

PODOSTEMACEAE OF AFRICA AND MADAGASCAR: KEYS TO GENERA AND SPECIES, INCLUDING GENERA DESCRIPTIONS, ILLUSTRATIONS¹ TO ALL SPECIES KNOWN, SYNONYMS², AND LITERATURE LIST³

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This homepage is dedicated to Dr. Colette Cusset (Paris). She described in Africa two new monotypic genera (Djinga, Zehnderia) and 18 new species of already known genera. Moreover she rearranged and renamed additional 35 species of this continent. Many illustrations of African Podostemaceae are due to Madame Cusset. Without her lifelong effort we would know much less about this enigmatic family in Africa and Madagascar.

How to use the keys: There are 16 genera and c. 85 species known from Africa and Madagascar. **KEY A** allows to identify all African (incl. Madagascan) genera. **KEY B** points to all genera of Cameroon which is the country with the highest number of genera (10) and species (c.34) in Africa. The **MAIN DOCUMENT** contains the **DIAGNOSES** to all genera. Eight out of the 16 genera occur with just one species in Africa and Madagascar; five of them are monotypic genera restricted to Africa (continent), two of them are monotypic genera endemic to Madagascar. Most genera consist of 6 or less species. Species keys are added allowing the identification of species when there is more than one species per genus. The genus *Ledermanniella* (as defined by Cusset 1974, 1983, 1984) is an exceptionally large genus, containing c. 46 spp., i.e. more than half of all podostemaceous taxa from Africa. It should be possible to identify the species of this large (and perhaps artificial) genus with its two subgenera: **subg. Ledermanniella (Keys D and E)** and **subg. Phyllosoma (Keys F and G)**. Links to illustrations of all species in Africa and Madagascar allow to check the identification (see Excel Files, including complete list of taxa, and synonyms, adapted from Lebrun & Stork 1991).

Note for botanists in trouble: It is difficult and often impossible to identify most taxa if reproductive structures (flowers, capsules) are lacking. If you have difficulties you may also try **KEY C** which is a **multiple-access key** pointing to some (but not all!) podostemaceous taxa from Africa and Madagascar sharing unique characters. Please check also literature with complete species descriptions (not provided in this homepage).

The whole document will become part of a Homepage on African Podostemaceae (under construction). This version still needs improvement. Please send comments back to rutishau@systbot.unizh.ch. Cite this electronic document as follows:

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¹ See Excel File: afr.podos,tab.2_Figs-List (All drawings from literature are also on CD; ask R. Rutishauser, Zurich <rutishau@systbot.unizh.ch> for a copy).

² See Excel File: afr.podos,tab.1_Species-List

³ See Word File: Pod-Afr-Literature-20-09-04

KEY A: KEY TO THE PODOSTEMACEAE GENERA OF AFRICA AND MADAGASCAR

(taken over from Cook & Rutishauser, Chapter on Podostemaceae in Kubitzki (ed.) Families & Genera of Vascular Plants, in press 2004; key modified by R. Rutishauser)

1. Tepals 3, imbricate and surrounding the flower buds, ovate to oblong-obovate; flower buds not enclosed in a spathe; capsules opening by 3 valves (widespread in Africa and Madagascar) **Subfamily Tristichoideae 1. *Tristicha* (1sp.)**
- Tepals 2 or occasionally 3 or 4, not imbricate and restricted to one side of the flower, linear to subulate; flower buds totally enclosed in a spathe; capsules opening by 2 valves **Subfamily Podostemoideae 2**
2. Stigma 1, semi-globose; stamens 3 or rarely 4, united only at the base (Angola) **Subfamily Podostemoideae 2. *Angolaea* (1sp.)**
- Stigmas 2, linear, horn-like or flattened and lobed; stamens 1, 2 or rarely 3, when 2 or 3 then born on an elongate andropodium 3
3. Flowers erect or rarely oblique (slightly inclined) within the unruptured spathe
Go on with subkey **13** or subkey **18**
- Flowers inverted or strongly inclined within the unruptured spathe 4
4. Tepals 3, 1 each side of the andropodium and 1 born terminally on the andropodium between the stamens 5
- Tepals 2, 1 each side of the andropodium and without an appendage between the stamens 6
5. Capsules obovoid; capsule valves with 3 wide ribs, each extending from base to apex (Madagascar) **14. *Thelethylax* (2spp.)**
- Capsules broadly ellipsoidal; capsule valves with 5 or 7 narrow ribs, those closest to the commissures not reaching the base and the apex (tropical W Africa) **13. *Stonesia* (4spp.)**
6. Capsules smooth, globose or subglobose (tropical Africa) **7. *Leiothylax* (3spp.)**
- Capsules with longitudinal ribs, globose to ellipsoid or cylindrical 7
7. Ovaries and capsules flattened laterally; capsules with or without winged nerves 8
- Ovaries and capsules circular in cross-section, not flattened; capsules without winged nerves 9
8. Capsules strongly flattened, middle nerves winged and with apical horns; stamens 2 (Cameroon) **15. *Winklerella* (1sp.)**
- Capsules slightly to strongly flattened, not winged; stamens 1 or 2 or 3 (tropical W Africa) **9. *Macropodiella* (6spp.)**
9. Capsules globose to subglobose 10
- Capsules ovoid-ellipsoidal or partly cylindrical 11
10. Stamen 1 or 2; pollen in dyads; capsules sessile or born on minute gynophores; pedicels less than 5 mm long (Madagascar, tropical East & S Africa) **12. *Sphaerothylax* (2spp.)**
- Stamens 2 or rarely 3; pollen in monads; capsules born on up to 2 mm long gynophores; pedicels up to 15 mm long (Cameroon) **16. *Zehnderia* (1sp.)**
11. Solitary flowers or flower clusters secund along the shoot; andropodium usually less than 1 mm long; stigmas conical, erect, rigid; capsules cylindrical to oblong (W Africa) **3. *Dicraeanthus* (2spp.)**
- Flowers arranged around the shoot, rarely secund; andropodium occasionally much exceeding 1 mm long; stigmas linear, spreading or reflexed, flexible; capsules obovoid to ovoid or fusiform 12
12. Capsule valves with 3 narrow (occasionally crest-like) ribs; capsules ovoid to ellipsoid or fusiform (species rich and widespread in tropical Africa) **6. *Ledermanniella* (46spp. in 2 nearly equal subgenera, see KEYS D, E, F AND G)**

- ⁴ Capsule valves with 3 wide and flattened ribs; capsules obovoid (Madagascar) **14. *Thelethylax*** (2spp.)
- 13**⁵. Capsule valves slightly unequal; capsule sutures slightly acentric and oblique; usually one valve caducous, one valve persistent on pedicel or gynophor 14
- Capsule valves equal; capsule sutures centric; usually both valves persistent 15
14. Stamen 1; capsules globose or subglobose; capsule valves with 3 wide ribs, each extending from base to apex (Cameroons) **4. *Djinga*** (1sp.)
- Stamens 2, born on an andropodium; capsules asymmetrically ovoid and somewhat laterally flattened; capsule valves with 7 narrow ribs, those closest to the sutures not reaching the base and the apex (Madagascar) **5. *Endocaulos*** (1sp.)
15. Capsules globose or subglobose, smooth and shiny (W Africa) **8. *Letestuela*** (1sp.)
- Capsules ovoid to ellipsoid or fusiform, with ribs 16
16. Flowering stems covered with many (at least 8), overlapping, scale-like leaves; stamens 2, born on an andropodium (Madagascar) **10. *Paleodicraeia*** (1sp.)
- Flowering stems with elongate, simple or forked leaves or if leaves scale-like then rarely more than 4; stamen 1 17
17. Leaves below the flowers scale-like, shorter than the flowers; capsules ovoid, laterally flattened; stigmas unequal, flattened, elliptic to ovate in outline (Nigeria) **11bis. *Butumia*** (1sp.; now merged with **11. *Saxicolella***)
- Leaves below the flowers linear or divided into linear segments, longer than the flowers; capsules elliptic to fusiform, terete; stigmas equal, linear (tropical W Africa) **11. *Saxicolella*** (6spp.)
- 18.** Ovary and capsule globose or subglobose; capsules smooth or with 3 wide ribs per valve, each rib extending from base to apex; flowers slightly inclined (oblique) in spathella (W Africa) 19
- Ovary and capsule ellipsoid to fusiform (or subglobose and somewhat laterally flattened; capsules with 3 - 7 ribs per valve; flowers usually erect in spathella [*check*] (Madagascar and W Africa) 20
19. Capsules smooth and shiny; stamens 2 or 1 (Western to Southern Africa, incl. Cameroon) **8. *Letestuela*** (1sp.)
- Capsule valves with 3 wide ribs, each extending from base to apex; stamen 1 (Cameroon) **4. *Djinga*** (1sp.)
20. Stamens 2, born on andropodium; capsule with 5 or 7 ribs per valve, those closest to the sutures not reaching the base and the apex⁶; stems short (or lacking), covered by 2 rows of overlapping, boat-shaped scales⁷; elongate leaves (if present) usually thread-like and entire (Madagascar) 21
- Stamen 1; capsule with 3 ribs per valve, each rib extending from base to apex ribs; stems with elongate, simple or forked leaves or if leaves scale-like then rarely more than 4 per 22
21. Capsule valves with 7 narrow ribs; capsules asymmetrically ovoid and somewhat laterally flattened; flowers solitary at end of short stems which are covered with 7 or less overlapping scales **5. *Endocaulos*** (1sp.)

⁴ *Thelethylax minutiflora* subsp. *orientalis* Perrier with only 2 tepals, i.e. additional third one lacking between the fused filaments (see Perrier 1952).

⁵ If you have difficulties with this character set, try subkey **18!**

⁶ Same pattern found in *Stonesia* (W Africa)! This feature needs to be checked again for *Paleodicrea* (see Cusset 1972: Fig. 2-4)

⁷ Most of these scales are widened boat-shaped sheaths which have already dropped an apical thread-like blade!

- Capsule valves with 5 narrow ribs; capsule subglobose; flowering stems covered with many (at least 8) overlapping scales **10. *Paleodicraeia*** (1sp.)
- 22. Leaves below the flowers scale-like, shorter than the flowers; capsules ovoid, laterally flattened; stigmas unequal, flattened, elliptic to ovate in outline (Nigeria)
11bis. *Butumia* (1sp.; now merged with **11. *Saxicolella***)
- Leaves below the flowers linear or forked into linear segments, longer than the flowers; capsules elliptic to fusiform, terete; stigmas equal, linear (tropical W Africa)
11. *Saxicolella* (6spp.)

KEY B: KEY TO THE PODOSTEMACEAE GENERA OF CAMEROON

(adapted from C. Cusset 1987: *Podostemaceae. Flore du Camérroun* 30: 51-95; translated and modified by R. Rutishauser)

1. Tepals 2 or occasionally 3 or 4, not imbricate and restricted to one side of the flower, linear to subulate; flower buds totally enclosed in a spathella; capsules opening by 2 valves 2
 - Tepals 3, imbricate and surrounding the flower buds, ovate to oblong-obovate; flower buds not enclosed in a spathella; capsules opening by 3 valves **1. *Tristicha*** (1sp.)
2. Ovaries and capsules globose, smooth 3
 - Ovaries and capsules globose or ellipsoidal, capsules with longitudinal ribs 4
3. Flowers erect or rarely oblique within the unruptured spathellas; gynophore very short **8. *Letestuela*** (1sp.)
 - Flowers inverted or strongly inclined within the unruptured spathellas; gynophore long **7. *Leiothylax*** (1 out of 3spp. in Cameroon)
4. Ovaries and capsules globose to subglobose 5
 - Ovaries and capsules ovoid-ellipsoidal to fusiform, or flattened 6
5. Flowers erect or oblique within the unruptured spathellas; ovary and capsule sessile or nearly so, pedicel very short (exceeding to 3 mm after anthesis) **4. *Djinga*** (1sp.)
 - Flowers inverted within the unruptured spathellas; pedicel very long (up to 1.5 cm long after anthesis) **16. *Zehnderia*** (1sp.)
6. Flowers erect or rarely oblique within the unruptured spathellas; ovaries and capsules ellipsoidal to fusiform, sessile or with short gynophore; pedicels always short (1-2 mm) **11. *Saxicolella*** (3 out of 6 spp. in Cameroon)
 - Flowers inverted within the unruptured spathellas; pedicels well developed (at least after anthesis) 7
7. Ovaries and capsules flattened laterally; capsules with or without winged nerves 8
 - Ovaries and capsules terete, not flattened; capsules without winged nerves 9
8. Capsules with winged middle nerves; wings longer than the capsule **15. *Winklerella*** (1sp.)
 - Capsules not winged **9. *Macropodiella*** (2 out of 6spp. in Cameroon)
9. Flowers secund along the shoot; andropodium usually less than 1 mm long; stigmas conical, erect, rigid; capsules cylindrical to oblong **3. *Dicraeanthus*** (2spp.)
 - Flowers arranged around the shoot, rarely secund; andropodium usually much exceeding 1 mm; stigmas linear, spreading or reflexed, flexible; capsules obovoid to ovoid or fusiform **6. *Ledermanniella*** (20 out of 46spp. in Cameroon; 14 spp. in subgenus *Ledermanniella*, 6 spp. in subgenus *Phyllosoma*; see **KEYS D, E, F AND G**)

KEY C: MULTIPLE-ACCESS KEY LEADING TO SOME (BUT NOT ALL!) PODOSTEMACEAE TAXA FROM AFRICA AND MADAGASCAR WITH UNIQUE CHARACTERS

Many African (incl. Madagascan) Podostemaceae have ribbon-like or foliose roots, erect or inverted flowers in the bud stage (spathella), 1-locular or 2-locular ovaries, pollen in monads or dyads (Ameka et al. 2002, 2003). The multiple-access key does not help when only such character-states are observable. This key is also useless as long as the plant has a standard set of characters such as two stamens with common stalk (andropodium), or capsules valves with three ribs, each extending from base to apex. However, it may be helpful when unusual or unique characters are observable, restricted to a small number of taxa. They will be mentioned below. Characters I – VIII focus on morphological peculiarities of the vegetative body (roots, stems, leaves, scales) as well as flower position; characters IX – XVII cover unique features of the flowers and fruits.

I. Stems lacking, all leaves and flower buds sessile, inserted on upper surface of foliose (crustaceous) root. The following list contains some (but probably not all) taxa with this pattern⁸:

- *Ledermanniella aloides*, *L. thalloidea* [Angola, Cameroon, Sierra Leone]: capsules ellipsoidal, not compressed; stems may be present (usually short in *L. aloides*)
- *Macropodiella pellucida* [Cameroon]: capsules laterally compressed; stems seem to lack completely in this species!
- *Sphaerothylax abyssinica* [Ethiopia, Kenya, Tanzania, Malawi, Zimbabwe, Madagascar]: capsules globose to subglobose, not compressed; stems may be present
- *Stonesia heterospathella* [Guinea, Sierra Leone]: capsules broadly ellipsoidal, slightly compressed, with peculiar rib pattern!

II. Scales, 0.5 – 2 (rarely up to 5) mm long, around the stems, arranged irregularly or in more than two rows; often overlapping each other and covering the surface of certain stem portions completely; scales may be triangular, orbicular or even linear; they are arranged irregularly or in three rows:

- *Tristicha trifaria* [many African countries and Madagascar]: scales ovate to narrow lanceolate, often with midrib; in three rows along moss-like photosynthetic branchlets (“ramuli”)
- *Ledermanniella* subg. *Phyllosoma* [20 spp., W, SW and Central tropical Africa]: scales entire or dentate to lobate, never with midrib; arranged irregularly along stems, never in three rows; large compound leaves (> 2 cm long, forked into linear segments) usually present as well; see **KEY F AND KEY G!**

⁸ There must be other podostemoid taxa in Africa with this habit when elongate shoots are lacking or already dropped.

III. Peculiar leaf shape: lanceolate to ribbon-like blades with more than 4 parallel nerves (ribs)

- *Ledermanniella letouzeyi* [Cameroon]: prominent leaves (up to 30 cm long), entire and narrow lanceolate (width up to 2 cm) or bifurcated once or twice into narrow lanceolate segments (width up to 2 cm)⁹
- *Thelethylax minutiflora* [Madagascar]: certain forms (especially Perrier's subsp. *orientalis*) with entire elliptical to oblong blade, 3-4 cm long and 7-17mm wide

IV. Peculiar leaf sheaths, presence of intrapetiolar stipules; most African Podostemoideae have leaf sheaths with two attached lateral stipules or without any type of stipule!

- *Ledermanniella bowlingii* [Ghana], *L. prasina* [Cameroon], *L. thalloidea* [Cameroon]: especially bracts (leaves just below flowers or flower clusters) with hood-like sheath¹⁰ and dorsally inserted blade which is thread-like or forked once

V. Stems with secund inflorescences; i.e. reproductive shoots with elongate stems and flowers or (stalked) flower clusters restricted to one stem sector, occasionally flowers or flower clusters opposite to leaves which are restricted to another stem sector:

- *Dicraeanthus africanus* [Cameroon]
- *Ledermanniella* subg. *Ledermanniella*: *L. boloensis*, *L. nicolasii* [both Gabon]
- *Leiothylax callewaertii* [Zaire]
- *Macropodiella hallaei*, *M. heteromorpha*, *M. taylorii*, *M. uoroensis* [Equatorial Guinea, Gabon, Cameroon, Ivory Coast]

VI. Stems with solitary flowers (or flower clusters) arranged in two rows (orthostichies), i.e. in the same plane as the distichously inserted foliage leaves. Exceptions as follows:

- *Ledermanniella annithomae* [Cameroon, Gabon]: each flower (or cluster) opposite a foliage leaf
- *Stonesia taylorii* [Guinea, close to Mali]: flowers usually along two rows; only one row of flowers (i.e. 1-flowered short-shoots) well developed; flowers of second row stay rudimentary; thus inflorescence seemingly secund

VII. Terminal flowers or terminal flower clusters, arising from angles of repeatedly forked stems or from angles of repeatedly forked leaf blades; i.e. shoot and its subunits with repetition of Y-shaped branching and flower(s) in between:

- *Ledermanniella letouzeyi* [Cameroon]: few flowers epiphyllous in angles of forked leaf blades, most flowers along stem¹¹
- *Ledermanniella letestui* [Gabon], *L. prasina*¹² [Cameroon], *L. schlechteri* [Cameroon, Congo, Zaire]

⁹ See description and figures in Rutishauser (2004); check also if *Macropodiella pellucida* (usually devoid of stems and prominent leaves at all) rarely produces "de grandes lames foliacées plurinervées" (as mentioned by Cusset 1987:64)

¹⁰ This hood-like or scale-like sheath is homologous to an intrapetiolar (median) stipule (see Ameka et al. 2003).

¹¹ See Rutishauser (2004): *L. letouzeyi* with epiphyllous flowers inserted in angles of forked leaf blade

¹² See Schenk & Thomas (2004): flowers perhaps also epiphyllous in angles of forked leaf blades (?)

- *Macropodiella garrettii* [Sierra Leone]¹³

VIII. Terminal leaves¹⁴; foliage leaves arise from the distal angles of repeatedly forked stems. They may be called „terminal leaves“ because they terminate the mother stem and give rise to two daughter stems which form the legs of the new stem fork (see Ameka et al. 2003; Rutishauser 2004).

- *Ledermanniella bowlingii* (subg. *Ledermanniella*) [Ghana]
- *Ledermanniella abbayesii*, *L. adamesii* (subg. *Phyllosoma*) [Guinea, Sierra Leone]
- Terminal leaves may also occur in other African Podostemoideae, at least occasionally (see e.g. *Ledermanniella tenax*, Cusset 1997, Fig. 1-B1; *Zehnderia*, Cusset 1987: Fig. 16-1).

IX. Spathella lacking; i.e. no tubular or saccate thin cover around the flower bud:

- *Tristicha trifaria* (because this is the only tristichoid member in Africa and Madagascar!)

X. Unusual orientation of flower buds in spathella; most African (Madagascan) members of subfamily Podostemoideae have flowers which are erect or completely inverted in the spathella. Exceptions as follows:

- *Djinga felicis* [Cameroon], *Letestuella tisserantii* [Western to Southern Africa]: flowers often not erect, but slightly inclined (oblique) in the spathella; i.e. the longitudinal axis of the ovary forms a right or obtuse angle as compared to the longitudinal axis of the spathella
- *Thelethylax isalensis* [Madagascar]: flowers strongly inclined or inverted in the spathella

XI. Three subulate (inconspicuous) tepals¹⁵ **per flower**, associated with 2 stamens with common stalk (andropodium); one tepal on each side of the andropodium, the third tepal in the fork between the filaments:

- *Stonesia* spp. (all species) [tropical W Africa]
- *Thelethylax minutiflora*, *Th. isalensis* [Madagascar]

XII. Increased stamen number per flower, usually with common stalk (andropodium).

Typical flowers of African and Madagascan Podostemoideae have Y-shaped structure with only 2 stamens on a common stalk (= andropodium) or just 1 stamen. Exceptions as follows:

• **Stamens 2 and 3** (usually on the same individual):

- *Ledermanniella* subg. *Ledermanniella*: *L. boloensis*, *L. raynalianorum*, *L. sanagaensis*, *L. variabilis* (the latter species with up to 4 stamens) [Gabon, Cameroon, Nigeria]
- *Ledermanniella* subg. *Phyllosoma*: *L. annithomae*, *L. harrisii* [Gabon, Cameroon, Sierra Leone]

¹³ See Cusset (1978, Fig. 4-1)

¹⁴ Terminal leaves (with two opposite sheaths!) are found in many American Podostemoideae. (see Rutishauser 1995, 1997).

¹⁵ *Tristicha trifaria* (subfamily Tristichoideae) has also 3 tepals; unlike all African Podostemoideae the *Tristicha* tepals are conspicuous, forming a complete (imbricate) cover around the inner flower parts.

- *Leiothylax quangensis* [Cameroon, Zaïre]
 - *Macropodiella hallaei*, *M. heteromorpha*, *M. taylorii*, *M. uoroensis* [Equatorial Guinea, Gabon, Cameroon, Ivory Coast]
 - *Winklerella dichotoma* [Cameroon]
 - *Zehnderia microgyna* [Cameroon]
- **Stamens 3 or 4** (on the same individual):
 - *Angolaea fluitans* [Angola]
 - *Ledermanniella variabilis* (this species also with 2 stamens, see above) [Cameroon]

XIII. Unusual length proportions of common stalk (andropodium) to free filaments; when there are 2 (or 3 or 4) stamens per flower in African Podostemoideae the filaments have about the same lengths as the common base (andropodium); exceptions as follows:

- **Filaments very short, less than ½ of anther length, andropodium much longer**
 - *Ledermanniella bifurcata* [Cameroon, Congo, Gabon], *L. letestui* [Gabon], *L. torrei* [Mozambique]
 - *Letestuella tisserantii* [Western to Southern Africa]
- **Filaments usually much longer than anthers and andropodium**
 - *Angolaea fluitans* [Angola]: the 3 (rarely 4) stamens free or united only at the base (i.e. with very short andropodium)
 - *Ledermanniella variabilis* [Cameroon]: the 2 – 3 (or rarely 4) stamens usually with short andropodium

XIV. Stigma shape, as observable in open flowers. Usually there are two stigmas (stigma lobes) which are linear or short. Exceptions as follows:

- **Semi-globose stigma on a single style**
 - *Angolaea fluitans* [Angola]
- **Two stigmas conical, rigid, erect and parallel**
 - *Dicraeanthus africanus*, *D. zehnderi* [Cameroon]
 - *Ledermanniella bowlingii*, with the two erect stigmas fused into one basal cushion [Ghana]
- **Two stigmas linear, each stigma with bifid apex**
 - *Ledermanniella prasina* [Cameroon]
- **Two stigmas cock's comb-like with serrate margin**
 - *Macropodiella heteromorpha* [Gabon, Cameroon, Ivory Coast]
- **Three linear stigmas**
 - *Tristicha trifaria*

XV. Capsule stalk and gynophore (ovary stalk). Unlike most American and Asian members of the family, the ovaries and capsules of African Podostemoideae often show a stalk = gynophore (up to 1 mm, usually shorter than the mature capsule). Moreover, African

Podostemoideae have a flower stalk (pedicel, i.e. the stalk below the insertion of the androecium) of 3 – 10 mm length. Exceptions as follows (measured when capsules mature):

- **Pedicels up to 15 or more mm, gynophores up to 8 mm**
- *Zehnderia microgyna* [Cameroon]: capsules subglobose, smooth
- *Dicraeanthus africanus* [Cameroon]: capsules cylindrical, ribbed¹⁶
- *Leithylax callewaertii*, *L. quangensis* [Cameroon, Zaïre]: capsules globose, ribbed

- **Pedicels and gynophores lacking or nearly so (thus, capsules sessile within spathe)**

- *Saxicolella amicorum*, *S. submersum* [Ghana]; pedicels up to 2 mm in *Saxicolella* spp.

XVI. Capsule shape; apex of capsule (ovary) with teeth or horns. Typical capsules are globose to ovoid or fusiform (spindle-shaped), i.e. with circular cross-section. All examples mentioned below have (as typical for African Podostemoideae) three ribs per valve, each extending from base to apex. They are exceptional with respect to their capsule shape:

- **Capsules strongly flattened, with two flattened apical horns;** i.e. similar to *Veronica* capsules:

- *Winklerella dichotoma* [Cameroon]

- **Capsules slightly to strongly flattened, but without apical teeth or horns**

- *Macropodiella* spp., only slightly flattened capsules in *M. taylorii* [tropical W Africa incl. Equatorial Guinea]
- *Thelethylax* spp. [Madagascar]

- **Capsules slightly flattened, with two apical teeth** (i.e. conspicuous tips of the two median ribs)

- *Ledermanniella congolana* [Zaïre]

- **Capsules spindle-shaped, not flattened, with six apical teeth** (i.e. conspicuous tips of six ribs)

- *Ledermanniella warmingiana* [Angola, Namibia]

XVII. Increased rib number per capsule valve (i.e. more than 3 ribs per valve), with the ribs nearest the sutures shorter than the others and not reaching the ends of the valves

- *Stonesia* spp. [Guinea, Sierra Leone], all with broadly ellipsoidal capsules, each valve with 5 or 7 ribs (i.e. with 12 or 16 per capsule)
- *Endocaulos mangorensis* [Madagascar], capsule asymmetrically ovoid and slightly flattened, each valve with 7 ribs
- *Paleodicraeia imbricata* [Madagascar], capsule ovoid and slightly flattened, each valve with 5 ribs¹⁷

¹⁶ Check Hess (1961): *Dicraeanthus africanus* with capsule stalks up to 6 cm (!)

¹⁷ Verify this rib pattern in *Paleodicraeia*, see Cusset 1972, Fig.2-4; check also *Thelethylax*, the third podostemoid genus of Madagascar, having 3 ribs per valve, perhaps the two lateral ones also not reaching the ends of the valves (see Cusset 1972, Fig.3-4, especially *T. isalensis*)

MAIN DOCUMENT: GENERA DIAGNOSES AND KEYS TO THE SPECIES OF ALL AFRICAN AND MADAGASCAN PODOSTEMACEAE

Note: The genera diagnoses are taken over from Cook & Rutishauser (2004)¹⁸ “Podostemaceae“ which will be published as chapter in Kubitzki (ed.) ”Families & Genera of Vascular Plants”. Species keys are added to all genera with more than one species. These keys are “enriched”. They contain several pertinent characters from the various species diagnoses. The keys should allow the identification even when some characters (organs) are lacking. Detailed species diagnoses, however, are not given here. In order to ensure a correct identification please check the figures¹⁹ and the species diagnoses in the original literature²⁰. For the species-rich genus *Ledermanniella* the identification keys are labelled as **Keys D, E, F and G**.

Subfamily Tristichoideae

1. *Tristicha* Du Petit-Thouars (Cook 1996, Fig.338; also Rutishauser 1995, 1997)

Tristicha Du Petit-Thouars, Gen. Nova Madag. 3 (1806).

Malaccotristicha C. Cusset & G. Cusset, Bull. Mus. Natn. Hist. Nat. Paris Sér. 4. Sect. B. Adansonia 10: 174 (1988).

Roots creeping, flattened and ribbon-like, 0.5 – 1 mm wide, branched, attached to rock by disk-like holdfasts. Stems polymorphic, creeping or floating; floating stems simple or branched, up to 10 cm long, bearing scales and ramuli (photosynthetic branchlets); ramuli moss-like, 2 – 4 cm long; scale-like appendages of ramuli entire or divided, arranged in 3 rows, usually 2 rows spreading and the third row smaller and appressed. Spathella and cupule around flower bud absent. Flowers pedicellate, solitary or sometimes in clusters. Tepals 3, lanceolate to narrowly ovate, free or united at the base. Stamens 1, 2 or rarely 3 (*never 3 in Africa*); pollen in monads, pantoporate. Capsules ellipsoidal to ovoid, opening by 3 equal valves; each valve with 3 ribs; style short; stigmas 3, linear or (rarely) forked. Seeds up to ± 70.

One very polymorphic sp., *T. trifaria* (Bory ex Willdenow) Sprengel [widespread in Africa and Madagascar; also tropical America, Mascarene Islands, Malaysia, NE Australia].

Subfamily Podostemoideae

2. *Angolaea* Weddell (Cook 1996, Fig. 299)

Angolaea Weddell, in A. de Candolle, Prodrusus 17: 300 (1873).

Roots unknown. Stems branched, floating, up to 50 cm long. Leaves repeatedly forked, segments filiform. Spathellas ellipsoidal, born on 5 – 8 mm long stalks. Flowers erect in the spathella, born in umbel-like clusters. Tepals 2, small, one each side of the stamens or

¹⁸ File name: POD_GEN3.doc [16-May-2001], adapted 8-9-04

¹⁹ All species figures as available from literature are part of this homepage! (see Excel File: afr.podos,tab.2_Figs-List; Excel File: afr.podos,tab.1_Species-List)

²⁰ See Word File: Pod-Afr-Literature-20-09-04

andropodium if present. Stamens 3 or rarely 4, free or united below, born in a cluster together on one side of the flower; andropodium very short or apparently absent; pollen in dyads. Capsules ellipsoidal, 1- or 2-ocular (?)²¹, opening by 2, equal valves; each valve with 3 ribs; style 1, short, erect, bearing a semi-globose stigma.

One sp., *A. fluitans* Weddell [Angola: River Cuanza].

Ang_flu_Warming1899_38

3. *Dicraeanthus* Engler

(Cook 1996, Fig. 308)

Dicraeanthus Engler, Bot. Jahrb. Syst. 38: 94 (1905).

Roots usually ± star-shaped. Stems arising from roots elongate, branched, floating, up to 1 m long, bearing leaves in 2 rows and in a third row flowers. Leaves arising at almost regular distances along opposite sides of the stem; blades linear or up to 3 times forked, often fan-like; ultimate segments linear. Spathellas elongate. Flowers inverted within the unruptured spathe, solitary or 3 – 20 in sessile or pedunculate clusters, mostly appearing to be opposite leaves; pedicels up to 6 cm long in fruit. Tepals 2, much shorter than the ovary, one each side of the andropodium; andropodium rarely exceeding 1 mm long. Stamens 2, about half as long as the ovary; filaments half as long as the anther; pollen in dyads. Capsules cylindrical to oblong, all ribs running the length of the capsule; 1-ocular; opening by 2 equal and persistent valves; each valve with 3 ribs; stigmas 2, conical, erect, persistent in fruit. Two spp., tropical W Africa.

KEY TO THE 2 SPECIES OF *DICRAEANTHUS* (ACCORDING TO CUSSET 1987; MODIFIED BY R. RUTISHAUSER)

1. Main stems strong, 30 – 75 cm long, without prominent lateral branches; (4-) 6 – 8 flowers in sessile clusters secund²² along main stems, seemingly opposite to the leaves; leaves 3-5 cm long, with 3-4 mm broad base, forked into linear segments

D. africanus Engler (including *D. ramosus* H. Hess)

[Cameroon: Rivers Doumba, Koudini-Mandal, Lobé, Sanaga, Vina]

Dic_afr_Cusset87_21
Dic_afr_Engler30,36
Dic_afr_Hess61_1

- Stems thinner and branched several times, (5-)10 – 60 cm long; solitary flowers along the stems (*occasionally secund?*), or towards the shoot tips, or sessile on upper surface of ribbon-like roots; leaves 1.5 – 3 cm long, with narrow base, forked up to 6 times into thread-like segments

D. zehnderi H. Hess [Cameroon: Sanaga]

Dic_zeh_Hess61_2
Dji_zeh_Hess61_2

23

²¹ Check (not mentioned by Cook 1996)

²² Similar branching patterns with secund arrangement of flower clusters also occur in *Macropodiella*, e.g. *M. taylorii*.

²³ The frames contain names of files with illustrations of the various species; such frames are added in this preliminary version only for the genera *Angolaea*, *Dicraeanthus* and their species; for all other taxa see under Excel File: afr.podos,tab.2_Figs-List. (part of this Homepage).

4. *Djinga* C. Cusset

(Cook 1996, Fig. 310)

Djinga C. Cusset, Flore du Cameroun 30: 58 (1987)

Roots foliose or ribbon-like. Stems arising endogenously from the root margin, elongate, up to 12 cm or more long, irregularly branched, with long shoots or rosette-like short shoots.

Leaves 0.5 – 1.5 cm long, subulate, entire or once forked. Spathellas ovoid to elliptic, arising in a rosette of linear or scale-like leaves. Flowers erect in spathella, solitary or 3 – 4 as part of dense short shoots; subsessile at anthesis; pedicels hardly elongating in fruit, up to 4 mm long. Tepals 2, linear, much shorter than the filament. Stamen 1; filament 1.2 – 1.4 mm long; pollen in monads or loose dyads²⁴. Capsules globose to subglobose, ± 1.2 mm long, 1-locular²⁵, opening by 2 slightly unequal²⁶ valves; each valve with 3 ribs; ribs somewhat flattened, wider than the furrows; stigmas 2, equal, linear to lanceolate and flattened, 0.7 – 0.8 mm long. –

This monotypic genus seems to be related to *Letestuella*!

One sp., *D. felicis* C. Cusset [Cameroon: Mount Djinga – Adamaoua].

5. *Endocaulos* C. Cusset

(Cook 1996, Fig. 311)

Endocaulos C. Cusset, Adansonia, Sér. 2. 12(4): 560 (dated 1972, published 1973).

Roots ribbon-like, 0.3 – 1 mm wide, infrequently branched, closely attached to rock or partly floating. Stems arising along the margins of the root, very short, simple. Leaves simple, elongate, 2 – 3 cm long, swollen at base; base sometimes with 2 stipule-like lobes, at flowering time the elongate portions of the leaves become detached. Spathellas ovoid, obtuse at the tip, opening irregularly. Flowers solitary, somewhat inclined within the spathella; pedicel in fruit 2 – 3 mm long. Tepals 2, obovate, one each side of the andropodium. Stamens 2, born on an andropodium, somewhat exceeding the ovary; pollen in dyads. Capsules asymmetrically ovoid, somewhat flattened laterally, held obliquely at the tip of the pedicel, 2-locular, opening by 2 unequal and persistent valves; each valve with 7 ribs, the ribs nearest the sutures shortest and not extending the whole length of the capsule; stigmas 2, elongate, equal.

One sp., *E. mangorense* (Perrier) C. Cusset [Madagascar].

6. *Ledermanniella* Engler

(Cook 1996, Fig. 317)

Ledermanniella Engler, Bot. Jahrb. Syst. 43: 378 (1909); Cusset, Les genres *Ledermanniella*, *Monandriella* et *Inversodicraeia*. Adansonia, Sér. 2. 14: 271-275 (1974); Cusset, *Ledermanniella* sous-genre *Phyllosoma*. Bull. Mus. Natn. Hist. Natn. Paris Sér. 4. Sect. B. Adansonia 5: 361-390 (1983); op. cit., sous-genre *Ledermanniella*. 6: 249-278, (1984), rev. *Inversodicraeia* Engler ex R. E. Fries, Wiss. Ergebn. Schwed. Rhod. Kongo Exped. 1911-1912, 1: 56 (1914).

Monandriella Engler, Bot. Jahrb. Syst. 60: 457 (1926).

Sphaerothylox Bischoff ex Krauss, Flora 27: 426 (1844), pro parte.

²⁴ According to own studies on isotype material (Rutishauser, unpubl.)

²⁵ According to Cusset (1987) and own observations

²⁶ Check if valves often nearly equal!

Roots ribbon-like or foliose. Stems rudimentary to well developed, erect, simple or branched, up to 80²⁷ cm or more long. Leaves very variable, simple, lobed or forked, linear with thread-like segments or scale-like with entire or toothed margins and sometimes with apical teeth, imbricate scales and prominent main leaves often develop on the same stem. Spathellas opening irregularly at the tip. Flowers inverted within the unruptured spathella, solitary or sometimes in sessile or stalked clusters. Tepals 2, linear or filiform, one each side of the andropodium or filament. Stamens 1 or 2 (3), either single or born on an andropodium; andropodium usually more than 1 mm long, usually exceeding the ovary at anthesis; pollen in monads or dyads. Capsules ovoid to ellipsoid or fusiform, 1-locular²⁸, with all ribs running the entire length of the capsule, opening by 2 equal²⁹ or unequal valves; each valve with 3 ribs; one or both valves persistent; stigmas 2, linear, spreading or reflexed, or very short. About 46 spp., tropical Africa, most in W Africa. We are of the opinion that this is not a natural genus; it is the only Podostemoideae genus with pollen in monads and dyads.

KEY D: KEY TO THE 2 SUBGENERA OF *LEDERMANNIELLA* (ACCORDING TO CUSSET 1983, 1984, 1987; COMBINED AND MODIFIED BY R. RUTISHAUSER)

1. Scale-like leaves (especially overlapping scales) lacking along the stems; all leaves usually elongate and forked with thread-like segments; when only scale-like leaves present, these leaves forming broad sheaths and arranged in 2 rows (distichous) along stems. ***Ledermanniella* subgenus *Ledermanniella* (26 species, see KEY E below)**
- Overlapping³⁰ scales (inserted all around the stem) and prominent main leaves (arranged in 2 rows) often develop on the same stem, at least towards the shoot tips. Main leaves simple, lobed or forked, linear with thread-like segments; overlapping scales with entire or toothed margins and sometimes with apical teeth.
***Ledermanniella* subgenus *Phyllosoma* (20 species, see KEY F and KEY G below)**

Note: It is difficult and often impossible to identify the species of both subgenera when reproductive structures (flowers, capsules) are lacking. ***Ledermanniella* subgenus *Phyllosoma*** as defined by Cusset (1983) is characterised by often imbricate **scales** (teeth, enations, ...) which are **inserted irregularly around the stem**, i.e. not restricted to two opposite rows (orthostichies) along the stem. These **scales** are a unique character of subg. *Phyllosoma*. Other African Podostemoideae (including some members of **subg. *Ledermanniella***) with scale-like leaves have them arranged in two rows (i.e. distichously) along the stem. The scales of subgenus *Phyllosoma* are called “little leaves” (“feuillettes”) in French (Cusset 1983). They are only 0.5 – 2 (rarely up to 5) mm long. Typical foliage leaves (also present in many members of subg. *Phyllosoma*, at least in young shoots) are arranged in 2 rows along the stem, and usually much longer (>1 cm), linear or forked into linear or thread-like segments. It seems that the scales provide excellent characters for species identification. **Key E** below should allow to identify the species of subg. *Ledermanniella*, including the two recently described species *L. prasina* and *L. onanai* (Cheek 2003; Schenk & Thomas 2004). Two keys will be added below for the species of subg. ***Phyllosoma*: KEY F** is a modified and version of Cusset’s (1983) key. **KEY G** gives more emphasis on the shape of the scales.

²⁷ Maximal shoot lengths in *Ledermanniella bowlingii*: up to 120 cm (see Ameka et al. 2003)

²⁸ According to Cusset (1987)

²⁹ Equal valves: e.g. *Ledermanniella bowlingii* (Ameka et al. 2003)

³⁰ They may be called “imbricate scales” as well.

KEY E: KEY TO THE 26 SPECIES OF *LEDERMANNIELLA* SUBGENUS *LEDERMANNIELLA*
(ACCORDING TO TAYLOR 1954; CUSSET 1983, 1984, 1987; AMEKA ET AL. 2003; CHEEK 2003; SCHENK & THOMAS 2004; COMBINED AND MODIFIED BY R. RUTISHAUSER)

1. Leaves all short, scale-like or boat-shaped or if leaves conspicuous (> 3 cm long and often forked), at least bracts below flowers hood-like (i.e. provided with intrapetiolar stipule) giving rise to thread-like blade on dorsal side 2
 - Leaves neither boat-shaped nor hood-like, stipules (if present at all) 2 lateral ones, attached to leaf base (never 1 intrapetiolar stipule per leaf); leaves (blades) usually conspicuous, entire and elongate, or forked few to many times, with linear to thread-like segments; stamens 1, 2 or 3 6
2. All leaves short, boat-shaped (laterally flattened), arranged in 2 dense rows (distichous); elongate blades and stipules lacking; stamens 2 3
 - Leaves with hood-like (cupuliform) sheath (i.e. with intrapetiolar stipule) and filamentous, inconspicuous blades (1 – 8 mm long, rarely bifid) arising from dorsal side; elongate main stems present and up to 5 (?) cm long or absent; sessile flowers along stems and on upper surface of foliose root; stamens 1 or 2 4
3. Stems only 2 – 3 mm long, with solitary terminal flower each; or with solitary flowers sessile on foliose root *L. aloides* (Engler) C. Cusset [Angola; Cameroon: Tschape Pass - Adamaoua; Sierra Leone]
 - Stems (2-)5 – 7 cm long; leaves stiff, laterally flattened, 5 – 8(-10) mm long; solitary flowers, with a boat-shaped prophyll each, inserted in leaf axils *L. onanai* Cheek [Cameroon SW: Chide River]
 - Stems c. 6 cm long (*check*), with densely arranged boat-shaped leaves; spathe lateral dehiscence (i.e. similar to *L. onanai*) *L. keayi* (G. Taylor) C. Cusset [Cameroon: Bamenda, Kumbo]
4. Leaf sheaths hood-like³¹ but incised apically into 2 stipular appendages ; stems up to 5 (?) cm long; flowers restricted mainly to shoot tips; stamens 2; pollen in dyads *L. batangensis* (Engler) C. Cusset [Cameroon: Lobé Falls - Grand Batanga]
 - Leaf sheaths (especially bracts below flowers) hood-like and not incised apically, with dorsally inserted thread-like blade (entire or forked once); pollen in monads 5
5. Slender shoots (9 – 13 cm tall) with foliage leaves up to 4 (20?) cm long and forked several times into thread-like segments; flowers along stem and inserted in angles of stem forks or leaf forks³²; stamens 1 (rarely 2) *L. prasina* J. Schenk & D. W. Thomas [Cameroon]
 - Shoots with stout stems (if present at all); forked foliage leaves along stem lacking (or not known); flowers on foliose root or sessile along stem; stamens 2 *L. thalloidea* (Engler) C. Cusset [Cameroon: Sanaga, Bipindi]
6. Most leaves entire and elongate 7
 - Leaves compound, at least those next to flowers 18
7. Plants without stems (or with stems less than 1 cm long) 8

³¹ This hood-like sheath is identical (homologous) to a bifid intrapetiolar stipule. Such stipules also occur in *L. bowlingii* [Cameroon], in combination with 1 stamen per flower, pollen in dyads and ribbon-like roots (see this key below, and Ameka et al. 2003).

³² Check if *L. prasina* really with flowers arising from leaf forks, i.e. epiphyllous from sites where leaf blade is forked (similar to *L. letouzeyi*, see Rutishauser 2004).

- Plants with conspicuous stems (usually much more than 1 cm long) 12
- 8. Leaves arranged in rosettes (not restricted to 2 rows); roots foliose or ribbon-like 9
- Leaves along two rows (distichous), arising on upper surface of foliose roots 10
- 9. Roots ribbon-like; leaves linear, 2 mm long, without broadened base; stamen 1; stigmas linear
L. minutissima C. Cusset [Sierra Leone]
- Roots foliose; leaves linear to subulate, 3 – 5 mm long, with suddenly broadened sheath; stamens 2; stigmas very short
L. tenuifolia (G. Taylor) C. Cusset [Gabon; Nigeria; Cameroon?]
- 10. Leaves narrow linear to filamentous, occasionally with 2 lateral stipules, but without broad enclosing sheath; filamentous blade 1.5 cm long, as long as flower in anthesis; stamens 2; roots foliose
L. linearifolia Engler [Cameroon: Campo, Lobé, Sahé]
- Leaves with broad enclosing sheath; leaf blade shorter than the flower in anthesis 11
- 11. Leaves stipulate, with narrow linear blade, 2 – 4 mm long
L. sanagaensis C. Cusset [Cameroon: Sanaga Falls]
- Stems only 2 – 3 mm long; leaves very short (0.1 – 0.8 mm), boat-shaped³³ or trifid³⁴ with 2 stipular teeth and subulate blade, with solitary terminal flower each; or with solitary flowers sessile on foliose root
L. aloides (Engler) C. Cusset [Angola; Cameroon: Tschape Pass - Adamaoua; Central African Republic; Sierra Leone]
- 12. Leaves mainly towards the shoot tips, or arising from the angles of bifurcating stems 13
- Leaves arranged along the whole stem length (at least leaf scars observable) 14
- 13. Leaves linear, with progressively broadened base; spathellas dehiscing from top
L. ramosissima Hauman ex C. Cusset [Uganda]
- Leaves boat-shaped and densely arranged along 2 rows (distichous); spathellas dehiscing with lateral slits
L. keayi (G. Taylor) C. Cusset³⁵ [Cameroon: Bamenda, Kumbo]
- 14. Leaves at least 2 – 4 cm long (often much longer, up to 30 cm³⁶), usually entire and sword-like (ensiform) with few to several parallel veins; roots as broad ribbons (up to 5 mm wide)
L. letouzeyi C. Cusset [Cameroon: Ure – Mts Rumpi]
- Leaves usually less than 2 cm long, neither ensiform nor provided with parallel nervature 15
- 15. Stamen 1 16
- Stamens 2 or 3; leaves distichous; spathella with lateral dehiscence 17
- 16. Leaves filiform, 3 – 5 mm long, with narrow base, devoid of stipules; stamen shorter than the ovary; pollen in dyads
L. jaegeri C. Cusset [Sierra Leone]
- Leaves triangular, 1 – 2 mm long, or with blade³⁷ up to 1 cm long, broad sheath provided with 2 stipules; stamen as long or longer than the ovary; pollen in monads
L. monandra C. Cusset [Cameroon: Mayo Bika - Tignère]
- 17. Shoots heterophyllous; basal leaves short (3 – 5 mm), leaves below flowers linear, 10 – 15 mm long; stamens 2, shorter than ovary
L. musciformis (G. Taylor) C. Cusset [Cameroon: Bamenda, Tchampa]
- All leaves similar, 3-4 mm long, densely arranged, with inrolled margins; stamens 2 or 3, as long or longer than ovary
L. raynalianum C. Cusset [Cameroon: Massif du Vokré; Nigeria]
- 18. Stamen 1 (rarely 2 in *L. prasina*) 19
- Stamens 2 – 3(-4) 22

³³ See Engler (1930, Fig.46)

³⁴ See Cusset (1984, 1987)

³⁵ Check if this description also fits for recently described species *L. onanai*...

³⁶ See Rutishauser (2004)

³⁷ According to Cusset (1997) leaf blade very short, only 0.4 – 0.6 mm (but see Engler 1930: Fig. 38: blade up to 10mm)

19. Stems 5 – 8 mm high; leaves forked once or twice, with deciduous linear segments; pollen in dyads *L. pygmaea* (Pellegrin) C. Cusset [Gabon]
 — Stems usually more than 2 cm long 20
20. Roots as ribbons, 1 – 4 mm wide, branched exogenously; stems up to 120 cm long; leaves up to 15 cm long, usually forked 3 – 7 times with thread-like segments, provided with 2 intrapetiolar stipules (basal leaves may be thread-like, entire or bifid); flowers along stems or root-born; pollen in dyads; stigmas conical (only 0.5 mm long), the two lobes with common cushion-like base *L. bowlingii* (J.B. Hall) C. Cusset [Ghana]³⁸
 — Roots foliose, pollen in monads; stigmas linear, not fused at base 21
21. Stems long and slender, 30 – 100 cm long; leaves 4 – 6 cm long, forked several times into thread-like and deciduous segments; flowers in stalked clusters (bracts lacking); stigmas linear (c. 1 mm long) with entire apices *L. guineensis* C. Cusset [Guinea]
 — Main stems up to 3 cm; slender secondary shoots (9 – 13 cm tall) with foliage leaves up to 4 (20?) cm long and forked several times into thread-like segments; flowers along stem and inserted in angles of stem forks or leaf forks³⁹, subtended by few hood-like bracts with inconspicuous thread-like blade arising from dorsal side⁴⁰; stamens 1 (rarely 2); stigmas linear, each one with a bifid apex
L. prasina J. Schenk & D. W. Thomas [Cameroon]
22. Stems simple and less than 1 cm long; leaves entire and linear or forked; leaves below flowers usually with 2 attached lateral stipules; capsules with 1 valve caducous and one valve persistent 23
 — Stems more than 1 cm long, often up to 15 – 25 cm long; capsule valves caducous or persistent **Go on with subkey 25 or subkey 29**
23. Stigmas short (< 0.5 mm), dentate or with three lobes; stamens 2 – 3(-4) with filaments longer than common stalk (andropodium); leaves 5 – 10 mm long, entire and linear or bifid, with broad sheath, occasionally provided with two lateral stipules; flowers solitary or in clusters of 2 (– 7) at shoot tips
L. variabilis (G. Taylor) C. Cusset [Cameroon: Lobé, Munaya – Mamfe]
 — Stigmas linear (0.6 – 0.7 mm); stamens 2 with common stalk usually longer than free filaments; leaves 0.7 – 6 cm long, entire and linear, or forked up to 3 times into linear segments 24
24. Stems (if short) with solitary flower in terminal position; pollen in monads (*also dyads?*)⁴¹
L. bifurcata (Engler) C. Cusset [Cameroon: Bipindi, Lobé, etc.; Congo; Gabon]
 — Stems always short (up to 1 cm) and with terminal clusters of up to 5 – 7 flowers, or shoots reduced to root-born rosettes with solitary terminal flower; pollen in dyads
L. pusilla (Warming) C. Cusset [Cameroon: Lobé, Lokoundje; Gabon; Zaïre]
25. Capsules with one valve caducous; stamens 2 or 3 26
 — Dehiscing capsules with both valves persisting on pedicel; stamens 2 28
26. Shoots 10 – 15 cm long, rarely branched; stalked flower clusters secund along the stems; stamens 2 or 3, with free filaments as long as common stalk (andropodium); stigmas very short; (*pollen in monads or dyads?*)⁴². *L. boloensis* C. Cusset [Gabon]

³⁸ See Ameka et al. (2003) on comparative morphology of *L. bowlingii*

³⁹ Check if *L. prasina* really with flowers arising from leaf forks, i.e. epiphyllous from sites where leaf blade is forked (similar to *L. letouzeyi*, see Rutishauser 2004).

⁴⁰ See this key above

⁴¹ See Engler (1915, 1926, 1930: Fig.48 under synonym *Inversodicraea minima*)

- Shoots (if present at all) up to 20 cm long; flowers not secund along the stems; stamens 2, with free filaments much shorter than common stalk (andropodium); stigmas linear; pollen in monads⁴³ 27
27. Leaves up to 25 mm long, entire and linear or forked up to 3 times into linear segments; some leaves with 2 attached lateral stipules
L. bifurcata (Engler) C. Cusset [Cameroon: Bipindi, Lobé, etc.; Congo; Gabon]
- Leaves up to 15 mm long, forked up to 6 times into thread-like segments; no stipules
L. letestui (Pellegrin) C. Cusset [Gabon]
28. Main shoots 5 – 25 cm long, with sessile or stalked flower clusters secund (restricted to one sector) along the stems; pollen in monads *L. nicolasii* C. Cusset [Gabon]
- Shoots up to 30 cm long; flowers often solitary in the angles of forked stems⁴⁴ or in leaf axils but never secund; spathe often stalked; pollen in dyads
L. schlechteri (Engler) C. Cusset [Cameroon: Dehane, Edéa; Congo; Zaïre]
29. Roots ribbon-like; elongate shoots often forked (branched dichotomously); solitary flowers or flower clusters in the angles of forked stems or in leaf axils along stems, but not secund 30
- Roots foliose (crustaceous); elongate main shoots 5 – 25 cm long, with usually stalked flower clusters restricted to one side of the stem (i.e. secund) 32
30. Shoots up to 6 cm (?) long; stems relatively thick; leaves up to 25 mm long, entire and linear or forked up to 3 times into linear segments; at least some leaves with 2 attached lateral stipules; pollen in monads (*also dyads? See footnote*)
L. bifurcata (Engler) C. Cusset [Cameroon: Bipindi, Lobé, etc.; Congo; Gabon]
- Shoots (including stems) elongate and slender, up to 20 cm and more, branched dichotomously (or seemingly so); leaves c. 3 (?) cm long, forked up to 6 times into thread-like segments; stipules lacking; flowers inserted in angles of stem forks 31
31. Shoots 4 – 20 cm long; flowers in sessile clusters in angles of stem forks (or along zig-zag stem); pollen in monads *L. letestui* (Pellegrin) C. Cusset [Gabon]
- Shoots up to 30 cm long; flowers solitary in angles of stem forks⁴⁵; pollen in dyads
L. schlechteri C. Cusset [Cameroon: Dehane, Edéa; Congo; Zaïre]
32. Elongate shoots always with stalked flower clusters; (*leaves unknown*); stamens 2 or 3, with free filaments at least as long as common stalk (andropodium); (*pollen in monads or dyads?*⁴⁶); stigmas very short (c. 0.2 mm) *L. boloensis*⁴⁷ C. Cusset [Gabon]
- Elongate shoots with (*occasionally sessile?*) flower clusters; each flower cluster opposite to a foliage leaf; stamens 2; with free filaments shorter than common stalk (andropodium); pollen in monads; stigmas filiform (c. 0.7 mm)
*L. nicolasii*⁴⁸ C. Cusset [Gabon]

⁴² Check! Not mentioned by Cusset (1984)

⁴³ Engler found dyads in *L. bifurcata* (syn. *Inversodicraea minima*, see foot-note above)

⁴⁴ This branching pattern with flowers or flower clusters arising from the angle of forked stems (or forked leaf lobes!) resembles similar patterns in *L. letestui*, *L. letouzeyi*, and *L. prasina*.

⁴⁵ Closely resembling *L. prasina*! Check if *L. schlechteri* and *L. letestui* really without (intrapetiolar) stipules! Similar to *L. prasina* it appears also difficult to decide in these two species where the forked stems continue into the forked leaves...

⁴⁶ Check! Not mentioned by Cusset (1984)

⁴⁷ *L. boloensis* resembles to some degree *L. nicolasii* and *Macropodiella* spp. (check if capsule really terete and one valve always caducous; these taxa are sympatric in Gabon). Check if *L. boloensis* is nothing but a badly collected form of *L. nicolasii*... (leaves unknown, stigmas dropped to some degree).

⁴⁸ *L. nicolasii* resembles to some degree *L. boloensis* and *Macropodiella* spp. (check if capsule really terete and both valves always persistent; these taxa are sympatric in Gabon)

KEY F: FIRST KEY TO THE 20 SPECIES OF *LEDERMANNIELLA* SUBGENUS *PHYLLOSOMA* (ACCORDING TO TAYLOR 1954; CUSSET 1983, 1987, 1997; COOK 2004; COMBINED AND MODIFIED BY R. RUTISHAUSER). This is a modified and version of Cusset's (1983) key. If you are not successful with this key, try also KEY G and KEY C!

1. Stems and all twigs densely covered⁴⁹ with scales; stems up to 15 cm long (often much less); roots often ribbon-like (if known at all; foliose roots in *L. gabonensis*) 2
- Scales do not cover stem completely; proximal stem portions with few or no scales at all; densely overlapping scales only found along the distal flower-producing twigs; main stems usually more than 15 cm long (in some species much longer, up to 80 cm; only 1 – 2 cm in e.g. *L. thollonii*); roots ribbon-like or foliose 10
2. Scales entire or with denticulate margin 3
- Scales clearly dentate or digitate 5
3. Stems 4 – 6 cm long, simple or forked once; scales subulate to linear, 1 – 1.5 mm long; ribbons (0.5 mm wide); stamens 2; *monads or dyads* (?)
- L. mertonii* C. Cusset [Sierra Leone]
- Stems 2 – 3 cm long, branched; scales lanceolate to orbicular 4
4. Scales lanceolate to obovate; stamens 1 (or rarely 2); pollen in monads; roots foliose
- L. gabonensis* C. Cusset [Congo; Gabon]
- Scales orbicular (circular and flat) or nearly so; stamens 2; pollen in dyads; *roots* (?)
- L. boumiensis* C. Cusset [Cameroon: Ntem; Gabon]
5. Scales digitate with 5 – 7 obtuse lobes, at least those in the upper portion of the main stems and the branches; stems up to 5 cm long; stamen 1, clearly shorter than ovary; pollen in monads; *roots* (?)
- L. digitata* (Hess) C. Cusset [Angola]
- Scales dentate; stamens usually 2 (rarely 3) [stamen also 1 in *L. ledermannii* and *L. taylorii*] 6
6. Scales along branches with 5 – 7 (-10) triangular teeth; stems 2 – 15 cm long; stamens 2, as long or longer than ovary; pollen in monads; roots ribbon-like (up to 1 mm wide)
- L. cristata* (Engler) C. Cusset [Angola; Cameroon: Malaka, Mari, Mvigli; Central African Republic; Gabon]
- Scales tridentate (with additional conspicuous dorsal tooth in *L. harrisii*; less conspicuous dorsal teeth occasionally or rarely observable in *L. congolana*, *L. ledermannii* and ... *L. tenax*) 7
7. Capsule apex indented due to the median ribs having a short apical tooth each; stamens 2, shorter or only as short as ovary; pollen in monads; roots ribbon-like (up to 1mm wide)
- L. congolana* (Hauman) C. Cusset [Zaire]
- Capsule devoid of apical teeth 8
8. Scales carrying a conspicuous dorsal tooth which is recurrent; plants look “prickly”; shoots 1 – 3 cm long, branched; stamen 2 (or 3); pollen in monads; capsule with 8 ribs, only 6 of them conspicuous; *roots* (?)
- L. harrisii* C. Cusset [Sierra Leone]
- Scales usually without dorsal teeth; stamens 1 or 2; pollen in dyads; stems up to 5 cm long; roots ribbon-like 9
9. Capsule with 8 fine ribs, all equal; stamens (1 or) 2; stems 2 - 5 cm long, often branched; roots ribbon-like (2 – 3 mm wide)
- L. ledermannii* (Engler) C. Cusset [Angola; Cameroon: Lobé, Mboro, Ndian; Gabon; Zaïre; Ivory Coast]
- Capsule with 8 ribs, only 6 of them conspicuous (the two suture ribs inconspicuous); stamen 1; shoots less than 1 cm long, rarely branched; roots ribbon-like (c. 1mm wide)
- L. taylorii*⁵⁰ C. Cusset [Guinea]

⁴⁹ This character may be misleading for certain species; e.g. elongate shoots of *L. ledermannii* (as far as I know) may have only few scales along proximal stem portions!

⁵⁰ Check if *L. taylorii* is nothing but a dwarf form of the more widespread *L. ledermannii*!

10. Main stems elongate and unbranched, except for several reproductive short-shoots; roots ribbon-like (as far as known) 11
 — Stems branched; roots ribbon-like or foliose 12
11. Scales broad elliptical, margin nearly smooth to denticulate (rarely lanceolate with 5 prominent teeth); roots unknown; shoots 5 – 25 cm long; flowers or flower clusters opposite to forked foliage leaves; stamens 2 or 3, with free filaments slightly to clearly shorter than common stalk (andropodium)
 L. annithomae C. Cusset [Cameroon: Ntem; Gabon]
 — Scales lanceolate, digitate with 3 linear lobes as long as common sheath; roots ribbon-like (up to 1 mm wide); shoots 10 – 20 cm long; stamens 2, with free filaments much longer than common stalk (andropodium)
 L. paulsitae C. Cusset [Congo; Gabon]
12. Scales dentate with 5 – 7 marginal teeth, densely imbricate along flowering twigs; roots ribbon-like (up to 1 mm wide); shoots up to 50 or more cm long; stamens 2 (rarely 1 in *L. fluitans*); pollen in monads 13
 — Scales entire or tridentate (additional dorsal teeth in *L. tenax*); roots foliose or unknown (ribbon-like in *L. tenax*); shoots up to 20 cm long; stamens 1 or 2 14
13. Ovary apex with 6 short teeth, i.e. each of the 3 ribs per valve with an apical tooth
 L. warmingiana (Gilg) C. Cusset [Angola; Namibia]
 — Ovary with 8 ribs but without apical teeth *L. fluitans* (Hess) C. Cusset [Angola]
14. Flowers several towards the shoot tips; scales obovate, with 3 conspicuous distal teeth and (quite often) 1 or 2 inconspicuous dorsal teeth; robust plants with shoots up to 20 cm long; roots ribbon-like; stamens 2
 L. tenax (C.H. Wright) C. Cusset [Angola; Zambia; Zimbabwe; Botswana]
 — Flowers solitary at the shoot tips or in the angles of forked twigs; scales not as above (never with additional dorsal teeth) 15
15. Scales restricted to the shoot tips; more proximal stem regions devoid of scales (few inconspicuous scales lower down in e.g. *L. abbayesii*) 16
 — Scales present along the whole stems but often scantily lower down; roots foliose 18
16. Uppermost scales at shoot tips tridentate to trilobate, with median tooth longer than the lateral ones, or scales entire and subulate to narrow triangular; stems up to 30 cm long; stamens 1 or 2; pollen in dyads *L. abbayesii* (G. Taylor) C. Cusset [Guinea]
 — All scales entire ovate to cuneate or tridentate to trilobate; main leaves few, forked (if present at all); plants from Cameroon; roots (?); pollen in monads or dyads (?) 17
17. Main leaves without stipules; scales with broad base; scales (c. 0.6 x 0.2 mm), entire and ovate, or tridentate with nearly equal teeth; flowers arising along distal short-shoots which are densely covered with scales; stamens 2
 L. bosii C. Cusset [Cameroon: Lobé Falls, Ntem Falls]
 — Main leaves stipulate (?); scales cuneate, i.e. with narrow (petiole-like) base, margin entire or denticulate; solitary flowers arising from the angles (axils) of uppermost stem forks; stamen number?⁵¹
- L. kamerunensis* (Engler) C. Cusset [Cameroon: Campo River]
18. Most scales trilobate, often very slender, up to 5 mm long (median lobe often much longer than lateral ones); flowers and leaves arising from stem forks; foliage leaves forked (or trifurcate) several times into thread-like ultimate segments; shoots 4 – 10 cm long; stamens 2, with free filaments much shorter than common stalk (andropodium); pollen in monads; ovary sessile; roots foliose *L. torrei* C. Cusset [Mozambique]
 — Scales entire or with inconspicuous lobes; main leaves forked once or twice into linear segments; stems 1 – 15 cm long; ovary stalked (i.e. with gynophore); stamens 2 (or rarely 1), with free filaments as long or slightly shorter than common stalk (andropodium); ovary with short stalk (gynophore, c. 1mm or less) 19

⁵¹ This seems to be a badly known species (type in Berlin destroyed, according to Cusset 1983)

19. Stems 1-2 cm long, unbranched or forked once; scales entire, triangular to ovate; capsule with 8 inconspicuous ribs; stamens 2; pollen in monads; roots foliose, deeply incised *L. thollonii* (Baillon) C. Cusset [Gabon]
 — Stems up to 15 cm long forked several times, with terminal foliage leaf in stem fork; scales lanceolate, entire or dentate or with 2 – 3 lobes; capsule with 6 prominent ribs (i.e. the 2 sutures not differentiated into ribs); stamens 2 (rarely 1); pollen in dyads; *root* (?) *L. adamesii* (G. Taylor) C. Cusset [Guinea, Sierra Leone]

KEY G: SECOND KEY TO THE 20 SPECIES OF *LEDERMANNIELLA* SUBGENUS *PHYLLOSOMA* (NEW KEY BY R. RUTISHAUSER; USING DATA FROM TAYLOR 1954; CUSSET 1983, 1987, 1997; COOK 2004)

This key gives more emphasis on the shape of the stem scales. It is based on the hypothesis that the shape of the scales is specific for species, or at least specific for certain species groups.

1. Scales tridentate to trilobate (at least along distal stem portions) or awl-shaped (subulate) 2
 — Scales ovate to broad-orbicular, scale margin smooth or with 5 – 7 (-10) teeth or lobes; scales never awl-shaped (*L. bosii* also with tridentate scales besides entire ones) 11
2. All scales awl-shaped or needle-like (loosely arranged around stem) *L. mertonii* C. Cusset
 — Tridentate or trilobate scales with middle tooth (lobe) much longer than (at least twice as long as) lateral ones; scales usually narrowed towards their insertion area; scales without additional dorsal teeth; awl-shaped (subulate) scales may be present along proximal stem portions; roots foliose or ribbon-like 3
 — Tridentate or trilobate scales with middle tooth as long as lateral ones (or only slightly longer); scales usually with somewhat broadened base (spathulate scales in *L. kamerunensis*); scales occasionally or regularly with additional dorsal tooth (teeth); entire scales (if present at all) not awl-shaped; roots ribbon-like (if known at all) 7
3. Stems and all twigs densely covered with scales; stems up to 5 cm long; pollen in dyads; roots ribbon-like 4
 — Scales do not cover stem completely; proximal stem portions with few or no scales at all; densely overlapping scales only found along the distal flower-producing twigs; main stems usually 10 cm and more (in some species much longer, up to 80 cm); frequently forked; stamen 2; pollen in monads or dyads; roots foliose or unknown 5
4. Capsule with 6 conspicuous ribs (the two suture ribs inconspicuous); stamen 1; pollen in dyads; stems short, up to 1 cm long, rarely branched; ribbon-like roots c. 1 mm wide *L. taylorii* ⁵²C. Cusset [Guinea]
 — Capsule with 8 fine ribs, all equal; stamen (1 or) 2, clearly longer than ovary (free filaments twice as long as common base); pollen in dyads; stems usually 2 - 5 cm long,

⁵² It seems that this species is closely related to *L. abbayesii* and *L. adamesii*. These three species occur in West tropical Africa, more exactly in Guinea (*L. adamesii* also in Sierra Leone).

occasionally branched; ribbon-like roots up to 2 – 3 mm wide

*L. ledermannii*⁵³ (Engler) C. Cusset

[Angola; Cameroon: Lobé, Mboro, Ndian; Gabon; Zaïre; Ivory Coast]

5. Most scales trilobate, often very slender, up to 5 mm long (median lobe often much longer than lateral ones); flowers and leaves arising from stem forks; foliage leaves forked (or trifurcate) several times into thread-like ultimate segments; stems 4 – 10 cm long; stamens 2, with free filaments much shorter than common stalk (andropodium); pollen in monads; ovary sessile; roots foliose *L. torrei* C. Cusset [Mozambique]
 - Distal scales tridentate with long median tooth, or scales with 2 teeth; some proximal scales (especially those along proximal stems) entire, awl-shaped to narrow triangular; scales less than 2 mm long (*check!*⁵⁴); foliage leaves forked 2 or 3 times (*check*) into thread-like ultimate segments; each stem unit distally forked into two spreading twigs and a foliage leaf (“terminal leaf”) arising from the angle⁵⁵ in between; pollen in dyads; ovary stalked (with gynophore); plants from Guinea and Sierra Leone; *roots* (?) 6
6. Stems up to 30 cm long; *stipules* (?); scales, if not dentate, entire and subulate to narrow triangular; capsule with 8 prominent ribs (i.e. the 2 sutures also differentiated into ribs) *L. abbayesii* (G. Taylor) C. Cusset [Guinea]
 - Stems up to 15 cm long; foliage leaves often stipulate; scales, if not dentate, entire and lanceolate; capsule with 6 prominent ribs (i.e. the 2 sutures not differentiated into ribs) *L. adamesii* (G. Taylor⁵⁶) C. Cusset [Guinea, Sierra Leone]
7. Trilobate scales (c. 2 mm long) lanceolate, digitate with 3 linear and parallel lobes as long as common sheath; shoots 10 – 20 cm long; stamens 2, with free filaments much longer than common stalk (andropodium); pollen in monads; capsule with 8 equal ribs *L. paulsitae* C. Cusset [Congo; Gabon]
 - Tridentate scales (c. 1 mm long), carrying a conspicuous dorsal tooth which is recurrent; shoots 1 – 3 cm long, branched; plants look “prickly”; stamen 2 (or 3); capsule with 8 ribs, only 6 of them conspicuous (the two suture ribs inconspicuous); *roots* (?) *L. harrisii* C. Cusset [Sierra Leone] 8
 - Tridentate scales (c. 1 mm long), with or without dorsal teeth; the 1 or 2 dorsal teeth (if present) inconspicuous; capsule with 8 ribs 8
8. Capsule apex indented due to the prominent median ribs having a short apical tooth each; stamens 2, shorter or only as short as ovary; shoots only 5 – 15 mm long, stem entire or forked few times *L. congolana* (Hauman) C. Cusset [Zaïre]
 - Capsule devoid of apical teeth, with 8 equal ribs; stamens (1-)2, longer⁵⁷ than ovary; scales polymorph (some of them tridentate with equal teeth); compound leaves (if present at all) without stipules 9

⁵³ See Cusset (1987). Fig. 23-2: stem portion of *L. led.* with tridentate scales provided with dorsal tooth. Scales of *L. ledermannii* seem to be quite polymorph, with the three teeth or lobes equal or the the median one much longer than the 1 or 2 lateral ones.

⁵⁴ Check Taylor (1953:69) again: *L. adamesii* with scales up to 5mm.

⁵⁵ Single compound leaves inserted in the angles of repeatedly forked stems are also found in *Ledermannia bowlingii* (subg. *Ledermannia*) from Ghana (see Ameka et al. 2003; Rutishauser 2004). They may be called „terminal leaves“ because they terminate the mother stem unit and give rise to two twigs (daughter stems) which form the legs of the new stem fork.

⁵⁶ Check Taylor (1953) who found only cleistogamous flowers in *L. adamesii* (probably apomictic because pollen often lacking). Check also idea that *L. abbayesii* and *L. adamesii* are conspecific although both species were first described by Taylor (1953)!

⁵⁷ But see Cusset (1997, Fig. 1-B1/B4): *L. tenax* with androecium shorter than ovary

9. Stems usually 2 – 5 cm, branched; completely covered with scales; scales usually tridentate (rarely with dorsal teeth); marginal teeth often unequal, with median tooth longer than lateral ones; stamens (1-)2, free filaments twice as long as common base; pollen in dyads; ribbon-like roots up to 2 – 3 mm wide
*L. ledermannii*⁵⁸ (Engler) C. Cusset
 [Angola; Cameroon: Lobé, Mboro, Ndian; Gabon; Zaïre; Ivory Coast]
- Stems 5 – 7 cm long, branched; flowers arising along distal short-shoots which are densely covered with scales; proximal stem portions without scales; scales ovate and entire or tridentate with nearly equal teeth; stamens (1 or) 2, free filaments as long as common base; *monads or dyads?*⁵⁹; *roots (?)*
L. bosii C. Cusset [Cameroon: Lobé Falls, Ntem Falls]
- Robust plants with shoots up to 20 cm long; capsule with 8 obvious ribs; scales all tridentate and (usually) with 1 or 2 inconspicuous dorsal teeth; stamens 2, free filaments shorter than common base; pollen in monads; ribbon-like roots c. 1mm wide
L. tenax (C.H. Wright) C. Cusset [Angola; Zambia; Zimbabwe; Botswana]
- 11.** All scales entire ovate or orbicular to linear-oblong (rarely lobate or dentate); main leaves few, forked (if present at all); pollen in monads or dyads; stems 1 – 7 cm long; plants from Cameroon 12
- Scales clearly dentate (denticulate) or digitate; roots ribbon-like, up to 1 mm wide (as far as known); pollen in monads; stems longer than 10 cm (except for *L. digitata*) **15**
12. Scales spatulate, with narrow (petiole-like) base; scale margin entire or denticulate; flowers arising from the angles (axils) of uppermost stem forks; main leaves stipulate (?); *root (?)*; *monads or dyads?*⁶⁰
L. kamerunensis (Engler) C. Cusset [Cameroon: Campo River]
- Scales lanceolate to orbicular, with broad base (in *L. bosii* besides ovate and entire scales also tridentate ones with nearly equal teeth, see above) 13
13. Stems 5 – 7 cm long; proximal stem portions without scales; flowers arising along distal short-shoots which are densely covered with scales; main leaves without stipules; stamens 2; *monads or dyads?*⁶¹
L. bosii C. Cusset [Cameroon: Lobé Falls, Ntem Falls]
- Stems 1 – 2 cm long, unbranched or forked once, only scantily covered with scales; scales entire, triangular to ovate (0.5 mm long); stamens 2; pollen in monads; capsule with 8 inconspicuous ribs; roots foliose but deeply incised
L. thollonii (Baillon) C. Cusset [Gabon]
- Stems 2 – 3 cm long; branched; scales covering stems completely; stamens 1 or 2 14
14. Scales lanceolate to obovate (uppermost scales occasionally with 2 or 3 lobes); stamens 1(-2); pollen in monads; roots foliose *L. gabonensis* C. Cusset [Congo; Gabon]
- Scales orbicular (circular and flat) or nearly so; stamens 2; pollen in dyads; *roots (?)*
L. boumiensis C. Cusset [Cameroon: Ntem; Gabon]
- 15.** Scales digitate with 5 - 7 obtuse lobes, at least those in the upper portion of the main stems and the branches; stems up to 5 cm long; stamen 1, clearly shorter than ovary
L. digitata (Hess) C. Cusset [Angola]

⁵⁸ See Cusset (1987). Fig. 23-2: stem portion of *L. ledermannii* with tridentate scales provided with an inconspicuous dorsal tooth

⁵⁹ Nothing said by Cusset (1983); check material!

⁶⁰ This seems to be a badly known species (type in Berlin destroyed, according to Cusset 1983)

⁶¹ Nothing said by Cusset (1983)

- Scales broad elliptical, with margin 5 - 7 dentate to denticulate (or rarely lanceolate scales with 5 prominent teeth); shoots 5 – 25 cm long; flowers or flower clusters opposite to forked foliage leaves; stamens 2 or 3, with free filaments slightly to clearly shorter than common stalk (andropodium); *roots* (?)
L. annithomae C. Cusset [Cameroon: Ntem; Gabon]
- Scales dentate with 5 – 7 (-10) triangular teeth, densely overlapping at least along flowering twigs; stems 2 – 80 cm long; stamens 2 (rarely 1 in *L. fluitans*), at least as long as ovary 16
- 16. Ovary apex with 6 short teeth, i.e. each of the 3 ribs per valve with an apical tooth; shoots up to 50 or more cm long
L. warmingiana (Gilg) C. Cusset [Angola; Namibia]
- Ovary with 8 ribs but without apical teeth 17
- 17. Shoots 2 – 15 cm long *L. cristata*⁶² (Engler) C. Cusset
[Angola; Cameroon: Malaka, Mari, Mvigli; Central African Republic; Gabon]
- Shoots up to 80 cm long *L. fluitans* (Hess) C. Cusset [Angola]

7. *Leiothylax* Warming

(Cook 1996, Fig. 318)

Leiothylax Warming, Overs. Kong. Danske Vid. Selsk. Skr. Ser. 6. 9: 147 (1899); Cusset, Les genres *Leiothylax* et *Letestuella*. Adansonia Sér. 2. 20: 199-209 (1980), rev.
Leiocarpodicraeia (Engler) Engler, Bot. Jahrb. Syst. 38: 98 (1905).

Roots foliose, entirely attached to rock or partly free and floating. Stems branched, erect, up to 30 cm or more long. Leaves up to 4 cm long, linear or forked with linear segments. Spathellas ovoid to subglobose. Flowers inverted in unruptured spathella, solitary or in clusters, the pedicel elongating after anthesis, 1 – 2 cm long in fruit. Tepals 2, one each side of the andropodium, much shorter than the ovary or stamens, less than 0.4 mm long. Stamens 2 (3), born on an andropodium; pollen in monads. Capsules with gynophore up to 3 mm long, subglobose, smooth, 1-locular⁶³, opening by 2 equal and caducous valves; stigmas 2, linear. Three spp., tropical Africa.

KEY TO THE 3 SPECIES OF *LEIOTHYLAX* (ACCORDING TO CUSSET 1980, 1997; COMBINED AND MODIFIED BY R. RUTISHAUSER)

1. Persisting leaves only at the tips of elongate shoots, more proximal leaves drop before anthesis; most flowers at the shoot tips
L. quangensis (Engler) Warming [Cameroon: Sanaga; Zaïre]
- Leaves along the stems (twigs) present until anthesis; flowers often solitary along the stems, arising from the leaf axils (or seemingly so) 2
2. Shoots frequently branched; leaves and flowers arranged irregularly along the stems
L. drummondii C. Cusset [Zambia]
- Shoots simple; flowers and subtending leaves secund, all along the same stem sector
L. callewaertii G. Taylor ex C. Cusset [Zaïre]

⁶² Check if *L. cristata* [Angola to Cameroon] and *L. fluitans* [Angola] are conspecific.

⁶³ According to Cusset (1987)

Note: There may be more *Leiothyllax* species in Africa, such as *L. penicilloides* A. Chevalier and *L. sessilis* A. Chevalier [both Central African Republic: Nana Falls], *L. sphaerothyllax* (Engler) Engler [country?] and *L. violascens* (Engler) C. H. Wright [Malawi]. C. Cusset (1980) labelled the first two taxa as “species excludendae”, the latter two taxa as “species non satis cognitae”. The monotypic genus *Zehnderia* (with *Z. microgyna*, Cameroon; with globose, ribbed capsules) is probably closely related to *Leiothyllax*!

8. *Letestuella* G. Taylor

(Cook 1996, Fig. 319)

Letestuella G. Taylor, Bull. Brit. Mus. Nat. Hist. Bot. 1: 57 (1953); C. Cusset, Adansonia Sér. 2. 20: 199-209 (1980), rev.

Roots ribbon-like, branched. Stems arising from the margin of the root, elongated, branching, up to 6 cm long. Leaves linear or forked with linear segments, up to 4 cm long but usually less, often with stipule-like teeth at the base. Spathellas oblong-ovoid, surface rough, becoming campanulate with revolute teeth after rupturing. Flowers erect in the spathella, 2 or 3 in irregular clusters, or rarely solitary, subsessile at anthesis; pedicels elongating to \pm 1 cm long in fruit. Tepals 2, very small, 1 each side of the andropodium or stamen filament. Stamens 2 or 1, when 2 then born on an andropodium with very short filaments; pollen in monads. Capsules 1-locular⁶⁴, globose, smooth and shiny, papillate at the tip, born on a short, 0.4 – 0.5 mm long gynophore, opening by 2 equal and caducous valves; stigmas 2, linear to clavate. This monotypic genus seems to be related to the monotypic genus *Djinga* from Cameroon! *Djinga* has globose to subglobose capsules with three somewhat flattened ribs per valve, whereas *Letestuella* capsules are smooth.

One sp., *L. tisserantii* G. Taylor [Western to Southern Africa: Benin; Ivory Coast; Mali - Niger Falls near Bamako; Cameroon: Sanaga, Vina; Central African Republic; Angola; Namibia].

9. *Macropodiella* Engler

(Cook 1996, Fig. 323)

Macropodiella Engler, Bot. Jahrb. Syst. 60: 466 (1926); Cusset, Adansonia Sér. 2. 17(3): 293-303 (1978), rev.

Roots foliose or ribbon-like. Stems simple or branched, very short or in some species up to 85 cm long. Leaves usually divided into linear or capillary segments or scale-like. Flowers inverted within the unruptured spathella, solitary or in clusters of up to \pm 12 flowers, either terminal or on elongated stems in leaf axils but appearing opposite leaves (secund); pedicel reaching up to 1.5 cm long in fruit. Tepals 2, linear to filiform born one each side of the andropodium. Stamens 1 or 2 or 3; pollen in monads. Capsules born on a gynophore up to 2 mm long, ellipsoidal, laterally flattened, 1-locular⁶⁵, opening by 2 equal and caducous valves; each valve with 3 ribs; stigmas variable simple and elongate or divided into linear lobes or cock's comb-like with flattened and serrated margins. Six spp., tropical W Africa including Equatorial Guinea.

KEY TO THE 6 SPECIES OF *MACROPODIELLA* (ACCORDING TO CUSSET 1978, 1987; COMBINED AND MODIFIED BY R. RUTISHAUSER)

⁶⁴ According to Cusset (1987), but 2-locular according to Obermeyer (1970: Fig.31-1d)

⁶⁵ According to Cusset (1987)

1. Stamen 1, stigmas 2, linear, irregularly branched shoots, flowers in fascicles towards shoot tips (not secund along the main stem)
M. macrothyrsa (G. Taylor) C. Cusset [Guinea] 2
- Stamens 2 or 3 (ocasionally 1 in *M. pellucida*) 2
2. Stems and conspicuous leaves usually lacking⁶⁶; all flowers arising from upper surface of foliose root; stamens 1 or 2; stigmas 2, linear
M. pellucida (Engler) C. Cusset [Cameroon: Mundemba, Nkong'samba]
- Main stems 3-17 cm long, irregularly branched, lateral branches forked more than once; distal leaves forked 2 – 3 times; flowers towards shoot tips (not secund along the main stem); stamens 2; stigmas 2, short, entire or toothed
*M. garrettii*⁶⁷ (C.H. Wright) C. Cusset [Sierra Leone]
- Main stems 20 – 85 cm long, conspicuous branches only from base; secund (= comb-like) arrangement of solitary flowers or flower fascicles along main stem; seemingly opposed to forked leaves which also show secund arrangement; stamens 2 or 3 3
- 3 Flowers solitary (rarely in pairs); stigmas entire, very short; stamens 3 (rarely 2); stems 20 – 40 cm long; forked leaves 5 – 10 mm long, with linear segments
M. hallaei C. Cusset [Gabon]
- Flowers in fascicles of 2 - 7 (occasionally solitary in *M. heteromorpha* and *M. uoroensis*) 4
4. Shoots up to 85 cm long; internodes along main stem (15-) 20 – 30 (-40) mm; leaves up to 9 cm long, with segments 2 – 4 mm broad; fascicles with up to 7 flowers
M. taylorii (De Wilde & Guillaumet) C. Cusset [Ivory Coast]
- Shoots up to 60 cm long; internodes usually less than 20 mm; leaves up to 25mm, with segments linear or thread-like 5
5. Stigmas entire, very short; stamens 3 (rarely 2); stems 40 – 60 cm long; forked leaves 5 – 10 mm long, with linear segments; fascicles usually with 3 – 4 flowers (rarely 2 or 1)
M. uoroensis Rial⁶⁸ [Equatorial Guinea]
4. Stigmas cock's comb-like with serrate margins; stamens 2 (rarely 3); forked leaves up to 25 mm long, with linear to thread-like segments; fascicles usually with 2 or 3 flowers (rarely 1)
M. heteromorpha (Baillon) C. Cusset
 [Cameroon: Nyong - Makak; Gabon; Ivory Coast]

10. *Paleodicraeia* C. Cusset

(Cook 1996, Fig. 328)

Paleodicraeia C. Cusset, *Adansonia Sér.* 2. 12(4): 562 (dated 1972, published 1973).

Roots ribbon-like, branched, ± 1 cm wide. Stems arising along the margins of the root, up to ± 2 cm long, branched and covered with at least 8, overlapping scale-like leaves. Leaf bases persistent, 1.5 – 2 mm long, swollen and overlapping, shallowly 3-lobed; the lateral lobes stipular; the central lobe (or blade) caducous, linear and entire or bifid. Spathellas ovoid, splitting more or less regularly down one side. Flowers erect in the spathella, subsessile, solitary at the ends stems or their branches; pedicel reaching 2 mm long in fruit. Tepals 2, lanceolate, 0.5 mm long, 0.2 mm wide at the base, one each side of the andropodium. Stamens

⁶⁶ Check if Cusset (1987: 64) is right citing Engler: „Selon Engler, il existerait également des pousses stériles, faites de grandes lames foliacées plurinervées...“.

⁶⁷ Check if Taylor (1953: 69) is right with his hypothesis that *M. garrettii* is closely related to *Ledermanniella adamesii*! See for another plate with drawings of *M. garrettii* (syn. *Dicraeia garrettii* C.H. Wright): Hook. Ic. Pl. Vol. 31, Plate 3042 (1915), as cited in Taylor (1953)

⁶⁸ This species newly described by Rial (2002) may be nothing but a luxuriant form of *M. hallaei*!

2 born on an andropodium; *pollen unknown*. Capsules ovoid, 1- or 2-locular⁶⁹, opening by 2 equal valves; each valve with 5 ribs⁷⁰; stigmas 2, linear and short.

One sp., *P. imbricata* (Tulasne) C. Cusset [Madagascar].

11. *Saxicolella* Engler

(Cook 1996, Fig. 333)

Saxicolella Engler, Bot. Jahrb. Syst. 60: 456 (1926).

Pohliella Engler, Bot. Jahrb. Syst. 60: 457 (1926).

Butumia G. Taylor, Bull. Brit. Mus. Nat. Hist. Bot. 1: 55 (1953).

Aulea C. Cusset ex Lebrun & Stork, Enum. Pl. Fleurs Afr. Trop. 1: 79 (1991), nom. illeg.

Roots foliose or ribbon-like. Stems rudimentary or well developed, up to 20 cm long, somewhat flattened, simple or branched. Leaves linear and simple, forked or lacinate with linear ultimate segments; leaves below spathellas occasionally with stipular teeth. Spathellas ovoid, opening irregularly at the apex. Flowers erect in the spathella, solitary or in loose clusters, hardly exceeding the spathella; pedicels up to 2 mm long. Tepals 2, minute, one each side of the filament. Stamen 1; pollen in dyads. Capsules ellipsoidal to fusiform, 1- or 2-locular⁷¹, opening by 2, equal⁷² and persistent valves; each valve with 3 or 5 narrow ribs; stigmas 2, linear. About six spp. in western tropical Africa, from Angola to Nigeria.

11bis. *Butumia*⁷³ G. Taylor

(Cook 1996, Fig. 301)

Butumia G. Taylor, Bull. Brit. Mus. Nat. Hist. Bot. 1: 55 (1953).

Merged with *Saxicolella* by Cusset

Roots ribbon-like, ± 2 mm wide, branched, resembling a liverwort, sometimes connected by thread-like roots. Stems arising endogenously from the margin of the root, simple, very short. Leaves in rosettes, sessile, subulate; the inner leaves subtending flowers with stipular teeth. Spathellas ovoid, apiculate, ± 1 mm long. Flowers erect in the spathella, terminal, solitary, subsessile. Tepals 2, minute, 1 each side of the stamen. Stamen 1; filament ultimately 1 – 2 mm long; anther ± 0.5 mm long; pollen in dyads. Capsules ovoid, ± 1 mm long, unilocular⁷⁴, opening by 2 equal valves; each valve with 3 ribs; stigmas 2, unequal, flattened, ovate to elliptic in outline, divergent, persisting in fruit. One sp., *B. marginalis* G. Taylor, River Butum, Nigeria. C. Cusset merged this monotypic genus with *Saxicolella*, as *Saxicolella marginalis* (G. Taylor) C. Cusset (see also Lebrun & Stork 1991).

KEY TO THE 6 SPECIES OF *SAXICOLELLA*, INCLUDING *BUTUMIA* AND *POHLIELLA* (ACCORDING TO TAYLOR 1953; HALL 1971; CUSSET 1978, 1987; AMEKA ET AL. 2002; COMBINED AND MODIFIED BY R. RUTISHAUSER)

1. Shoots lacking or very short; rosettes with up to 6 (?) leaves and single terminal flower each arising from endogenous buds of ribbon-like roots 2
- Shoots well developed; leaves and flowers along elongate stems 3
2. Leaves linear or forked with 2 – 4 linear segments, 1.5 – 3 mm long; roots foliose; ovary and capsule fusiform, unilocular

S. nana Engler [Cameroon: Mbalmayo - Nyong]

⁶⁹ Check (not mentioned by Cook 1996)

⁷⁰ These ribs seem to be arranged similar to those in *Endocaulos* and *Stonesia*: see Cusset 1972: fig.2-4

⁷¹ *S. amicomum* and *S. submersum* with bilocular ovaries; see Ameka et al. (2002), other species seem to be 1-locular according to Cusset (1987), see also in key below.

⁷² They are unequal according to Perrier (1952: 10).

⁷³ We still should check the possibility to keep *Butumia* as a genus on its own! It may finally end up as more closely related to *Djinga* and *Letestuela*, two other genera from tropical W Africa with nearly globose ovaries (capsules). Typical *Saxicolella* capsules (ovaries) are spindle-shaped....

⁷⁴ 1-locular according to Hall (1972) and Taylor (1953: fig.2-8)

- All leaves subulate, up to 1.5 (?) mm long; roots ribbon-like, c. 2 mm wide; ovary and capsule ovoid
S. marginalis (G. Taylor) C. Cusset
(syn. *Butumia marginalis* G. Taylor) [Nigeria: River Butum]
- 3. Roots filiform or narrow ribbons, usually <1 mm wide 4
- Roots foliose, stems up to 20 cm long, branched (forked) several times; leaves up to 3 cm long, divided into thread-like segments
S. flabellata (G. Taylor) C. Cusset [Cameroon & Nigeria: Ndiar River]
- 4. Shoots branched and up to 50 cm long; leaves 4-16 cm long, simple and thread-like; flowers probably cleistogamous and not emerging
S. submersa (J.B. Hall) C.D.K. Cook & Rutish.
- Shoots usually simple, unbranched, 1 – 12 cm long 5
- 5. Leaves 5 – 18 mm long, simple or bifid with linear segments
S. amicorum J.B. Hall [Ghana: Ankasa River]
- Leaves c. 10 mm long, simple and 7 – 8 mm wide in lower half, then divided (forked) irregularly into linear segments
S. laciniata (Engler) C. Cusset [Cameroon: Bakaka – Dinger River, Bawan River]

12. *Sphaerotherylax* Bischoff ex Krauss

(Cook 1996, Fig. 334)

Sphaerotherylax Bischoff ex Krauss, Flora 25: 426 (1844).

Anastrophea Weddell, in A. de Candolle, Prodrum 17: 79 (1873).

Roots foliose and lobed with rounded lobes (rarely ribbon-like⁷⁵). Stems arising from the upper surface of the root either very short and simple or elongate and branched, up to 10 cm or more long. Leaves either forked with linear segments and 2 – 7 (-12cm) long, or scale-like. Stipular teeth usually present and attached to slightly widened leaf sheath⁷⁶. Vegetative parts often red, or green and flushed red. Spathellas globose, rupturing irregularly. Flowers either solitary, subtended by 2 bracts and sessile on the upper surface of the creeping root, or in clusters and subtended each by a filamentous leaf along the elongate stems, inverted in the unruptured spathe. Tepals 2, one each side of the filament. Stamen 1 (or 2⁷⁷); filament often flattened; pollen in dyads. Capsules subsessile, globose to subglobose, 2-locular⁷⁸, opening by 2 slightly unequal valves, the larger one persistent; each valve with 3 wide and flattened ribs; stigmas 2, short (c. 0.2 mm long), linear to ovate. Two or perhaps more spp., Madagascar, tropical East and S Africa.

KEY TO THE 2 SPECIES OF *SPHAEROTHERYLAX* (ACCORDING TO OBERMEYER 1970; CUSSET 1997; GILBERT 2000; COOK 2004; COMBINED AND MODIFIED BY R. RUTISHAUSER)

1. Roots foliose (up to >2 cm wide, resembling *Marchantia*), shallowly lobed; stems green, up to 30 cm long, sometimes apparently absent; leaves 2 – 4 (-12) cm long, divided into linear segments; stamen 1
S. abyssinica (Wedd.) Warming
[Ethiopia, Kenya, Tanzania, Malawi, Zimbabwe, Madagascar]

⁷⁵ *S. abyssinica* and *S. algiformis* have foliose roots, *S. algiformis* occasionally also ribbon-like roots, thus probably never thread-like... (see Cusset 1997, Gilbert 2000, Cook 2004).

⁷⁶ check if stipules present in *S. abyssinica*...

⁷⁷ *S. algiformis* with 1 stamen (Cusset 1997: Text; Cook 2004) or with 2 stamens (Obermeyer 1970: Text and Fig.31-2e; Cusset 1997: Fig. 3-4). Check Fries (1914) in Wiss. Ergebn. Schwed. Rhod.-Kongo-Exped. 1(1): 56, fig.11/1-14!; *S. abyssinica* always with 1 stamen

⁷⁸ 2-locular according to Jäger-Zürn (2000), unilocular according to Cusset (1972, 1997)

- Roots foliose and irregularly lobed, or ribbon-like and branched; stems usually red, 5 – 50 cm long; leaves 1 – 7 cm long, filiform, simple or repeatedly forked; stamens (*1? or*)
2 *S. algiformis* Bisch. ex Krauss [South Africa: Transvaal, KwaZulu-Natal, Cape; Zambia; Zimbabwe; Malawi; Mozambique]⁷⁹

13. *Stonesia* G. Taylor (Cook 1996, Fig. 335)
Stonesia G. Taylor, Bull. Brit. Mus (Nat. Hist.) Bot. 1(3): 59 (1953); Cusset, Le genre
Stonesia. Adansonia Sér. 2. 13: 307-312 (1973), rev.

Roots foliose⁸⁰. Stems simple or branched, very short or elongate and then 10 – 40 cm long. Leaves repeatedly forked into linear segments or scale-like, when scale-like then often lobed, with 1 or 2 lobes prolonged into thread-like appendages. Flowers either sessile on the upper surface of the creeping root, or along the elongate stems, either in clusters or solitary. Spathellas subsessile, ± 2 mm long subtended by 2 – 6, usually lobed, scale-like leaves. Flowers inverted in the unruptured spathella, solitary or in clusters; pedicel 0.4 – 1 cm long in fruit. Tepals 3, one each side of the andropodium, the third⁸¹ between the filaments. Stamens 2, born on an andropodium; pollen in dyads. Capsules broadly ellipsoidal, each valve with 5 or 7 ribs (i.e. with 12 or 16 per capsule⁸²), the ribs nearest the sutures shorter than the others and not reaching the ends of the valves, *2-locular*⁸³, opening by 2, equal and persistent valves; stigmas 2, linear. Four spp., tropical W Africa, confined to a small region in Guinea and Sierra Leone.

KEY TO THE 4 SPECIES OF *STONESIA* (ACCORDING TO TAYLOR 1953; CUSSET 1973; MODIFIED BY R. RUTISHAUSER)

1. Shoots unbranched, up to 10 cm long; flowers usually along two rows (orthostichies); only one row of flowers (i.e. 1-flowered short-shoots) well developed; flowers of second row stay rudimentary; thus inflorescence seemingly secund; bracts (leaves) of 1-flowered short-shoots entire or trifid or with 4 filamentous lobes (the 2 median lobes 3 – 5 times as long as the lateral ones)
S. taylorii C. Cusset [Guinea, near Fandanga, close to Mali border]
- Flowers irregularly arranged, not along two rows, solitary or in clusters; *bracts subtending flowers always entire* (?) 2
2. Stems simple, rarely bifid, up to 22 cm long; stigmas thread-like (0.3 mm long)
S. gracilis G. Taylor [Guinea; Sierra Leone]
- Stems branched 3
3. Stems up to 40 cm long; flowers arranged in clusters (fascicles); stigmas short (0.1 mm)
S. fascicularis G. Taylor [Guinea]
- Stems up to 12 cm long; flowers solitary and (*usually?*) subtended by a leaf; stigmas thread-like (up to 0.5 mm long) *S. heterospathella* G. Taylor [Guinea; Sierra Leone]

⁷⁹ endemic to South Africa according to Cook (2004), also other countries in South Tropical Africa according to Cusset (1997). Check if *S. algiformis* is nothing but a South African variant of *S. abyssinica*!

⁸⁰ Root not known in *S. fascicularis*!

⁸¹ A third tepal in the fork of the two filaments is also known from *Thelethylax* (Madagascar)!

⁸² *Stonesia*, *Endocaulos* and *Paleodicroaia* (the latter two genera from Madagascar) are the only African genera with 5 and more ribs per valve!

⁸³ 2-locular according to Cusset 1973, cross-sections of *Stonesia* capsules seemingly 1-locular (see Taylor 1953)

14. *Thelethylax* C. Cusset

(Cook 1996, Fig. 336)

Thelethylax C. Cusset, *Adansonia Sér.* 2. 12(4): 564 (1972).

Roots ribbon-like (up to 1 mm wide), branched, bearing shoots along the margins. Vegetative shoots and reproductive short-shoots of different shape. Vegetative stems of *T. minutiflora* bearing up to 4, often very long (10 – 100 cm) and repeatedly forked foliage leaves with linear ultimate segments (broad and entire blades with parallel venation occasionally in *T. minutiflora*); vegetative shoots of *T. isalensis* are rosettes, bearing 5 – 20 simple leaves, up to 5 cm above, widened and overlapping at the base, filamentous above. Reproductive short-shoots (with terminal flower each) restricted to few-leaved rosettes along roots (see key below). Flowers strongly inclined or inverted in the unruptured spathella, terminal, solitary. Tepals 3, one each side of the andropodium, the third between the filaments (subsp. *orientalis* Perrier with only 2 tepals). Stamens 2, born on an andropodium; pollen in dyads. Capsules obovoid, ± 1 mm long, 2-locular⁸⁴, opening by 2 equal or unequal valves; each valve with 3 wide ribs; stigmas 2, linear.

KEY TO THE 2 SPECIES OF *THELETHYLAX* (ACCORDING TO PERRIER 1952; CUSSET 1972; MODIFIED BY R. RUTISHAUSER)

Note: See more differentiating characters in the genus diagnosis above.

1. Spathellas subtended by 4 short oval bracts (i.e. sheaths lacking a filamentous blade); flowers inverted in the unruptured spathella; stigmas linear; vegetative stem only few cm long, continuing into 4 (or less) foliage leaves which are 10 – 100 cm long, with 10 – 20 subunits, each of them 10 – 15 cm long and repeatedly forked into thread-like segments; or (subsp. *orientalis*⁸⁵ Perrier?) foliage leaves with entire elliptical to oblong blade, 3-4 cm long and 7-17mm wide, containing several parallel nerves
T. minutiflora (Tul.) C. Cusset [Madagascar: several rapids and waterfalls]
- Spathellas subtended by 3 entire leaves with filamentous blade and broadened sheath; flowers strongly inclined or inverted in the spathella; stigmas club-shaped; stems lacking, non-flowering root-born rosettes with 5 – 20 simple leaves, up to 5 cm above, widened and overlapping at the base, filamentous above
T. isalensis (Perrier) C. Cusset [Madagascar: Isalo]

15. *Winklerella* Engler

(Cook 1996, Fig. 343)

Winklerella Engler, *Bot. Jahrb. Syst.* 38: 97 (1905).

Roots foliose to ribbon-like, 4 – 5 mm wide. Stems simple or branched, 1 – 3 cm long. Leaves up to 6 mm long, once or twice forked into linear segments; ultimate segments filamentous. Spathellas ellipsoid, attenuate towards the base. Flowers inverted in the unruptured spathella, solitary or in clusters; pedicel up to 1 cm long in fruit. Tepals 2, very small, not more than 0.2 mm long, one each side of the andropodium. Stamens 2 or rarely 3; pollen in monads. Capsules ovate in outline, strongly flattened laterally with 2 lateral wings, each longer than the capsule and forming 2, flattened, horn-like protuberances⁸⁶ each side of the stigmas, 1-locular⁸⁷, opening by 2 equal valves; stigmas 2 linear.

⁸⁴ According to Cusset (1972) and own studies (Rutishauser unpubl.)

⁸⁵ This must be identical to Perrier's "forma *insoleta*" (at least according to G. Cusset 1970: 124).

⁸⁶ Capsules with 2 horn-like protuberances are also observable in *Ledermannia congolana* (Cusset 1983).

⁸⁷ According to Cusset (1987)

One sp., *W. dichotoma* Engler [Cameroon: Sanaga-Edéa].

16. *Zehnderia* C. Cusset

(Cook 1996, Fig. 344)

Zehnderia C. Cusset, Flore du Cameroun 30: 56 (1987).

Roots foliose. Stems simple or branched, up to 3 cm long. Leaves ribbon-like, simple, 2 – 3 mm long, with stipules. Spathellas ovoid, \pm 1.5 mm long. Flowers inverted in the unruptured spathella, arranged irregularly, solitary or in clusters; pedicels up to 1.5 cm long in fruit. Tepals 2, filiform, 0.2 – 0.3 mm long, one each side at the base of the andropodium. Stamens 2 or rarely 3; anthers \pm 0.7 mm long; pollen in monads. Capsules globose, 0.6 – 0.7 mm long, 1-locular⁸⁸, opening by 2, equal valves; each valve with 3 ribs; gynophore up to 8 mm long; stigmas 2, equal, linear, 0.7 – 0.8 mm long. This monotypic genus is probably closely related to *Leiothylax* (with globose, smooth capsules).

One sp., *Z. microgyna* C. Cusset [Cameroon: Sanaga-Edéa]

⁸⁸ According to Cusset (1987)