Preliminary key to the genus *Lejeunea* in Brazil

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Introduction

A first key to 28 selected species of *Lejeunea* in Brazil was published by Reiner-Drehwald in Gradstein & Costa 2003.

In the present preliminary key 41 species of *Lejeunea* already recorded for Brazil or expected to be found there are treated. It is a partial result of the revision of the genus *Lejeunea* for Flora Neotropica (Reiner-Drehwald in prep.).

The key was prepared for

"An Overview of the genus *Lejeunea* in Tropical America – Workshop on *Lejeunea*" ,

a two-week workshop held in Recife (Universidade Federal de Pernambuco, Feb-Mar 2007). Comments or suggestions on the present key are welcome and will be used for its improvement.

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Observations on the key:

The key presented here includes two species more than the key tested in Recife.

Most of the species have already been described and/or illustrated (references to these are included). A few species are not published yet, the references on these will be included as soon as the publications appear.

Small and sterile collections of *Lejeunea* are difficult to identify. Fertile specimens with mature perianths are often needed to recognize the species.

Almost all species of *Lejeunea* often present undeveloped lobules; shoots with reduced lobules are not always easy to identify.

Many species appear more than once in the key, in order to take into account the different "shapes" they possess (e.g. *Lejeunea controversa* has perianth keels with teeth, cilia and lacinia, but forms with nearly "entire" perianths are also often found, as in the course in Recife …). But not all species can be included in a key with all the possible variation found. Therefore, it is advisable to begin learning to identify *Lejeunea*s with large and fertile collections.

1. Underleaves entire …… ***L. reflexistipula***

1. Underleaves bifid …… **2**

2. Lobule tooth (2-)3-18 cells long, 1-4 cells wide …… **3**

2. Lobule tooth 1(-2) cells long, 1 cell wide, or tooth undifferentiated …… **6**

3. Plants with caducous leaves; tooth 5-7 cells long, 1-4 cells wide; underleaves 50-75 % bifid, lobes ± divergent …… ***L. ptosimophylla***

3. Plants without caducous leaves; tooth (2-)3-18 cells long, 1-4 cells wide; underleaves 40-60 % bifid, lobes straight …… **4**

4. Lobule tooth (2-)3-4(-6) cells long, 1(2-) cells wide; perianth not compressed …… ***L. setiloba***

4. Lobule tooth (3-)6-18 cells long, 1-4 cells wide; perianth dorsiventrally compressed …… **5**

5. Lobule tooth 2-4 cells wide, (7-)10-18 cells long, tooth usually extending more than ½ across the lobe …… ***L. spiniloba***

5. Lobule tooth 1(-2) cells wide, (3-)6-11 cells long, tooth usually extending less than ½ across the lobe …… ***L. trinitensis***

6. Dorsal surface of lobe entirely or at least the distal half roughened (due to mammillose cells, i.e. with the cell lumen extending into protuberances; ex *Echinocolea*, see Ilkiu-Borges 2005) …… **7**

6. Dorsal surface of lobe smooth …… **8**

7. Plants 0.3-0.5 mm wide; entirely dorsal surface of leaves strongly roughened, margin and keel of leaves strongly crenate to denticulate …… ***L. asperrima***

7. Plants 0.4-0.8 mm wide; distal half of dorsal surface of leaves strongly roughened, margin of leaves strongly crenate to denticulate, keel and dorsal base of leaves smooth …… ***L. subspathulata***

8. Lobe apex acute to acuminate, (1-)2-3(-6) cells in a row …… ***L. ramulosa***

8. Lobe apex widely rounded to acuminate (then 1-2 cells in a row) …… **9**

9. Underleaf with a pronounced tooth 1-2(-3) cells long on each margin; cuticle strongly papillose; perianth with teeth, cilia and lacinia …… ***L. boryana***

9. Underleaf without marginal teeth or only occasionally with 1 small marginal tooth (when underleaf margin often with teeth, then perianth without ornamentation, see *L. laetevirens*); cuticle smooth or papillose; perianth with or without ornamentation …… **10**

10. Lobule usually well developed, 2/3 the lobe length, strongly inflated throughout or only along the keel and flattened near the lateral margin …….... ***L. inflexiloba***

10. Lobule when well developed smaller …….. **11**

11. Plants with caducous leaves; dioicous ..… Key to *Lejeunea* with caducous leaves

11. Plants without caducous leaves; dioicous or autoicous …….. **12**

12. Plants 0.3-0.8 mm wide, cuticle strongly papillose, plants absorb water slowly; mostly sterile, shoots fragile, vegetative reproduction by fragmentation of the plants; one of the most abundant and variable species in the Neotropics …….. ***L. laetevirens***

12. Plants 0.3-2.2 mm wide, cuticle papillose or smooth; fertile or sterile, vegetative reproduction absent or when present via cladia, caducous leaves or regenerants, not by fragmentation …… **13**

13. Perianth terete, without keels …… ***L. capensis***

13. Perianth 5-keeled, dorsal keel equally developed or shorter and less pronounced than the others …….. **14**

14. Perianth keels variously ornamented with teeth, cilia, and lacinia …….. **15**

14. Perianth keels entire, at most ± strongly crenate …….. **28**

15. Underleaves with lobes triangular to subulate, apex ciliate, 1-3(-5) cells in a row …… ***L. controversa***

15. Underleaves with lobes triangular, apex 1-2 cells in a row …….. **16**

16. Leaf apex (obtuse-) acute, apiculate to acuminate …… **17**

16. Leaf apex rounded ……..**21**

17. Leaf margin strongly crenate due to mammillose marginal cells; cuticle smooth; underleaves distant, 1.4-2.5 x the stem width; perianth keels 2-winged, wings irregular, 1(2-4) cells wide, outermost cells elongate, rarely with few cilia (2-3 cells long) …… ***L. raddiana***

17. Leaf margin entire to slightly crenate; cuticle smooth to slightly to strongly papillose; underleaves distant to contiguous to imbricate, 1.4-4 x the stem width; perianth keels with cilia and lacinia or only occasionally with cilia …….... **18**

18. Leaf lobes ovate to lanceolate, apex acute to acuminate, (1-)2-3(-6) cells in a row; underleaves contiguous to imbricate, 2.5-4 x the stem width; dioicous …… ……..…… ***L. ramulosa***

18. Leaf lobes ovate to ovate-falcate, apex acute to apiculate, 1-2 cells in a row; autoicous ……..… …….. **19**

19. Underleaves 2.7-4 x the stem width; plants 0.9-1.2 mm wide ….. ***L. controversa***

19. Underleaves 1.4-2.4 x the stem width; plants 0.4-1.0 mm wide ……..…… **20**

20. Perianth wings with lacinia (3-6 cells long, 2-3 cells wide) and cilia (1-3 cells long); dorsal leaf margin without teeth …….. ***L. grossitexta***

20. Perianth wings without lacinia, seldom with short cilia (2 cells long); dorsal leaf margin occasionally with few obtuse teeth near apex …… ***L. bermudiana***

21. Perianth beak long, 100-140 m long ……..... ***L. grossiretis***

21. Perianth beak shorter, 25-50 um long (up to 75 um in *L. cristulata*) …… **22**

22. Leaf lobule usually well developed, 2/3 the lobe length; dioicous ……..…… ***L. inflexiloba***

22. Leaf lobule when well developed smaller, < 1/3 or seldom up to ½ the lobe length; autoicous …….. …… **23**

23. Plants small, 0.3-0.7 mm wide ……..……..…… **24**

23. Plants medium sized, (0.6-)0.8-1.6 mm wide ……..…… **25**

24. Perianths emergent ½ its length beyond the bracts; keels 2-winged, wings 1(-2-3) cells wide, outermost cells of wing irregular, often elongated …… ***L. elliottii***

24. Perianths emergent 1/3 its length beyond the bracts; keels with teeth and cilia; leaves distant; epiphyte (description based only on scanty type material) ……..… ***L. spinuliflora***

25. Underleaves 2.7-4 x the stem width, underleaf apices ciliate, 1-3(-5) cells long; cuticle strongly papillose; perianth 5(-4)-keeled, dorsal keel absent or shorter and less pronounced than the others …….. …….. ***L. controversa***

25. Underleaves 1.3-2.4 x the stem width, underleaf apices obtuse to acute, 1 cell at the apex; cuticle smooth to slightly papillose; perianth 5-keeled, all keels ± equally developed …… **26**

26. Leaf lobe apex rounded to subacute, often recurved (also seen in dried condition under the dissecting scope); leaf cells with small trigones, without intermediate thickenings; on rocks in or near rivers or waterfalls, or on soil, almost always in very humid or wet conditions, also partially submersed …….. ***L. laeta***

26. Leaf lobe apex rounded and plane; leaf cells with small to medium sized trigones and 0-2 intermediate thickenings; epiphytes, epiphylls or on rotten logs ……. **27**

27. Lobule inflated throughout, free margin involute, tooth 20-30 µm long; perianth lateral keels somewhat expanded above, occasionally with short cilia (2 cells long) ……..…….. ***L. cristulata***

27. Lobule inflated along the keel and the lateral margin appressed to the lobe, tooth 50-55 um long; perianth lateral keels not expanded above, with teeth, cilia and lacinia …… ***L. cristulaeflora***

28. Underleaves distant, strongly appressed on the stem, 75-95 um wide, 1-1.4 x the stem width, lobes triangular, apex with 1-2 cells in a row, apical cells of the lobes and occasionally also marginal cells extremely thin-walled and therefore collapsed ……..…….. ***L. filipes***

28. Underleaves distant to imbricate, not strongly appressed on the stem, wider than the stem, 1.5-4.5(-7) x the stem width, all cells equally thick walled ..…….…… **29**

29. Underleaf apices ciliate, 1-3(-5) cells long; cuticle strongly papillose; perianth without ornamentation or with few teeth when poorly developed, but often densely covered with cilia and lacinia …….. …….. ***L. controversa***

29. Underleaf apices not ciliate, 1(-2) cells in a row; cuticle smooth or papillose; perianth keels entire, at most crenate …… **30**

30. Underleaves (3-)4-7 x the stem width; gynoecia with 0-1(-2) innovations; perianths 1-7 in a cymose row ……..……..…… **31**

30. Underleaves smaller, 2-4 x the stem width; gynoecia with 1-2 innovations (0 innovations not observed); perianths 1-3 in a row …… **32**

31. Underleaves 4-5.5(-7) x the stem width; cuticle papillose; dioicous; gynoecia with 0-1(-2) innovations; gynoecia 1-2(-3) in a row …… ***L. cerina***

31. Underleaves 3-4.5 x the stem width; cuticle smooth; autoicous; gynoecia up to 5(-7) in a row …… ***L. obtusangula***

32. Lobule usually well developed, 2/3 the lobe length, strongly inflated throughout or only along the keel and distal half appressed on the lobe; dioicous …… ***L. inflexiloba***

32. Lobule when well developed smaller, usually 1/3 the lobe length or smaller, seldom up to ½ the lobe length (see *L. oligoclada*); autoicous or dioicous ……..… **33**

33. Perianth without beak, apex constricted and slightly depressed; plants 0.35-0.55 mm wide …… ***L. erostrata***

33. Perianth with beak, 1-3 cells long; plants usually > 0.6 mm wide (when smaller then perianth with beak conspicuous) …… **34**

34. Plants dioicous, often sterile; usually with vegetative reproduction via cladia, caducous leaves, regenerants from leaf margin, fragmentation of the shoot …... **35**

34. Plants autoicous, usually fertile; mostly without vegetative reproduction (seldom with caducous branches in *L. caulicalyx* and *L. angusta*) ……... **38**

35. Cuticle strongly papillose, the plants absorb water slowly; usually sterile, often with vegetative reproduction by fragmentation of the plants; underleaves often with a tooth on each margin; one of the most common and variable species in tropical America …….. ***L. laetevirens***

35. Cuticle smooth or slightly papillose; sterile or fertile; underleaves without marginal teeth …….. **36**

36. Plants mostly sterile with vegetative reproduction via numerous cladia; oil bodies numerous, 15-25(-50) per cell …….. ***L. cancellata***

36. Plants often with perianths and androecia; vegetative reproduction via regenerants and caducous leaves, seldom via caducous branches; oil bodies 2-4 per cell (*Lejeunea sp. B*) or oil bodies not known (*L. oligoclada*) …… **37**

37. Plants 0.4-0.8 mm wide; lobule ¼ to ½ the lobe length; underleaves 1.8-2.6 x the stem width …… ***L. oligoclada***

37. Plants 1.0-1.8 mm wide; lobule < 1/5 the lobe length; underleaves (2.3-)3.0-4.2 x the stem width …….. ***Lejeunea sp. B***

38. Underleaves contiguous to imbricate, seldom distant, 2.5-4.5 x the stem width, base rounded to slightly auriculate, seldom cuneate …….. **39**

38. Underleaves distant, 1.3-2.5(-3) x the stem width, base cuneate …… **41**

39. Oil bodies numerous, 20-40 per cell; underleaves usually wider than long; lobule usually reduced, when well developed oval, lateral margin involute and not seen *in situ* …… ***L. puiggariana***

39. Oil bodies 3-8(-9-13) per cell …… **40**

40. Cuticle papillose; lobe apex rounded; gynoecia 1-3 in a row …… ***L. flava***

40. Cuticle smooth; lobe apex narrowly rounded, acute to acuminate, up to 2 cells in a row; gynoecia 1-5(-7) in a row …….. ***L. obtusangula***

41. Lobe apex subacute to apiculate, 1-2 cells in a row …….…….…….. **42**

41. Lobe apex widely rounded to subacute …….…….…….. **43**

42. Leaf lobe on the dorsal distal half roughened due to convex to mammillose cells, lobe margin also strongly crenate, without teeth; perianth keels 2-winged, wings irregular, 1(2-4) cells wide, outermost cells elongate, rarely with few cilia (2-3 cells long) ……..…….. ***L. raddiana***

42. Leaf lobe on the dorsal side smooth, lobe margin crenate and occasionally with few obtuse teeth near apex; perianth keels 2-winged, wings 1 cell wide, crenate to denticulate, seldom with short cilia (2 cells long) …….. ***L. bermudiana***

43. Leaf lobe apex almost always recurved when dry (as seen under dissecting scope), extended or recurved when wet; underleaves at ± right angles to the stem; cell walls thin, without intermediate thickenings; on rocks or soil, in or near small rivers, often partially submersed ……..…… ***L. laeta*** (= *L. geophila*)

43. Leaf lobe apex plane or occasionally recurved when dry, extended or recurved when wet; underleaves mostly appressed on the stem; cell walls ± thin, with or without intermediate thickenings; epiphyll, epiphyte, rotten logs, seldom on soil or rocks, not submersed …… **44**

44. Underleaves 50-70 % bifid, lobes lanceolate, apex 1-2 cells in a row, sinus widely U- to V-shaped, margin without or with a small tooth; leaf cells with large trigones and intermediate thickenings; lobule when developed strongly inflated, lateral margin involute; perianth dorsiventrally compressed, obcordate with lateral keels ± dilated ……..…… ***L. magnoliae***

44. Underleaves at most 50 % bifid, lobes triangular, apex 1(-2) cells in a row, sinus mostly V-shaped, margin without teeth; leaf cells with small to medium-sized trigones, with or without intermediate thickenings; lobule variable; perianth not dorsiventrally compressed, at most dorsal keel shorter and less developed than the others …… **45**

45. Perianth keels 2-winged, wings 1-3 cells wide, …….. **46**

45. Perianth keels entire or when 1-2-winged with wings only 1 cell wide …… **47**

46. Plants 0.3-0.7 mm wide; lobules ½-1/3 the lobe length; gynoecia with 1 sterile innovation; perianth beak 35-50 µm long ……..…… ***L. elliottii***

46. Plants 0.5-1.2 mm wide; lobules 1/3-1/4 the lobe length; gynoecia with 1 (rarely 2) sterile or fertile innovation, up to 3 gynoecia in a row; perianth beak 40-75 µm long …….. ***L. cristulata***

47. Plants 0.4-0.9 mm wide; cuticle finely to strongly papillose; lobule up to 1/3 the lobe length ……..…….. ***L. angusta***

47. Plants 0.7-1.8 mm wide; cuticle smooth to finely papillose; lobule ¼-1/7 the lobe length …… **48**

48. Perianth shorter or as large as the bracts, seldom emergent up to ¼ its length beyond the bracts; perianth beak 50-85 µm long; lobe margin strongly crenate due to bulging cells; almost always growing on rotten logs …… ***L. immersa***

48. Perianth emergent ½ - 2/3 its length beyond the bracts; perianth beak 20-50 µm long (50-85 µm long in *L. monimiae*); lobe margin slightly crenate to entire; on rotten logs or epiphyllous …… **49**

49. Perianth beak 50-85 µm long; almost always epiphyllous …… ***L. monimiae***

49. Perianth beak 20-50 µm long; almost always on rotten logs or bases of trees …… **50**

50. Lobule line of union with stem long, subequal to keel; lobule tooth 1-celled; gynoecia terminal on short branches with one sterile innovation …… ***L. caulicalyx***

50. Lobule line of union with stem not long; lobule variable, mostly with one basal rectangular to triangular part and an apical tooth 1-4(-6) cells long and 1(-2) cells wide; gynoecia terminal on branches or on the main shooth, with one often fertile innovation, up to 3 gynoecia in a row …… ***L. setiloba***

Key to *Lejeunea* with caducous leaves

1. Leaf lobule with a rectangular base and a long tooth (1-4 cells wide, 5-7 cells long). …… ***L. ptosimophylla***

1. Leaf lobule tooth 1-celled . …… **2**

2. Leaf lobule rectangular, apical margin 6-8 cells long; plants large, up to 2.5 mm wide. …… ***Lejeunea sp. A***

2. Leaf lobule rectangular to triangular, apical margin 2-3 cells long; plants smaller. …… **3**

3. Leaf cells with triradiate trigones; bases of underleaves cuneate to quadrate; often with hyaline rhizoids on leaf margins; plants 0.9-1.7 mm wide ..…. ***L. tapajosensis***

3. Leaf cells without triradiate trigones; bases of underleaves rounded to cuneate …… **4**

4. Leaves ± suborbicular; underleaves large, 3.3-6 x the stem width, imbricate, sinus widely U- or V-shaped; plants 0.7-1.5 mm wide …… ***L. rionegrensis***

4. Leaves ± ovate; underleaves smaller, distant to contiguous, sinus V-shaped. …... **5**

5. Leaf lobe apex widely rounded, plane; plants 0.6-1.1 mm wide. …… ***L. phyllobola***

5. Leaf lobe apex rounded to subacute, often recurved; plants larger or smaller. ….. **6**

6. Plants 0.9-1.8 mm wide; often with microphyllous branches with large collars; lobules small, < 1/ 5 the lobe length. ……..…… ***Lejeunea sp. B***

6. Plants smaller, 0.3-0.8 mm wide; without microphyllous branches; lobules when developed up to ½ the lobe length ……..…….. **7**

7. Underleaves 40-50 % bifid ……..…. ***L. oligoclada***

7. Underleaves 50-75 % bifid ……..……..…… ***Lejeunea sp. C***

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