except in genera considered archaic, or modified into spines; fruit ,berry.....*Cactaceae*

2' - non-succulent plants; without chlorophyll and living parasitically on tree roots; flowers are extremely small, only the inflorescence is aerial, they develop from a thickened tuber-like underground part that opens like a mushroom volva; fruit resembles nuts with the presence of tuberous roots.....*Balanophoraceae (Cynomoriaceae)*

**Key 2:** Plants with developed leaves

1 - Families in which the leaf type is homogeneous (either simple or compound)

2 - Simple leaves

3 - Latex plants

4 - stipules present; trees, shrubs, vines or more rarely herbs; monoecious or dioecious; abundant latex, white or beige; often epiphytic, becoming parasitic and then strangler; leaves alternate (rarely opposite), simple, entire or cut; terminal bud very accentuated; blade palmatinervate at the base; terminal stipules often large and hooded, deciduous and leaving conspicuous annular scars; flowers arranged either on a thickened club-shaped axis, or on a flattened axis, or inside an urn; fruit, drupelets aggregated in clusters, fleshy syncarps, or achenes attached to the inner wall of a fleshy or succulent receptacle... ..*Moraceae*

4' - stipules absent

5 - woody plants, monocaules, with leaves in a terminal bunch; trees or shrubs, usually dioecious or polygamous (unisexual and bisexual flowers on the same plant); leaves alternate, deeply digitate, long-stalked; inflorescence in panicle, raceme or axillary solitary flower; sepals fused and small; petals with twisted pre-flowering fused into a long (male flowers) or short, if not almost free tube (female and hermaphrodite flowers); ovary superect; fruit, berry, often with a fleshy pulp.....*Caricaceae*

5' - plants with branched trunk

6 - leaves usually cut; annual or perennial herbs, some shrubs; leaves alternate, those at base often united in a rosette; latex-secreting apparatus (white, yellow, red, or transparent); inflorescence solitary or more rarely cyme, raceme or panicle; fruit, pyxis: capsule opening through apical pores or valves, sometimes silique.....*Papaveraceae*

6' - uncut leaves

7- petiole base enclosing the shoot; trees, shrubs, herbs, sometimes hemiparasitic and strangler; plants monoecious or dioecious in the case of unisexual flowers; sometimes root-stalked; leaves simple, opposite or whorled; leaves marked by traces of laticifers; secondary venation dense and fine; inflorescence cyme terminal, more rarely solitary flower; fruit : septicid capsule or septifrage often fleshy, crowned by remains of style and stigma, sometimes berry or drupe.....*Guttiferae (Clusiaceae)*

7' - base of petiole not sheathing

8 - seeds capped with a tuft of hairs; trees, shrubs or herbs, often lianas; trunk sympodial and branches whorled; stem growth bayoneted visible on young trees; shrubs sometimes candelabra-shaped; latex white abundant at the notch; leaves opposite, or alternate, sometimes condensed into flecks, simple, entire ; sometimes glandular stipular appendages; inflorescence axillary or terminal, cymeous, racemose or solitary flower; corolla with twisted pre-flowering; stamens alternately fused to corolla; ovary sterile to semi-infertile; fruit a more or less elongated follicle, or a berry... ..*Apocynaceae (Apocynoidae)*

8' - seeds hairless;

9- leaves opposite; woody or herbaceous, erect or voluble; latex usually white, sometimes yellowish or translucent; leaves usually entire but very variable in shape: linear, oval, elliptic, cordate, hastate or even sometimes absent, in cactiform species; often granulations on the blade at the base of the midrib; inflorescence axillary or terminal, cymememe, raceme or solitary; fruit follicle.....(*Apocynaceae) Asclepioidae*

9' - alternate leaves

10 - capsular fruit; annual or perennial herbaceous (tuberous root), woody or sub-woody lianas; the flowers, very varied in colour, from white to blue and from red to yellow, are generally campanulate, funnel-shaped, with some exceptions; the fruit is usually a conical capsule containing the seeds, which are glabrous or pubescent, sometimes with long urban or silky hairs.....*Convolvulaceae*

10' - fruit bacciform; trees or shrubs monoecious or dioecious; laticifying ducts in all organs; latex flowing rather slowly at the notch; sometimes whorled branches with rhythmic growth, plagiotropy by apposition (Aubréville's model); leaves alternate, grouped in speckles at the tip of the branches, simple, entire, glabrous or with squamous hairs; secondary veins sometimes dense and fine; generally without stipules; inflorescence axillary or cauliflorous; flowers often fasciculate; ovary superous; fruit : berry, smooth, shiny, flattened seed, characterized by a lighter, rough, matte scar on the edge.....*Sapotaceae*

3' - plants without latex

11- plants with hooks curved into a loop; woody lianas in the form of shrubs; entire leaves quite large and alternate; blade glabrous, obovate, elliptic; underside of blade remarkable for frequent nodules; leaves condensed at the apex of the twigs, petiole about nil, impasto on the twig.....*Ancistrocladaceae*

11' - plants without curved hooks

12- Watery plants

13 - flowers and leaves fleshy and shiny; trees or shrubs, sometimes climbing; glandular punctation on various organs; leaves alternate, simple, entire or toothed, leathery; inflorescence cymeous, racemose or paniculate, sometimes branched; sepals more or less fused; petals fused in a funnel shape; ovary superect, unilocular; fruit is a berry or drupe with usually a seed.....*Myrsinaceae*

13' - flowers and leaves not fleshy or shiny

14 - stems composed of successive articles; annual or perennial herbaceous, sometimes shrub-like; some genera have alternate ordinary leaves, upper leaves narrow and entire; petiole not very distinct, stem fluted, branches as a result of the ridge descending from the base of each petiole; flowers are tiny, green, without petals; ovary superect; fruit are also very small seeds .....*Chenopodiaceae*

14' - stems not composed of articles; herbaceous, rarely, sublinear-succulent plants; leaves opposite or alternate, without stipules or with stipules either rudimentary or replaced by a tuft of axillary hairs; blade simple, entire; cyme-shaped inflorescence taking on various aspects; sometimes solitary flowers; flowers hermaphroditic, usually with several planes of symmetry, surrounded by an involucre with 2 or more bracteoles, similar to sepals; fruit usually capsule-shaped with longitudinal or transverse dehiscence..... *Portulacaceae*

15 - inflorescence in a simple or more or less branched axillary spike; perennial, herbaceous, fleshy, voluble or trailing, may be green or red; leaves alternate, glabrous, semi-fleshy; blade oval, rounded wedge-shaped at the apex, broadly rounded at the base, then abruptly and shortly wedge-shaped, leaving a more or less distinct stalk; three to five lateral veins, those at the apex not very sensitive; fruit, globose berries, usually black when ripe.....*Basellaceae*

15' - inflorescence of different type

16 - plants with often jointed stems, sometimes climbing and with aerial roots, or stoloniferous; herbaceous perennials, more rarely shrubs; most species succulent, leaves alternate, simple, sometimes asymmetrical at base, with free stipules, deciduous; margins rather finely toothed, or with teeth interspersed with stronger teeth; flowers monoecious, actinomorphic, the males with two imbricated or absent sepals.....*Begoniaceae*

16' - plants with unjointed stems

17 - fairly thick, spongy, waterlogged stem; annual or perennial herbaceous; glabrous stem; leaves generally alternate, simple or lobed; leaves sometimes sessile; about ten fine veins running along the edges of the blade after leaving the median; the flowers, sometimes very conspicuous, are axillary or arranged in a cyme; the fruit is a capsule.....*Hydrophyllaceae*

17' - stem normal in appearance, not spongy

18 - flowers tubular, irregular, often double-lipped; herbaceous, but sometimes also shrubs or even small trees; leaves usually alternate; calyx over ovary has 5 lobes; fruit is a capsule, sometimes a berry.....*Lobeliaceae*

18' - flowers not tubular

19 - herbaceous plants lacking chlorophyll, parasitizing the roots of a host plant by underground suckers; perennial or, rarely, annual; stem more or less fleshy, erect, usually simple, with an often swollen base; leaves alternate, usually reduced to scales often fleshy; inflorescence in spike, raceme rarely panicle; fruits in the form of a capsule opening by 2 valves.....*Orobanchaceae*

19' - herbaceous plants with chlorophyll; plants of this family are annual, leaves simple, often toothed, alternate or opposite, sometimes whorled; flowers irregular with 3 petals, and usually 3 sepals, one of which is prolonged into a spur; the fruit is a capsule known for the spring-like dehiscence of its fruits, which, when ripe, throw the seeds at a distance at the slightest touch.....*Balsaminaceae*

12' - non-water plants

20 - stem knotty; growth sympodial, thickened at the nodes; herbs, shrubs or trees, sometimes climbing or epiphytic, aromatic; leaves simple, alternate, sometimes opposite, parallelepiped; stipules fused to the petiole or absent; inflorescence in a dense spike on a more or less fleshy axis, opposite the leaves, sometimes compound spike; bracts shield-shaped; fruit is a monosperm berry or drupe.....*Piperaceae*

20' - stems without nodes

21 - Plants often covered with hairs

22 - starry hairs on stems; trees or herbs lignified; leaves usually alternate, simple, with or without stipules; inflorescence diverse, sometimes solitary or cauliflorous, sometimes inflorescent bract; flowers hermaphroditic, regular, with valvate sepals; stamens often in clusters (5 or multiple of 5) or in a column; ovary superect; fruit a loculicidal or indehiscent capsule, berry or samara.....*Malvaceae (Tiliodae)*

22' - non-starred hairs

23 - Stinging hairs on stems and leaves; annual or perennial herbs, shrubs; monoecious, dioecious or polygamous; calcium oxalate throughout; leaves alternate or opposite, simple, toothed; stipules; contracted biparous cyme inflorescence (glomerulus) grouped in spiciform, paniculiform or capitulum inflorescence; ovary superecious; fruit: achene, sometimes drupe, usually included in persistent perianth.....*Urticaceae*

23' - squamous hairs (bifurcate or compass needle-shaped); creepers, shrubs or small trees; leaves opposite, simple; sometimes glands on blade; stipules intrapetiolar; inflorescence cymeous or racemose, terminal or axillary; sepals free or slightly fused at base, with extracalycal glands; petals free, spatulate, with often fringed margin; ovary usually trilocular; usually 3 free styles; fruit : three-winged schizocarpic samara, rarely drupe or berry.....*Malpighiaceae*

21' - plants often hairless

24 - plants with leaves, small and sometimes reduced to an expanded, flattened petiole, acting as a blade; opposite often decussate, sometimes fused at the base, more rarely pseudo-verticulate or alternate, and inserted on strongly swollen nodes at which the stem breaks easily; inflorescence diverse, sometimes dense, often biparous cyme, more rarely solitary flower; fruit: capsule opening by valves or teeth, more rarely achene or berry.....*Caryophyllaceae (Dianthaceae)*

24' - plants with developed leaves

25 - plants with usually sessile leaves; herbs or shrubs; leaves alternate or opposite, simple, entire; small stipules sometimes modified into glands or absent; inflorescence cymose, cluster or spike; sepals free or basally fused; 5 stamens sometimes alternating with 5 staminodes; gland or disc; ovary superect; 3 to 5 styles free or basally fused; fruit: septicid capsule, or drupe.....*Linaceae*

25' - plants with petiolate leaves;

26 - Plants with floral receptacle hollowed into a hypanthium

27 - seeds with fleshy endosperm; trees and shrubs; leaves alternate; leaf blade simple petiolate, with often shallowly crenellated margins; stipules either small and rapidly deciduous, or absent; floral envelope normally double; calyx 5-6-septate, imbricate or valvate in the bud, persistent; corolla, rarely absent, with petals in the same number as the sepals, often persistent; disc represented by glands alternating with the stamens; fruit capsule-shaped or indehiscent; seeds containing a relatively large embryo... ..*Samydaceae*

27' - seeds without endosperm; herbaceous, subshrubs and, rarely, woody plants; flowers pedicellate, with pedicels often bearing 2 bracteoles in its lower part; leaves either alternate or opposite, or, rarely, whorled; blade petiolate or sessile, simple; floral envelope double; flowers usually hermaphroditic, with several planes of symmetry or, more rarely, with 1 plane of symmetry, 2-4-6 mothers, with floral envelope double; sepals, possibly fused together at the base; corolla with 0-4-6 petals free from each other, in a contorted or imbricated situation in the bud; androecium either with 2 or 4 stamens, in 1 whorl, or with 8 or 10 or 12 stamens, in 2 whorls; ovary semi-infertile or infertile, with 1-4-7 chambers, each one containing ovules in a varied number; fruit of varied type... ..*Onagraceae*

26' - plants without hypanthium

28 - plants with opposite, prehensile branches; trees, shrubs which may be climbing (by adventitious roots, voluble axes or with the aid of spines), rarely herbs; woody lianas or small trees; leaves opposite, simple, sometimes alternate, stipules small and often deciduous; laticifers connecting the two parts of the leaf blade when torn; terminal or axillary cymose inflorescence, sometimes solitary flower; sepals free or basally fused; free imbricate petals; ovary superect or semi-infertile; fruit may be a capsule, samara, berry or drupe; seed albuminous, with a coloured aril... ..*Celastraceae*

28' - plants without prehensile branches

29 - plants more or less dichotomously branched, often reddish, marked with longitudinal ridges from the base of the petioles; herbaceous or woody, with erect or creeping stems; leaves alternate, with petiolate, simple, entire leaf blade; stipules rarely present; inflorescence, raceme-like, simple or compound, terminal or axillary; bract and pairs of bracts small ; Flowers small, hermaphroditic or unisexual, the latter almost always with aborted organs of the other sex; tepals

4-6, imbricate, equal or unequal to each other, free from each other or sometimes some fused together at the base; tepals usually persistent, sometimes brightly coloured; ovary superect; fruits of various types, with 1 or more carpels, fleshy or dry; seeds erect with a large embryo.....*Phytolaccaceae*

29' - plants not dichotomously branched

30 - stamens inserted on corolla; trees, shrubs, erect or lianas, but also some herbaceous plants; leaves opposite; flowers, tubular-based, lobed more or less numerous; fruit may be berry, capsule, or drupe.....*Loganiaceae*

30' - stamens independent of the corolla

31 - stamens inserted on calyx; trees or shrubs, but mostly herbaceous plants; leaves usually opposite or whorled, rarely alternate; calyx always present, consisting of sepals joined at the base in the form of a tube; petals inserted towards the top of the tube, but sometimes missing completely; stamens 4-8; superect ovary yields at maturity a capsule containing many small seeds.....*Lythraceae*

31' - stamens independent of calyx

32 - stipules present

33 - stipules often large and foliose,

34' - leaves opposite decussate, simple, entire; sometimes glandular, may form pseudovergrowths with the leaves or a sheath around the stem; trees, shrubs, herbs, vines, sometimes epiphytic; sometimes plagiotropic branches whorled; base of blade sometimes transformed into myrmecophilous cavities; inflorescence highly variable: cymeous, racemose or paniculate, sometimes solitary flowers; often pseudanth: capitulum or glomerule of very small flowers; corolla gamopetal actinomorphic; ovary inferior; fruit, septicidal or loculicidal capsule, berry, achene or drupe.....*Rubiaceae*

34' - leaves alternate, simple, three-lobed or reniform; aromatic perennial herbs, shrubs or vines; base of petiole decurrent on stem; base of blade palmatinervate; inflorescence: raceme, cyme, or solitary flower; sepals fused into a curved proboscis-like petaloid tube; petals absent or much reduced; fruit; usually an umbrella-shaped opening capsule.....*Aristolochiaceae*

33' - stipules small and linear

35 - plants with tendrils; herbaceous or woody lianas, rarely trees or shrubs; glands and outgrowths on the petiole; leaves alternate, entire or palmately lobed, often reniform, or more or less indented; tendrils bisecting petiole and stem; stipules, often foliaceous; inflorescence axillary, flowers solitary or geminate, frequently subtended by an involucre of large bracts; ovary superect, tricarpellate; 3 styles free or fused at the base; fruit; capsule or berry.....*Passifloraceae*

35' - plants without tendrils

36 -flowers sessile or subsessile; small, axillary, isolated in leaf axils; herbaceous, sometimes suffuscating, with simple, opposite or whorled leaves; fruits are capsules, often suborbicular, containing many seeds.....*Elatinaceae*

36' - pedunculated flowers

37 - zig-zag branches

38 - glands at the apex of the secondary veins; trees or shrubs, sometimes thorny; leaves simple, often distichous, sometimes blade with transparent punctation and palmate venation at the base; small deciduous stipules; inflorescence usually axillary, fascicle, spike, cluster, cyme, glomerule, rarely panicle or solitary flower; fruit berry, sometimes drupe or loculicidal capsule; seed often arillate.....*Flacourtiaceae*

38' - no glands at apex of secondary veins; trees and shrubs, sometimes thorny; leaves alternate, distichous sometimes opposite, simple; blade sometimes palmatinervate at base or throughout; stipules sometimes modified into spines;

petals valvate often deciduous and smaller than sepals; ovary usually superect plurilocular; fruit, often drupe or schizocarp.....*Rhamnaceae*

37' - straight branches

39 - plants with longitudinal traces of persistent folds on the leaf blade; annual or perennial herbs, lianas, shrubs, and more rarely, trees; myrmecophily in certain tropical woody plants (*Triplaris*); leaves alternate, simple, entire; ochrea, i.e. stipular sheath surrounding the stem above the petiolar insertion; inflorescence spikes, raceme or panicle of cymules; flowers homoiochlamyde, often trimeric, actinomorphic, iso-, diplo- or triplostemonous; ovary superect, unilocular; fruit; achene usually trigonous, surrounded by accrescent tepals, the whole forming a samara.....*Polygonaceae*

39' - plants without longitudinal traces of persistent folds on the leaf blade

40 - palmate venation; herbaceous, sometimes shrubs, rarely small trees; leaves alternate; stipules usually present, and pubescence formed of star-shaped hairs; sepals united at the base and may be accompanied by bracts that form an epicalyx on the calyx; corolla white, pink, red or yellow, formed of 5 petals inserted at the base of the central column that bears the stamens. The fruit is a capsule formed of several chambers which contain the seeds.....*Malvaceae (Malvoideae)*

40' - venation opposite or subopposite

41 - petiole sometimes winged, or enlarged by the decurrent blade; trees, shrubs, vines or herbs; leaves alternate, simple, scabrous, with entire or toothed margin, the secondary veins extending to the margin; inflorescence cymose or solitary flowers; flowers spiral-cyclic, heterochlamydial; sepals often spiral; ovary superect; carpels free or partially fused; fruit, berry or follicle.....*Dilleniaceae*

41' - petiole not winged

42 - plants with striated brown bark, sometimes spiny; shrubs and small trees, with a very branched trunk; young twigs, subcircular-subquadrangular in cross-section, with very narrowly winged edges; older twigs subcylindrical; leaves opposite, subopposite or subfasciculate at the apex of short twigs; leaves deciduous with petiolate, simple entire blade, lacking glands; venation pinnate; no stipules; flowers solitary or 2-3 in leaf axils, large, hermaphroditic, short-stalked; calyx dialypaleptic; corolla dialypaleptic; ovary inferere; fruit berry-like, with leathery exocarp, 2-3 storeys of chambers containing numerous seeds... ..*Punicaceae*

42' - plants with variously coloured bark

43 - plants with bark peeling off in patches and revealing a perfectly smooth and coloured inner bark; aromatic trees or shrubs; inner bast; leaves generally opposite, simple, entire, punctuated with translucent glands; no stipules or sometimes present; case of many *Eucalyptus* : alternate and laterally compressed into a sickle blade; inflorescence cymose, panicle or solitary flowers; cauliflora frequent; flowers hermaphroditic actinomorphic; calyx gamosepal or absent; ovary infertile; fruit, berry or loculicidal capsule, sometimes drupe or achene.....*Myrtaceae*

43' - plants with persistent bark

44 - herbaceous plants with small pockets or utricles on the roots; aquatic herbaceous plants living either submerged or on wetlands of swamps; flowers 2-lipped, with a spur, sessile or pedicellate, in the upper part of the plant; fruit is a small capsule.....*Lentibulariaceae*

44' - herbaceous without pockets or utricles on the roots

45-Petiform leaves; perennial, freshwater herbs; rhizomes; stem submerged, leaves long-stalked, alternate, simple, cordate, usually floating; flower solitary, large and very showy; 4-6 sepals, not much different from the petals; stamens very numerous, short-networked, terminated by long, flattened anthers; receptacle large, formed of 8-20 carpels: the whole, when enlarging, forms the subspheric fruit which contains very many small seeds.....*Nymphaeaceae*

45' - unpeeled leaves



46 - leaves usually with glandular hairs, or rather small stipulated glands that engulf insects; flowers are 5-petalled and followed by ovoid capsules containing many seeds.....*Droseraceae*

46' - leaves without glandular hairs

47- spadix inflorescence; aquatic herbaceous, alternately submerged and emerged, formed by a basal part and leafy stems; basal part, plate- or ribbon-shaped, more or less deeply lobed or more or less densely branched, tightly applied to a rocky substratum; simple or branched leafy stems, very short (a few mm) to nearly a metre long; leaves often rudimentary, arranged in a rosette in plants with a very short stem, regularly or irregularly inserted on the well-developed stem of other species; blade entire and divided in various ways; ovary superect; fruit in the form of a capsule opening by 2 equal or unequal valves... ..*Podostemaceae*

47' - inflorescence of different type

48 - aquatic herbaceous; heterophyllous, ± swimming, from warm temperate to tropical regions; stipules present; leaves are of two types: the submerged leaves, inserted along the stems, are very finely divided like feathers (they are actually roots by their anatomical structure), while the swimming leaves are entire, alternate and grouped in rosettes; fruit in globular nut, generally tetrahedral .....*Trapaceae*

48' - terrestrial herbaceous

49 - fillets inserted on corolla tube; annual or perennial herbs with rhizomes or tubers; stipules absent; leaves opposite or whorled, sometimes alternate or in rosettes, usually simple; inflorescence variable, often solitary flowers; corolla gamopetalous, sometimes inverted backwards; ovary superect; fruit a 5-valved capsule; pyxis.....*Primulaceae*

49' - free fillets

50 - flowers very small, whitish or green

herbaceous terrestrial; leaves simple, alternate or opposite, with very short papery stipules; petals often absent; fruit as a very small seed enclosed in the calyx; taproot single at first, later dividing.....*Illecebraceae*

50' - flowers developed and differently coloured

51 - leaf blade pubescent; leaves simple, opposite; evergreen shrubs; stems have dark brown, rough bark; leaves are grey, green, succulent, downy with a salty taste; crushed leaves release a cedar-like aroma; leaves are tightly packed at the end of the branches, sessile, narrowly obovate; inflorescence, solitary or cyme-like, are almost hidden among the leaves; stipules absent; flowers hermaphroditic; ovary superect... ..*Surianaceae*

51' - glabrous blade

52 - plants of mangroves or the edge of inlets

53 - plants with pneumatophore roots; shrubs with simple opposite leaves; blade elliptic lanceolate, base wedge-shaped, apex obtuse; ten to 15 lateral veins reaching about the margin; blade opaque, only the marginal fillet translucent, when fresh: underside whitish (cottony hairs very short and not visible); with a magnifying glass, very fine, waxy white lenticels on the leaf blade; all around the trunk, within a radius of 1 to 2 m, or more, numerous small roots 5 to 10 cm high emerge from the ground, bristling the soil like a brush.....*Avicenniaceae*

53' - plants with stilt roots; trees or shrubs; branches whorled with rhythmic growth, plagiotropy by apposition (Aubreville's model); leaves opposite or whorled, simple, entire, often speckled at the tip of the branches; long deciduous terminal stipules and axillary stipular scars; leaf blade entire; stipules present; axillary inflorescence; flowers hermaphroditic; sepals valvate, often fleshy, fused at their base; petals free, fleshy, shorter than sepals, often ciliated and/or spatulate; stamens fused; ovary supere or inferere; fruit berry or drupe; seed, often winged, with an embryo that is often viviparous, i.e. developing on the parent plant... ..*Rhizophoraceae*

52' - plants not inhabiting the edge of inlets

54 - branches opposite, pale green or greyish; bushes and small trees, with or without axillary spines, stem with grey or whitish bark; branches semi-voluble or drooping, glabrous ; leaves opposite, with petiolate, simple, entire, often leathery blade; stipules small or no stipules; inflorescence axillary or terminal; flowers hermaphroditic, unisexual; calyx gamosepal; corolla dialypetal; ovary superect; fruit fleshy.....*Salvadoraceae*

54' - unopposed branches

55 - trees with large yellow flowers; stemmed shrubs from more or less tuberous-woody roots; leaves simple, alternate palmately; terminal inflorescence: flowers come in a group at the top of the leafy stem; large yellow flowers with 5 petals and many stamens; flowers hermaphroditic; fruit in large ovoid capsules containing seeds covered with silky hairs .....*Cochlospermaceae*

55' - trees with large and varied flowers: red, white or orange

56 - plants with petals persisting on the fruit and curved outwards; trunk smooth; trees with leaves, usually alternate, are often digitate, but sometimes they may be simple; stipules exist, but soon deciduous; flowers, usually quite large, sometimes well coloured, may bear very many stamens; the fruits are rather large capsules, generally dehiscent, but may be indehiscent; blade entire or toothed, pubescent or glabrous; flowers hermaphroditic; ovary superect; fruit dry; in the capsules, the seeds may be alone, or embedded in mealy pulp; in other cases, they are covered with long silky white hairs.....*Malvaceae (Bombacoidae)*

56' - plants without petals at the base of the fruit

57 - leaf blade often toothed

58 - unisexual catkin inflorescence; trees, shrubs; dioecious plants; leaves simple; inflorescence: unisexual catkin, appearing before or with leaves; seeds hairy; flowers unisexual; sepals absent; petals absent; stamens free or fused; ovary superect; fruit capsule loculicidal .....*Salicaceae*

58' - inflorescence of variegated type

59 - base of blade asymmetrical; trees or shrubs, rarely climbing, sometimes thorny; no latex; branches stacked in arches (Troll pattern); branches often zig-zag and set like the teeth of a comb on the branches; leaves simple, alternate, short-stalked, usually distichous; blade palmatinervate; inflorescence in fascicles, glomerules or axillary cymes, sometimes sessile; flowers reddish, in lateral fascicles, appearing before the leaves; petals absent; fruit : flattened samara, indented at apex, surrounded by a broad veined foliaceous wing, unilocular, monosperm.....*Ulmaceae*

59' - base of blade symmetrical; trees or shrubs dioecious; darker fibrous network in inner bark; leaves simple with margin sometimes with prickles; stipules small and deciduous; inflorescence cyme-like: thyrses, thyrsoid, fascicle; ovary superect, multi-lobed; stigma sessile or subsessile, multi-lobed; fruit drupe with several pits, or pyrenes .....*Aquifoliaceae*

57' - blade not toothed

60 - fruit, large, multi-winged samaras; fine, dense tertiary veins; trees and shrubs; shyness at crowns; leaves simple; petioles sometimes swollen at tips; sometimes gland at base of blade (Monotes); inflorescence axillary, defined or indefinite; flowers hermaphroditic, actinomorphic; petals twisted pre-flowering, often coriaceous; anthers surmounted by an outgrowth formed by elongate connective; ovary superect .....*Dipterocarpaceae*

60' - variegated type of fruit

61 - leaf blade with numerous reticulate veins, rather spreading on either side of the midrib, and almost spider-webbed at the base of the leaf blade; trees with simple leaves; flowers regular, usually rather small, while fruits may be rather large; leaf blade glabrous elliptic, shiny above; midribs prominent above; 7-10 lateral veins; axillary inflorescence indefinite; flowers hermaphroditic actinomorphic.....*Irvingiaceae*

61' - leaf blade with non-reticulate veins

62 - veins parallel to each other and 1 to 1.5 mm apart; trees or shrubs with simple leaves; 15 to 16 lateral veins arched, the apices curving towards the preceding vein, 2 to 3 mm from the margin; blade glabrous; inflorescence indefinite, axillary or terminal; flowers hermaphroditic actinomorphic; ovary supereous; fruit capsule with 3 or 4 valves.....*Medusandraceae*

62' - veins not parallel

63 - leaves with a more or less dense indument of simple, star-shaped, scaly hairs; trees dioecious or sometimes monoecious, or sometimes shrubby, fragrant; branches plagiotropic, whorled; resin transparent, red or yellow; indument on twigs, leaves and inflorescences; leaves, simple, entire, distichous, often perforated by insects; inflorescence raceme, panicle or thyrese; petals absent; ovary supereous; fruit, monosperm capsule, bivalve, more or less leathery... ..*Myristicaceae*

63' - leaves without hairs

64 - rough trunk : bark peeling off in long strips; trees or shrubs; branches often plagiotropic by aposition; twigs terminated by a small folded leaf; leaves, entire or toothed (sometimes small glands on the margin), often speckled at the tip of the twigs; rudimentary stipules; inflorescence solitary, racemose or cymose ; flowers hermaphroditic, actinomorphic or zygomorphic; sepals reduced to hypanthium teeth; corolla dialypetal, petals sometimes fleshy, rarely absent; ovary inferior; very large woody pixid fruit formed of an urn and a lid; sometimes bacciform fruit or tetra-winged samara... ..*Lecythidaceae*

64' - smooth trunk

65 - petiole thickened at base; often large trees, or shrubs; silica grains in bark; leaves, simple, coriaceous, sometimes distichous; stipules small and deciduous, or absent; inflorescence axillary or terminal cymeous; anthers drop-shaped, bearing 2 or 4 superimposed pollen sacs; fruit, a drupe consisting of a more or less resinous fleshy or fibrous exocarp, and a multi-locular woody endocarp with an ornamented surface.....*Humiriaceae*

65' - petiole not thickened at the base

66 - seeds reniform to lenticular sometimes with hilar appendages; herbaceous, erect or spreading, with alternate or opposite leaves; flowers small, white or greenish, petals often absent; seed small with often mottled or chagrined surface; fruit small, multi-lobed capsule; .....*Molluginaceae*

66' seeds not reniform, nor lenticular; perennial herbs, rarely annuals, shrubs or more rarely lianas; in some woody plants, sympodial growth of branches by juxtaposition of articles; leaves in herbaceous plants, alternate or basal, simple, entire or toothed; in some woody plants (Rinorea), often opposite and anisophyllous; inflorescence axillary, cluster, thyrsoïd, panicle, or solitary flowers; ovary superect, tricarpellate and unilocular; style sometimes bent; seed sometimes winged, arilus frequently present; fruit in capsule with dehiscence sometimes explosive, or more rarely a berry.....*Violaceae*

32' - stipules absent

67 -extremity of internodes thickened; herbs, sometimes shrubs, lianas of dense humid forest undergrowth or edges; leaves opposite, often decussate; frequently with cystoliths appearing under the magnifying glass as traces; inflorescence spiciform, racemose, or whorled umbel, enriched by well-developed, coloured bracts; more rarely solitary flowers; calyx fused; corolla highly coloured, tubular, bilabiate, more rarely single-lipped; ovary superect, bicarpellate, bilocular; fruit, loculicidal capsule with propulsive dehiscence, abrupt opening of the two elastic valves which bend outwards projecting the seeds... ..*Acanthaceae*

67' - tips of internodes not thickened

68 - Stems often reddish; herbs, rarely sarmentose shrubs or trees; leaves alternate or opposite, decussate, simple and entire; inflorescence erect or pendulous, often scarce, cyme (or cyme inflorescence), spikes, panicle, glomerule, sometimes presence of sterile flowers with appendages (spines, hooks) for seed propagation; bracts and preleaves well developed, coloured, scarce, brittle and persistent; sepals usually dry and scarce, free; ovary unilocular; fruit, achene or pyxis, surrounded by a persistent perigone; seeds shiny.....*Amaranthaceae*

68' - stems not reddish

69 - terminal branches often chlorophyllous and zigzag; trees or shrubs autotrophic, or parasitic on roots; leaves alternate, distichous, simple, entire; petioles thickened at both ends or at one; sometimes white exudate; inflorescence axillary, fascicle, spike, or solitary flower; calyx first small, then concrescent with the fruit; corolla tubular; ovary superior or inferior, multi-locular at the base and unilocular above (imperfectly septate); fruit, monospermous achene or drupe, often surrounded by the cup-shaped or petaloid and coloured calyx; seed albuminous.....*Olacaceae*

69' - non-chlorophyllous, straight branches

70 - plants with grey to dark brown, fissured bark, ± fibrous and orange edge; shrubs with low branching, irregular crown consisting of numerous branched branches with spindly, drooping tips, greyish-green foliage; bark fissured, grey to dark brown, with ± fibrous and orange edge; twigs glabrous, light grey; leaves alternate, resembling imbricated scales and ± flattened on the twigs, triangular to oval; fruit pods.....*Tamaricaceae*

70' - plants with non-grey bark

71 - blade sessile, subsessile or short-stalked

72- leaves opposite; herbaceous and woody plants, annual or perennial, glabrous or pubescent with hairs, multi-celled, often terminating in a small gland; leaves simple, oval to linear, entire; inflorescence axillary, glomerulate or small cyme-shaped, erect, sessile or pedunculate, each with 1 to 3 sessile or pedunculate flowers; fruits in the form of a subglobose or ovoid capsule, surmounted by the persistent perianth (calyx and corolla); capsule opening by 2(3) valves; seeds numerous, small, oblong... ..*Vahliaceae*

72' - leaves alternate, rarely opposite, blade short-stalked; plants herbaceous, sublinear or woody, sometimes lianaceous; leaves simple, entire, usually oval, venation pinnate; inflorescence usually spike- or raceme-shaped; rarely solitary flowers; 1 bract and 2 bracteoles at base of pedicel; flowers hermaphroditic, has a single plane of symmetry; fruits either capsule-shaped with 2 chambers, each usually containing 1 seed, or rarely, samaritan or berry-shaped; roots smell of methyl salicylate when fresh, when cut or crushed... ..*Polygalaceae*

71' - leaf blade petiolate

73 - inflorescence in uniparous scorpioid cyme or more rarely helicoid; plants with staggered branches and bayonet growth, rough (unicellular hairs); herbs, trees more rarely lianas; trunk pubescent; leaves alternate, simple, entire, rough; sometimes persistent calyx; sepals free or fused at the base; stamens alternipetal, fused to the corolla, sometimes with appendages; ovary superior, bicarpellary, usually forming 4 chambers by the presence of a false partition; fruit, four indehiscent nutlets or mericarps forming a tetrahedron, more rarely a drupe or a capsule; sometimes diaspore samaroid.....*Boraginaceae*

73' - inflorescence of different type

74 - plants with very small opposite or whorled leaves, which spread easily over the ground in brackish soils; small plants, annuals or perennials; the flowers are also very small, as is the capsule which contains the seeds.....*Frankeniaceae*

74' - plants with developed leaves

75 - aromatic plants; herbs or shrubs, hairy, glandular; stems young, quadrangular; leaves opposite-decussate; sometimes whorled; usually simple; adaptation of leaves to dry climates characterized by a tough, reduced blade and secretory hairs; inflorescence in axillary cymes, condensed into a whorl; calyx regular, sometimes bilabiate, usually persistent; corolla with 2 upper lips which may be absent or very reduced; fruit, tetrahedron formed by 4 nutlets surrounded by the persistent calyx... ..*Labiaceae (Lamiaceae)*

75' - non-aromatic plants

76 - hemiparasitic plants (rarely holoparasitic and then aphyllous), presence of suckers; lianas or shrubs; plants monoecious or dioecious; leaves opposite, or sometimes whorled, simple, entire, leathery, with parallel and poorly

defined venation, or reduced to scales; inflorescence in raceme, panicle, spike or cyme; fruit berry or monosperm drupe engorged in sticky pulp, rarely dry fruit.....*Loranthaceae*

76' - free-standing plants

77 - anisophyllous plants; herbs, trees or shrubs sarmentose, sometimes thorny, monoecious or dioecious; leaves opposite, simple, entire; no stipules, but sometimes spines or hooks; inflorescence cymose, often surrounded by an involucre of coloured bracts; sepals petaloid fused into a tube; ovary superecious; fruit, anthocarp: achene monosperm surrounded by the persistent basal part of the perigone..... *Nyctaginaceae*

77' - isophyllous plants

78 - calyx persistent at base of fruit

79 - inflorescence sessile or subsessile axillary; trees or shrubs, without latex; petiole pubescent or glabrous; blade entire, plants dioecious; bark often dark outside and yellow below; wood very hard, red or black in centre; branches whorled; leaves simple, entire, distichous; fruit a berry subtended by the calyx accrescent .....*Ebenaceae*

79' - inflorescence pedicellate; herbs or shrubs sometimes climbing, sometimes epiphytic, more rarely trees; leaves alternate, simple, entire or toothed; inflorescence cymes or solitary flower; corolla forming a more or less long tube; stamens alternipetal, inserted on the corolla; ovary superect, bicarpellate, bilocular, oblique; ovules numerous, anatropic, unitumetal, borne by voluminous placentas; fruit, capsule, berry or pyxis; calyx persistent or totally enclosing the fruit... .....*Solanaceae*

78' - calyx not persistent at base of fruit

80 - inflorescence in spikes usually subtended by 3 bracts; herbaceous and, rarely; woody plants; leaves alternate or arranged in a rosette at the base of the plant; blade simple, sometimes much reduced; spikelets, sometimes reduced to one flower, usually arranged in cymes forming a panicle-like inflorescence or, rarely, a spike; fruit dry, indehiscent or dehiscent, included in the calyx, membranous-walled, 1-located, containing 1 seed.

80' - inflorescence of different type

81 - flowers more or less bell-shaped, almost always blue or white; grasses, shrubs, rarely small trees; sometimes latex present; autogamy frequent; leaves alternate, rarely opposite, simple, usually toothed; fruits usually capsules with many seeds.....*Campanulaceae*

81' - flowers not bell-shaped

82 - plants with winged fruits; trees, bushy shrubs or lianas, sometimes a mangrove species (*Conocarpus*); branches whorled with rhythmic growth, plagiotropy by aposition; leaves simple, entire, either alternate and grouped in flecks at the end of the branches, or opposite or whorled, sometimes glandular ; inflorescence in spikes, glomerules, clusters or terminal or axillary panicles; petals small, sometimes absent; ovary unilocular, sometimes deeply sunken in the flower-stalk; fruit a 2-winged or 4-winged samara, either a drupe or an indehiscent capsule adapted to hydrochory. ....*Combretaceae*

82' - plants with non-winged fruits

83 - leaf blade semi-bright below, edged with a yellowish thread: fine white lenticels on both sides; herbaceous, shrubs usually alternate, rarely opposite; leaf blade glabrous, petiole broadly gutter-shaped; branches thick, well-greened, glossy; flowers white, isolated in leaf axils, or in a dichotomous panicle of 2 flowers at the apex of the branches; flowers irregular, 1 or 2 lipped; fruit a drupe or capsule.....*Goodeniaceae*

83' - leaf blade not shiny

84 - leaf blade with several secondary veins parallel to the main one and connected by transverse tertiary veins; trees, shrubs or herbs, sometimes lianas, sometimes epiphytes; internal liber myrmecophily; leaves opposite sometimes whorled, simple ; base of blade often transformed into myrmecophilous cavities; sometimes anisophilous; inflorescence

cymeous or racemose; androecium diplostemonous, sometimes asymmetrical; ovary semi-infertile or infertile; fruit, loculic capsule, coloured and sometimes hairy berry.....*Melastomataceae*

84' - leaf blade with non-parallel secondary veins

85 - plants with secretory apparatus, canals and schizogenous pockets containing active essences and resins; shrubs or small trees with opposite or alternate, simple, entire leaves; yellowish or orange resin; flowers actinomorphic; hermaphroditic; calyx tubular with 4 or 5 imbricated lobes; ovary superect with 1 or 2 lodges, ovule solitary in each, style simple, stigma entire; fruit, small berry, pod or ovoid drupe .....*Hypericaceae*

85' - plants without secretory apparatus

86 - flowers small, inconspicuous

87 - leaf blade sessile or subsessile; shrubs or vines with opposite or alternate, simple, entire leaves; flowers actinomorphic; hermaphroditic; calyx tubular with 4 or 5 overlapping lobes; ovary superect with 1 or 2 chambers, ovule solitary in each chamber, style simple, stigma entire.....*Thymelaeaceae*

87' - leaf blade petiolate; petiole often bent and thickened at one or both ends, or petiole set below the leaf blade (peeled leaves); woody lianas, more rarely shrubs or small trees; plants dioecious; leaves alternate, usually simple, entire; venation palmate over the whole blade or only at the base; inflorescence in panicle or raceme, sometimes cauliflora; ovary superect; carpels free; fruit, usually coloured mericarps, with persistent styles; seeds horse-shoe-shaped.....*Menispermaceae*

86' - large flowers

88 - leaves alternate

89 - inflorescence axillary or opposite to leaves; trees, shrubs or rarely lianas, fragrant; branches alternate, sometimes in arches (Troll's model); no particular exudate; leaves simple, alternate distichous, entire; flower solitary or in pauciflorous cyme inflorescence; perianth trimeric, actinomorphic, polysemone, hypogynous; fruit, free stipulated follicles (monocarps) forming apocarpic or fused fruits and forming syncarps.....*Annonaceae*

89' - terminal inflorescence

90 - leaves palmate or digitate; trees or shrubs, erect or climbing, with simple alternate leaves; flowers, in cyme, corymb or panicle, are very small, greenish; male and female flowers may be on the same inflorescence; fruit usually winged.....*Hernandiaceae*

90' - leaves not palmate

91 - creeping; herbaceous, alternate leaves with entire or lobed margins; flowers hermaphroditic, actinomorphic yellow; calyx tubular; corolla dialypetal; ovary superect; fruit dry.....*Turneraceae*

91' - not creeping

92 - stumped plants; trees, shrubs and herbaceous plants with a perennial stump, rarely climbers; leaves usually alternate and simple; veins fine, fairly well developed and somewhat prominent below; blade with three to six lateral arched veins flowers regular, 3-5 petals or lobes, as many divisions to the calyx; they are grouped in fascicles, spikes, or corymbiform cyme; the fruit is usually a drupe.....*Icacinaeae*

92' - stumpless plants; trees, shrubs and woody creepers, usually monoecious, sometimes dioecious; leaves alternate, with a single entire leaf blade; floral envelope single or double; receptacle sometimes hollowed into a hypanthium; this, if any, partially fused to the ovary; inflorescence of various types, often in the form of a raceme, umbel or panicle; flowers unisexual or hermaphroditic, small, with several planes of symmetry, with a single or double floral envelope; ovary supereous or semi-inferous; fruit in the form of a drupe with a relatively thin mesocarp; seed with an abundant and oily endosperm.....*Opiliaceae*

88' - opposite leaves

93 - leaves opposite decussate; herbs, sometimes saprophytic (*Voyria*), or shrubs, usually with rhizomes, leaves simple, entire (sometimes reduced to scales in saprophytes); inflorescence cymose or solitary flowers; corolla with twisted pre-flowering; stamens alternipetal inserted on corolla; ovary superect unilocular; fruit usually septicid capsule.....*Gentianaceae*

93' - opposite leaves not decussate; herb semi-succulent, branched, leaves oval, elliptic, obtuse at the apex, rounded or subcordate at the base, pubescent to glabrescent on both sides; flowers cleistogamous, violet, 3 cm long, corolla tube pubescent on the outside; fruit a pubescent capsule not exceeding 5 cm in length.....*Gesneriaceae*

2' - compound leaves

94 - petiole thickened at base and, like rachis, often glandular, sometimes phyllodes (*Acacia*); trees or shrubs with rough trunk and erect habit, sometimes spiny; root nodules containing symbiotic bacteria (*Rhizobium*) fixing atmospheric nitrogen; often parasol-like cymes and branches in superimposed arches (Troll's model); leaves alternate, compound, bipinnate (more rarely imparipinnate : *Inga*); stipules sometimes developed into spines; inflorescence indefinite; stamens free; fruit dry.....*Fabaceae (Mimosoideae)*

94' - petiole not thickened at base

95 - petiole often jointed; herbaceous, annual or perennial, and, rarely, woody plants; leaves alternate or grouped, in a rosette at the top of stems and branches; blade usually compound, pinnate or digitate, with leaflets borne by a jointed petiole; stipules present or absent; young leaves curled in a crook at the top; stipules present or absent; inflorescence defined; flowers hermaphroditic actinomorphic; ovary superect; fruit dry.....*Oxalidaceae*

95' - petiole not articulated

96 - fruit elongate and dehiscent by its 3 valves, sometimes with a long apical beak; trees with bi- or tri-imparipinnate leaves; 3 to 5 pairs of well opposite leaflets on the lower pinnae, and the terminal leaflets inserted directly on top of the primary rachis; the zygomorphic hermaphrodite flowers somewhat resemble those of the *Caparidaceae*, but are irregular; the fruit is a long, pod-like capsule; the seeds are broadly winged. ....*Moringaceae*

96' - fruit of varied appearance

97 - fruit pod with two valves; trees, shrubs, sometimes thorny; sometimes root nodules; leaves alternate, compound, usually pinnate, sometimes bipinnate, bifoliolate, or unifoliolate; leaflets rarely reduced and rachis rarely phyllodial; Some genera have extrafloral nectaries (*Senna*, *Chamaecrista*), and twisted petioles (*Crudia*, *Azalia*); the stipules are almost always present and interpetiolar, arranged in pairs, and often deciduous; sometimes intrastipular spines are present (*Bauhinia*); in lianascent species of the genus *Bauhinia*, some leaves are transformed into tendrils and become sub-opposite again by abortion of an internode; indefinite terminal inflorescence; the fruit is a vegetable, usually oblong to linear, sometimes laterally compressed, straight or curved; it is dehiscent, two-valved, and fleshy to woody in nature, or indehiscent, and is then often drupaceous or samaroid, glabrous, pubescent (*Sindora*) or spiny (*Caesalpinia*).....*Fabaceae (Caesalpinioideae)*

97' - pod-like fruit opening with a valve

98 - pubescent petiole; sarmentose, voluble shrubs that may look like erect bushes when young; the leaves are alternate, trifoliolate or imparipinnate; the small, whitish flowers are usually in more or less developed clusters or panicles; they are followed by bursa-shaped fruits that split on one side to release the seed; the latter may or may not have tendrils. ....*Connaraceae*

98' - hairless petiole

99 - plants with very small flowers, with 2 or 4 petals, or no petals, and 2-8 rather large stamens; swamp herbs with opposite or whorled leaves, sometimes alternate; fruits also very small, in the form of humped or winged seeds; ovary inferior .....*Haloragaceae*

99' - large-flowered plants; trees or shrubs, polygamous, mono- or dioecious; plants with alternate leaves, speckled at the tip of the twigs, pari- or imperipinnate compound, sometimes tripinnate; twig tips often terminated by immature leaves, scent in bark and leaves; petiole thickened at base; sometimes continuous growth of rachis and/or terminal

leaflets; usually no visible stipules, but sometimes large foliaceous stipules; inflorescence thyrse or raceme sometimes spiciform, more rarely spike or fascicle; flowers hermaphroditic or unisexual, actinomorphic, monadelphic; sepals basally fused; petals free or basally fused or to the staminal tube; ovary superect; fruit, loculicidal or septicial capsule, more rarely berry or drupe. ....*Meliaceae*

1' - families in which the type of leaves is heterogeneous (simple or compound)

100 - Petiole thickened at the base, rachis sometimes winged; trees or shrubs monoecious, dioecious or polygamous (unisexual and bisexual flowers on the same plant); resin ducts in the bark; resin toxic and/or allergenic; leaves alternate, grouped in a speckled pattern at the end of the branches, usually pinnate compound, but simple in the best known genera (*Anacardium*, *Mangifera*); veins often light yellow contrasting with the green of the blade. No stipules; calyx gamosepal; corolla dialypetal; ovary superect; fruit dry or fleshy .....*Anacardiaceae*

100' - petiole not thickened at the base

101 - aromatic plants

102 - leaf blade with crenellated margin; leaves simple or compound, opposite or alternate; herbaceous erect or voluble; leaves usually alternate, but sometimes also opposite; leaf blade usually very divided, may be simply lobed, or compound-palmate; male and female flowers separate; male flowers in axillary raceme 3 to 5 cm long bearing numerous greenish flowers 4 mm long, 5 petals, 5 stamens; female flowers clustered in 2 or more in leaf axils, and enveloped by a pubescent leafy bract.....*Cannabaceae*

102' - leaf blades with entire margins; plants monoecious, dioecious or polygamous (unisexual and bisexual flowers on the same plant); opaque whitish resin exudate on the bark; leaf tips terminated by immature leaves; leaves alternate, often grouped in speckles at the end of the branches, compound imperipinnate or trifoliolate, more rarely simple; petioles often swollen at one or both ends; leaf rachis sometimes articulated (sympodial growth); no stipules; indefinite inflorescence; corolla gamopetalous or dialypetalous; ovary superect; fruit dry or fleshy.....*Burseraceae*

101' - non-aromatic plants

103 - fleshy fruit; trees with corky, deeply and coarsely longitudinally attached bark, ± soft, grey to beige, with a brown edge on the surface, pink to cream underneath; leaves alternate, pinnate or imparipinnate, stipules absent; flowers are disc-shaped, fruits are drupes.....*Zygophyllaceae (Balanitaceae)*

103' - dry fruit

104 - stem succulent; wetland herbaceous, erect, much branched from base, candelabra-shaped in profile; can reach 1 m in height; stem hollow cylindrical, smooth, often spongy at base; leaves alternate, ovate to lanceolate, characteristically pale green; inflorescence conical terminal; blade entire or toothed; stipules absent; ovary inferior; fruit dry.....*Sphenocleaceae*

104' - non-succulent stem

105 - herbaceous without roots, but colourless branches sometimes develop to anchor the plant to a substrate; herbaceous spindly, completely submerged, suspended in pond water; filiform linear leaves, much divided, are whorled; male and female flowers are separate and at different nodes; fruit is a small, ballooning ovoid capsule, indehiscent.....*Ceratophyllaceae*

105' - plants with roots

106 - plants with tendrils perpendicular to the stem-leaf plane; annual or perennial herbs, creeping or climbing, more or less woody; stem angular; plants monoecious or dioecious; leaves alternate, lobed, compound-palmate or digitate; no stipules; fruit, berry sometimes capsule; large seeds without albumen.....*Cucurbitaceae*

106' - plants without tendrils

107 - aquatic herbaceous plants, growing at the bottom of ponds; leaves often extend over the surface of the water, like water lilies; flowers, in panicles, or fascicles, have 5 white petals which often bear white prickles on the upper surface;



fruits are capsules of 1 to 4 carpels; axillary inflorescence; actinomorphic hermaphrodite flowers; superect ovary; dry fruit.....*Menyanthaceae*

107' - trees, shrubs, terrestrial herbaceous or lianas

108 - latex plants; trees, shrubs, herbs, or lianas, sometimes succulent and cactiform plants; monoecious or dioecious; often white or opaque exudate; leaves highly variable: often long-stalked, alternate, more rarely opposite, simple or compound, palmatinervate (at least at base) or pinnatinervate, sometimes reduced to spines; often glands on petiole and/or blade and/or margin, the latter toothed; indubitably variable, including sometimes urticating hairs (*Dalechampia*); Fruit, capsule tricolate; sepals absent, petals absent .....*Euphorbiaceae*

108' - plants without latex

109 - leaf blade fleshy; woody or herbaceous perennial with leaves often opposite, but may also be alternate or rosette-shaped; may be entire, toothed or crenate, simple or compound; stipules absent; flowers usually small, 4 or 5 petals, 4 or 5 sepals, free or united at base; 4 or 10 stamens; inflorescence indefinite; fruit dry.....*Crassulaceae*

109' - leaf blade not fleshy

110 - plants with tendrils sometimes flowering opposite the leaf; creepers, climbing or erect shrubs, more rarely trees with succulent trunks; leaves alternate, usually distichous, simple, margined, palmate or compound-digitate; stipules present; inflorescence often tendril-like opposite the leaves, cymeous; fleshy fruit.....*Ampellidaceae (Vitaceae)*

110' - plants without flowering tendrils

111 - calyx very reduced or absent, forming a ring sometimes wavy or with 4 to 5 teeth; trees or shrubs, more rarely lianas or herbs; resinous secretory ducts in all organs; leaves often very large, alternate, rarely opposite or whorled, differently composed: pinnate, bipinnate, tripinnate, or digitate; stipules and stipular sheaths around the petiole; inflorescence indefinite; flowers hermaphroditic; corolla gamopetalous or dialypetalous; ovary inferious; fruit fleshy....  
.....*Araliaceae*

111' - developed calyx

112 - leaves, often finely toothed, with many fine parallel secondary and/or tertiary veins; trees or shrubs, sometimes herbs; trees sometimes unbranched; leaves alternate, simple; large lateral stipules, sometimes fringed ; inflorescence definite or indefinite; flowers hermaphroditic; calyx dialypetal; corolla dialypetal; preflowering quincunx; ovary superect; fruit borne by thickened, coloured receptacle and surrounded by persistent sepals; seed often winged.  
.....*Ochnaceae*

112' - leaves not finely toothed

113 - plants with sometimes jointed rachis or clasping, woody lianas; trunk smooth or spiny; leaves opposite, differently compound; imparipinnate, digitate, bipinnate, bifoliolate; rarely simple; rachis of lianas terminated by clasping tendrils; leaflets often toothed; glands frequent at base of blade; no stipules; flowers hermaphrodite; ovary superect; fruit dry.....*Bignoniaceae*

113' - plants with non-articulated rachis

114- ovary situated at the top of a long stylopod; trees, shrubs, herbs, more rarely lianas; sometimes induced with scaly hairs; leaves simple, alternate, fasciculate (or opposite), unifoliolate or compound (rather palmate); petiole pubescent; petiole thickened; blade pubescent; stipules sometimes spiny; flowers hermaphroditic actinomorphic or zygomorphic; ovary supereous; fruit dry or fleshy.....*Capparidaceae*

114' - ovary without stylopod

115 - petiole thickened at base, rachis sometimes terminated by a mucron and stipules only in lianascent forms; trees, shrubs, lianascent subshrubs, lianas; plants monoecious or dioecious; bisecting or axillary tendrils in lianas; young angular twigs sometimes terminated by young coiled leaves; sometimes latex in lianascent species; leaves alternate,

often speckled at tip of twigs, pinnately compound, margins entire or toothed; sometimes continuous growth of rachis and terminal leaflets; stipules only in lianas; stipules present or absent; inflorescence indefinite; flowers hermaphroditic; calyx gamosepal; corolla dialypetal; ovary superect; fruit dry... .....*Sapindaceae*

115' - petiole not thickened at the base

116 - plants with opposite fleshy leaves and often shiny flowers; herbaceous, often perennial, or woody; erect, creeping or spreading habit; simple or compound leaves; flowers followed by capsules containing seeds; blade glabrous; fruit dry or fleshy.....*Ficoideae*

116' - plants with non-fleshy leaves

117 - butterfly-like flowers with 1 wing above, 2 lateral wings and a carina; herbaceous with a voluble stem, alternate paripinnate leaves, with a rachis bearing 10 to 13 pairs of oblong leaflets, with parallel margins and a slightly asymmetrical base, rarely simple; the very young leaves appear silvery; petiole short, thickened, hardly exceeding 2 to 3 mm; rachis with shaggy hairs; flowers dark garnet-red; fruit, pod with abruptly recurved apex; blade entire; inflorescence indefinite; flowers hermaphroditic; corolla dialypetal; ovary superect; fruit dry... .....*Fabaceae (Faboidae)*

117' - leaves not resembling butterfly

118 - stipules absent

119 - plants with watery stem; herbaceous, annual or perennial, and woody plants; mucilage glands present; leaves opposite or sometimes superiorly alternate; blade sessile or petiolate, simple but sometimes very deeply divided; no stipules; inflorescence axillary; flowers hermaphroditic zygomorphic; calyx gamosepal; corolla gamopetal; ovary superous; fruit dry or fleshy.....*Pedaliaceae*

119' - plants with non-watery stems

120 - flowers sessile; erect or climbing herbs, sometimes shrubs or trees; sometimes white latex; blade sessile; trunk pubescent, leaves alternate or opposite, sometimes in basal rosettes (or terminal in monocaulic shrubs), simple, entire or cut, sometimes compound ; no stipules; inflorescence in a flat, convex or concave capitulum, surrounded by an involucre of bracts; flowers hermaphroditic; calyx gamosepal; corolla gamopetal; ovary inferior; fruit dry... .....*Composeae (Asteraceae)*

120' - pedicellate flowers

121 - young quadrangular stems; herbs, trees, or vines; often aromatic; leaves opposite, simple, pinnate-compound or digitate; no stipules; calyx sometimes persisting around the fruit; inflorescence axillary or terminal; hermaphroditic zygomorphic flowers; sepals pubescent; calyx gamopetal; corolla gamopetal; ovary supercium; fruit, tetrakene, drupe or capsule.....*Verbenaceae*

121' - young cylindrical stems

122 - trunk pubescent; herbs, sometimes shrubs or trees, some hemiparasites; leaves alternate, opposite or whorled, simple, sometimes pinnate; no stipules; blade entire or toothed; terminal inflorescence indefinite; flowers hermaphroditic; calyx gamosepal; corolla gamopetal; ovary superect; fruit, capsule rarely a berry; seeds numerous with fleshy endosperm.....*Scrophulariaceae*

122' - glabrous trunk

123 - plants with spines on trunk, branches and sometimes leaf rachis; trees, aromatic shrubs, more rarely herbs; leaves alternate or opposite, simple or generally compound imparipinnate and in this case speckled at the tip of the branches, trifoliolate or unifoliolate, riddled with translucent punctation (schizolysigenous pockets in essence) ; rachis sometimes winged, as well as the petiole of unifoliolate leaves; no stipules; inflorescence axillary or terminal; flowers hermaphroditic; calyx gamosepal or dialepal; corolla dialepal; ovary superect; fruit dry or fleshy .....*Rutaceae*

123' - plants without spines

124 - fruit in a capsule or berry; herbaceous with simple or compound, toothed, lobed leaves, often hairy; herbs often in a rosette, sometimes succulent; leaves alternate, sometimes opposite or basal; no stipules; flowers hermaphroditic; petals sometimes reduced; presence of staminodes; anthers longitudinally dehiscent; ovary supere to inferere; seed with an albumen usually abundant .....*Saxifragaceae*

124' - fruits of various types

125 - woody or herbaceous plants with cross-shaped petals and 4 long inner and two short outer stamens; annual, biennial, or perennial herbs, rarely shrubs; leaves alternate, simple, cut or pinnate; no stipules; terminal inflorescence in clusters; actinomorphic hermaphrodite flowers; calyx dialyptate; corolla dialyptate; fruit, silique or silique; seeds in one or two rows in the fruit .....*Cruciferae (Brassicaceae)*

125' - plants not having cross petals, nor 4 long inner and 2 short outer stamens

126 - leaves leathery; shrubs or trees; leaves simple or compound, alternate or whorled; leaves often toothed, hairy, heterophyllous (variable on the same individual); no stipules; inflorescence indefinite; flowers hermaphroditic; ovary superect; fruit often infrutescence of follicles, more rarely achenes or drupes; seeds exalbuminate, often winged.....*Proteaceae*

126' - soft leaves

127 - petal with a small dimple at the base on the inner side in which a sweet liquid accumulates; herbaceous plants, usually terrestrial, more rarely woody sarmentaceous or aquatic plants, petioles enlarged at the base; rhizomes, tubers or bulbs ; leaves alternate or/and in basal rosette, opposite, simple, entire or cut or compound; inflorescence terminal; flowers hermaphroditic, dialytpetal or dialypetal, actinomorphic or zygomorphic, sometimes spurred; stamens numerous, centripetal, spirally inserted; ovary superect; fruit achenes, follicles or capsules, rarely berry; seeds with copious albumen, oleaginous.....*Renonculaceae*

127' - petals not bearing a sweet liquid at the base

128 - plants with dilated petioles, sheathing at nodes; herbaceous and, rarely, woody plants, often fragrant when crumpled; alternate leaves differently composed, sometimes simple; blade usually deeply cut, sometimes simple; flowering envelope normally double; inflorescence umbellate simple or composed of umbellules surrounded by an involucre of bracts sometimes deciduous; sometimes capitulum; flowers dialypetalous, actinomorphic; sepals very reduced or absent, free or fused; petals free; ovary inferere, bilocular, two free styles borne by the stylopod; fruit schizocarp with two cylindrical or flattened mericarps... .....*Ombellifereae (Apiaceae)*

128' - plants with undilated petiole

129 - calyx bell-shaped; trees, shrubs or woody lianas, usually with opposite branches; leaves usually opposite, rarely whorled or alternate, with simple or compound-pinnate petiolate blade; venation pinnate; no stipules; inflorescence definite or indefinite; flowers hermaphroditic; calyx usually with 4 sepals fused together, lobed or toothed bell-shaped; calyx often small, rarely absent; corolla usually with 4 petals more or less long fused together from the base; rarely, petals free from each other or absent; petals in valvular position or imbricated in the bud; androecium with 2(4) stamens inserted on the corolla tube when present; ovary superect... .....*Oleaceae*

129' - calyx not bell-shaped; trees, fragrant shrubs, rarely parasitic lianas, usually whorled; leaves simple, entire, opposite or alternate, sometimes paucinervate, rarely compound; young twigs angular; no exudate ; inflorescence paniculate or cymose, rarely solitary; flowers dialypetal, actinomorphic trimer, triplo- or tetrastemon; anthers with 2 or 4 flaps; ovary supere or inferere, formed of a single carpel, unilocular; one style, one stigma sometimes sessile; fruit, berry monosperm.....*Lauraceae*

118' - stipules present

130 - leaf blade pubescent

131 - fruit schizocarpic; annual or perennial herbs, small shrubs; leaves simple, alternate, opposite, divided or often compound, pinnate or palmate, fragrant; trunk pubescent; blade covered with glandular hairs; axillary inflorescence indefinite; flowers hermaphrodite actinomorphic ; sepals pubescent; calyx gamosepal or dialepal; corolla dialypal; fruit,

often long beak-shaped, is usually deeply lobed at the base; fruit often remains attached to the top of the styles by two tufts of silky hairs which will help in their dispersal ... .....*Geraniaceae*

131' - fruits are follicles or capsules, more rarely nuts or berries; trees or herbs pubescent trunk with alternate, simple or digiti -composed leaves; leaf blade often furnished with starry hairs; flowers hermaphrodite or unisexual, regular, with valvate sepals; stamens very often united in a column; inflorescence defined; flowers hermaphrodite; ovary superior.....*Malvaceae (Sterculioideae)*

130' - blade glabrous

132 - axillary inflorescence; herbaceous, possibly woody at base, perennial or annual, bushes, shrubs and trees; leaves opposite or, rarely, alternate, with blade either simple, or with 2-3 leaflets, or compound, with an even number of leaflets (paripinnate); leaflets possibly succulent, stipules persistent, sometimes transformed into spines; flowers either solitary, or grouped 2 by 2, or grouped in axillary cymes; no bracteoles; calyx gamosepal; petals free from each other, often with mitre-shaped base, usually wrinkled in the flower bud; ovary superect; fruit dry and capsule-shaped, either fleshy or dividing, at maturity, into 5 indehiscent parts... .....*Zygophyllaceae*

132' - terminal inflorescence; trees, shrubs or herbs; leaves simple or compound, alternate or rosette; blade entire or toothed; inflorescence definite or indefinite; flowers hermaphroditic; petals free or absent not folded in the floral bud; ovary superior or inferior; fruit, group of achenes, follicles, drupelets borne by the accrescent receptacle and constituting a compound fruit.....*Rosaceae*

#### 4. Conclusion

This study, whose aim was to contribute to a better knowledge of the plant biodiversity of Senegal, has shown that in the flora of Senegal, the dicotyledons are rich in 130 families. The families differ from each other by a certain number of characters elucidated in the determination keys. Indeed, this work has made it possible to propose two determination keys based on the distinctive characters of the vegetative, in particular the presence and absence of leaves, and reproductive systems of the families of the class Dicotyledons. Compliance with ethical standards.

#### Compliance with ethical standards

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The authors declare no conflict of interest.

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