

# ANNOTATED KEY TO THE SPECIES OF *PLAGIOCHILA* (MARCHANTIOPHYTA) FROM BRAZIL

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## Abstract

*Plagiochila* is the largest genus of liverworts and exhibits an extraordinary variation of forms. About 135 species have been recorded from Brazil but many of them are synonyms. In this paper an annotated key is provided to 34 species of Brazil which are accepted as good species. This is an improved version of the preliminary key in "*The Hepaticae and Anthocerotae of Brazil*" (Gradstein & Costa, 2003). Eleven species have been added to the key (*P. amicta*, *P. dominicensis*, *P. flabelliflora*, *P. husnotii*, *P. heteromalla*, *P. olivacea*, *P. pseudoradicans*, *P. punctata*, *P. subbidentata*, *P. subundulata*, *P. superba*), five species names are changed (*P. flaccida* = *P. macrostachya*, *P. bryopteroides* = *P. deflexirama*, *P. martiana* = *P. patula*, *P. micropteryx* = *P. laetevirens*, *P. patentissima* = *P. crispabilis*) and 28 species names are new synonyms.

**Key-words:** Brazil, liverworts, Plagiochilaceae, taxonomy

## Resumo

*Plagiochila* é o maior gênero de hepáticas e apresenta grande variação fenotípica. Aproximadamente 135 espécies têm sido referidas para o Brasil, embora muitas se constituam em sinônimos. Neste trabalho é apresentada uma chave comentada para 34 espécies válidas, de ocorrência no Brasil. Considerando-se o que já foi publicado para o Brasil, são incluídas 11 espécies (*P. amicta*, *P. dominicensis*, *P. flabelliflora*, *P. husnotii*, *P. heteromalla*, *P. olivacea*, *P. pseudoradicans*, *P. punctata*, *P. subbidentata*, *P. subundulata*, *P. superba*) e cinco espécies tiveram sua identificação revisada (*P. flaccida* = *P. macrostachya*, *P. bryopteroides* = *P. deflexirama*, *P. martiana* = *P. patula*, *P. micropteryx* = *P. laetevirens*, *P. patentissima* = *P. crispabilis*) e 28 nomes são novos sinônimos.

**Palavras-chave:** Brasil, hepáticas, Plagiochila, taxonomia

## Introduction

*Plagiochila* (Dumort.) Dumort. (Plagiochilaceae) is considered the largest genus of the liverworts with about 400-450 species worldwide (Heinrichs, 2002). Characteristic of the genus are the rather firm, greenish or brownish plants with rigid stems with a thick-walled cortex, lateral branching (terminal or intercalary), succubous leaves with a ± reflexed dorsal margin and a decurrent base, usually toothed leaf margins, reduced underleaves, dioicy, and a flattened perianth with

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a wide, truncate mouth fringed by cilia or lacinia (rarely entire). *Plagiochila* exhibits an extraordinary variation of forms and about 135 species have been reported from Brazil. However, many of them have proved to be synonyms. In this paper a key is provided for 34 species recorded from Brazil that are currently accepted as other species see Gradstein & Costa (2003). In addition, a list of new synonyms is provided. Eight species recorded from Brazil have not been studied and are listed as "Further records"; probably they will turn out to be synonyms as well.

More than two third (22) of the Brazilian *Plagiochila* species have wide neotropical distributions and occur throughout tropical America. Furthermore, 5 species occur in the Neotropics and in Africa, 5 in the Neotropics and western Europe, 1 is restricted to the mountains of Central America, the Andes and Brazil, 3 are only known from good taxa. The key is an improved version of the one published in "*The Hepaticae and Anthocerotae of Brazil*" (Gradstein & Costa, 2003), which included 26 species. The improvements are based on the recent publications on Plagiochilaceae of J. Heinrichs and his group (e.g., Heinrichs, 2002; Heinrichs *et al.*, 2002a, 2004a, 2004b, 2005; Groth *et al.*, 2002, etc.) and on examination of herbarium materials including types. As a result, eleven species have been added to the key (*P. amicta*, *P. dominicensis*, *P. flabelliflora*, *P. husnotii*, *P. heteromalla*, *P. olivacea*, *P. pseudoradicans*, *P. punctata*, *P. subbidentata*, *P. subundulata*, *P. superba*), five species names are changed (*P. flaccida* = *P. macrostachya*, *P. bryopteroides* = *P. deflexirama*, *P. martiana* = *P. patula*, *P. micropteryx* = *P. laetevirens*, and *P. patentissima* = *P. crispabilis*) and 25 species listed as "Further records" in Gradstein & Costa (2003) (*P. aliena*, *P. aurea*, *P. caldana*, *P. cava*, *P. confertissima*, *P. denudata*, *P. fendleri*, *P. geniculata*, *P. hoehnii*, *P. itatiajensis*, *P. latifolia*, *P. lutescens*, *P. magnistipula*, *P. minarum*, *P. puiggarii*, *P. pulchella*, *P. scissifolia*, *P. subbiloba*, *P. subcontigua*, *P. subcristata*, *P. subligulata*, *P. sylvicultrix*, *P. thamniopsis*, *P. trichomanes*, *P. uleana*) are reduced to synonymy.

For each species newly included in the key, a brief note on morphology and distribution in Brazil is provided; for data on the the West Indies and Brazil, and 3 species are endemic to Brazil. The species ranges may be summarized as follows:

**Neotropical:** aerea, amicta, crispabilis, cristata, deflexirama, disticha, distinctifolia, dominicensis, gymnocalycina, laetevirens, macrostachya, montagnei, raddiana, rutilans, simplex, subplana, superba, vinctina

**Neotropical + Africa:** exigua, boryana, corrugata, punctata, stricta

**Neotropical + W Europe:** bifaria, exigua, diversifolia, patula, punctata

**Central America, Andes and Brazil:** heteromalla

**West Indies and Brazil:** husnotii, lingua, subbidentata

**Brazil only:** flabelliflora, olivacea, subundulata

### Key to the *Plagiochila* species of Brazil

Note: leaf characters should be studied from mature stem leaves, not from branch leaves.

1. Ventral leaf margin strongly crispate-undulate (see Gradstein & Costa, 2003: Fig. 76B) ..... *P. corrugata* (Nees) Nees & Mont. 2
1. Ventral leaf margin not crispate-undulate ..... 2
2. Leaves entire ..... 3
2. Leaves toothed or bifid ..... 5
3. Leaves orbicular, transverse to obliquely spreading .....  
..... *P. subundulata* Lindenb. [Note 1] 4
3. Leaves elongate, rather widely spreading ..... 4
4. Leaves 1–1.4× longer than wide, ventral leaf base without high shoulder: margin ± immediately curved outwards from the base (Fig. 1A,B) .....  
..... *P. lingua* Steph. 4
4. Leaves usually more than 1.4× longer than wide, ventral leaf base with a high shoulder: margin first curved upwards parallel to stem, then outwards (Fig. 1H) .....  
..... *P. patula* (Sw.) Lindenb. [Note 2] 4
5. Branches predominantly of the terminal-type (*Frullania*-type; branch base without collar), especially in the upper parts of the plants (a few intercalary branches may be present in the lower parts of the plant); very rarely branches lacking (Note 3). Asexual reproduction by propagula from leaf surfaces, or absent ..... 6
5. Branches predominantly of the intercalary-type (*Plagiochila* type; branch base with collar), or branches lacking (Note 3). Asexual reproduction by caducous leaves or leaf fragmentation, or absent ..... 16
6. Plants pinnate, branches numerous. Ventral leaf base shortly decurrent .....  
..... *P. deflexirama* Taylor [Note 4] 6
6. Plants dichotomous, branches usually rather few (rarely lacking). Ventral leaf base shortly or longly decurrent ..... 7
7. Ventral leaf bases strongly expanded ("ampliate"), concealing the stem (Fig. 1H,I). Leaves conspicuously narrowed towards apex ..... 8
7. Ventral leaf bases not or weakly expanded, not concealing the stem, ventral stem surface clearly visible (Fig. 1A,B). Leaves little narrowed towards apex.. 10
8. Ventral leaf base entire, usually longly decurrent (Fig. 1H) *P. raddiana* Lindenb. 8
8. Ventral leaf base toothed, shortly decurrent (Fig. 1I) ..... 9
9. Teeth on ventral leaf base linear (1 cell wide, except at base). Underleaves conspicuous, 0.5–1.5 mm long, with many cilia .....  
..... *P. disticha* (Lehm. & Lindenb.) Lehm. & Lindenb. 9
9. Teeth on ventral leaf base at least in part triangular (more than 1 cell wide). Underleaves vestigial, to 0.6 mm long, with few cilia ..... *P. montagnei* Nees 9
10. Ventral leaf base ± toothed (with linear teeth) .....  
..... *P. disticha* (Lehm. & Lindenb.) Lehm. & Lindenb. 10
10. Ventral leaf base entire ..... 11

11. Leaves 1–1.5× longer than wide, horizontally spreading ..... 12
11. Leaves 1.5–2.4× longer than wide, horizontally spreading or ventrad ..... 14
12. Underleaves present (small, to 1 mm long). Stems turning blackish-brown. Leaves ovate-oblong. Ventral leaf base without a high shoulder (for explanation see couplet 10). Leaf cells without distinct trigones. Oil bodies brown .....  
..... *P. diversifolia* Lindenb. & Gottsche
12. Underleaves ± absent. Stems not turning blackish-brown. Leaves ovate. Ventral leaf base with or without high shoulder. Leaf cells with distinct trigones. Oil bodies colorless..... 13
13. Leaves distinctly toothed and with a high shoulder at the ventral base: margin first curved upwards parallel to stem, then outwards (Fig. 1H) .....  
..... *P. laetevirens* Lindenb. [Note 5]
13. Leaves entire or sometimes with a few small, obscure teeth at apex, without a high shoulder: margin ± immediately curved outwards from the base (Fig. 1A,B)..... *P. lingua* Steph.
14. Leaves ventrad (= leaf surface tilted to the ventral side). Leaf margins with a border of ± thicker-walled cells. Plants rather small and delicate.....  
..... *P. distinctifolia* Lindenb.
14. Leaves horizontally spreading, not ventrad. Leaf margins without border of thicker-walled cells..... 15
15. Ventral leaf base without high shoulder, margin immediately curved outwards from the base (Fig. 1A,B). Leaves rectangular, margins conspicuously parallel: ventral and dorsal leaf margins almost straight.  
..... *P. crispabilis* Lindenb. [Note 6]
15. Ventral leaf base with a high shoulder: margin first curved upwards ± parallel to stem, then outwards (Fig. 1H). Leaves ovate-lingulate, margins not conspicuously parallel: ventral leaf margin distinctly curved, dorsal leaf margin ± straight ..... *P. patula* (Sw.) Lindenb. [Note 2]
16. Dorsal leaf margin toothed near the base (to be observed on vegetative leaves, not on leaves near the gynoecia). Plants robust..... 17
16. Dorsal leaf margin entire near the base. Plants small or robust..... 20
17. Ventral leaf base longly decurrent, toothed. Ventral leaf bases strongly expanded (= ampliate), concealing the stem (Fig. 1H,I) .... *P. vincentina* Lindenb.
17. Ventral leaf base shortly decurrent, toothed or entire. Ventral leaf bases not strongly expanded, not concealing the stem, ventral stem surface clearly visible (Fig. 1A,B)..... 18
18. Ventral leaf base strongly toothed ..... *P. husnotii* Steph. [Note 7]
18. Ventral leaf base entire..... 19
19. Leaves elongate-triangular, asymmetric. Leaf cells elongate, trigones radiate. Androecia in a fan-shaped cluster of 3–8 male branches .....  
..... *P. dominicensis* Taylor [Note 8]

19. Leaves ovate-oblong to rectangular, subsymmetric. Leaf cells subsodiametric, trigones lacking or simple triangular, not radiate. Androecia singly, not in a fan-shaped cluster ..... *P. subplana* Lindenb.
20. Leaves with only 2–3(-4) teeth. Plants small, less than 2 mm wide ..... 21
20. Leaves usually with more than 3 teeth. Plants small or large ..... 23
21. Leaves orbicular, apex rounded, entire or with 2-4 very small teeth. Leaf base shortly decurrent ..... *P. subundulata* Lindenb. (Note 1)
21. Leaves ovate to narrowly oblong, apex clearly bifid. Leaf base not decurrent ..... 22
22. Leaves ovate or ovate-oblong, 1-1.5× longer than wide. Cuticle smooth .....  
..... *P. exigua* (Taylor) Taylor
22. Leaves narrowly oblong, ca. 2× longer than wide. Cuticle finely papillose. West Indies and northern South America but not yet recorded from Brazil .....  
..... [*P. tenuis* Lindenb. (Note 9)]
23. Underleaves well-developed, to 3 mm long (but fragile, soon breaking off) .....  
..... *P. subbidentata* Taylor [Note 10]
23. Underleaves absent or rudimentary ..... 24
24. Leaves (sub)opposite ..... 25
24. Leaves alternate ..... 27
25. Mid-leaf cells 25–35 µm wide. Leaf margin bordered by thicker-walled cells. Leaves about as long as wide, often strongly secund (curved to one side). Androecia not in a fan-shaped cluster .....  
..... *P. heteromalla* Lehm. & Lindenb. [Note 11]
25. Mid-leaf cells larger, 35–60 µm wide. Leaf margin not bordered by thicker-walled cells. Leaves distinctly longer than wide, secund or spreading. Androecia in a fan-shaped cluster of (2–)3–8 male branches ..... 26
26. Ventral leaf bases strongly expanded ("ampliate"), concealing the stem (Fig. H,I) .....  
..... *P. macrostachya* Lindenb. [Note 12]
26. Ventral leaf bases not strongly expanded, not concealing the stem, ventral stem surface clearly visible (Fig. 1A,B). ..... *P. flabelliflora* Steph. [Note 13]
27. Leaves transverse to obliquely spreading (Gradstein & Costa, 2003: Fig. 78G,H). Leaf base with a vitta of elongate cells. Leaves sometimes fragmented, teeth or upper half of leaf broken off. Very common species .....  
..... *P. bifaria* (Sw.) Lindenb. [Note 14]
27. Leaves obliquely to widely spreading. Vitta lacking (but present in *P. punctata*: couplet 36). Leaves not fragmented (but sometimes caducous: falling off as a whole) ..... 28
28. Ventral leaf base expanded ("ampliate"), ± concealing the stem (Fig. 1H,I). Plants robust, 5–10 mm wide, leaves imbricate ..... 29
28. Ventral leaf base not expanded. Plants smaller, 2–5(-6) mm wide, leaves distant to subimbricate. .... 34

29. Mid-leaf cells large, 35–60  $\mu\text{m}$  wide. Androecia in a fan-shaped cluster of (2–)3–8 male branches ..... 30
29. Mid-leaf cells smaller, 20–35  $\mu\text{m}$  wide. Androecia not in a fan-shaped cluster ..... 32
30. Leaf cells papillose ..... *P. boryana* Steph.
30. Leaf cells smooth ..... 31
31. Leaves elongate-triangular, distinctly narrowed to apex. Teeth on leaf margins mostly linear (mostly 1 cell wide, except at the base) ..... *P. superba* (Spreng.) Mont. & Nees [Note 15]
31. Leaves ovate-oblong, not distinctly narrowed to apex. Teeth on leaf margins triangular (more than 1 cell wide) ..... *P. amicta* Steph. [Note 16]
32. Leaves ovate-oblong, not distinctly narrowed to apex. Leaf margin with a yellowish border of thicker-walled cells. Widespread in tropical America but not yet recorded from Brazil (see Heinrichs, 2002) .. [*P. adianthoides* (Sw.) Lindenb.]
32. Leaves elongate-triangular, distinctly narrowed to apex. Leaf margins without border of thicker-walled cells ..... 33
33. Leaves 1.8–2.5 $\times$  longer than wide, with 15–50 teeth, apex with 2 large teeth. Ventral leaf base toothed. Leaf apex usually with 2 large teeth (Gradstein & Costa, 2003: Fig. 79H) ..... *P. cristata* (Sw.) Lindenb.
33. Leaves less than 1.8 $\times$  longer than wide, with 2–20 teeth, apex not with 2 large teeth. Ventral leaf base  $\pm$  entire ..... *P. olivacea* Steph. [Note 17]
34. Mature leaves conspicuously elongate, 2–4 $\times$  as long as wide ..... 35
34. Mature leaves shorter, mostly 1.5–2(–2.5) $\times$  as long as wide (when in doubt try both leads) ..... 38
35. Mid-leaf cells conspicuously elongate, (1.5–)2–4 $\times$  as long as wide (Fig. 1F) ..... *P. aerea* Taylor
35. Mid-leaf cells shorter, 1–1.5(–2) $\times$  as long as wide (Fig. 1D) ..... 36
36. Leaves horizontally spreading (Fig. 1B,C). Leaf apex and upper margins with rather small teeth (Fig. 1C). Cuticle smooth. Plants with peppermint smell (when fresh, or in recent herbarium material). Perianth base enveloped by bracts ..... *P. rutilans* Lindenb.
36. Leaves ventrad (= leaf surface tilted to the ventral side of the stem; Fig. 1E). Leaf apex usually with 2 large teeth and a few smaller ones. Cuticle smooth or papillose. Plants without peppermint smell ..... 37
37. Plants more than 3 mm wide. Leaves distinctly asymmetrical (dorsal margin  $\pm$  straight, ventral margin strongly curved). Cuticle smooth. Perianth base “naked“, not covered by bracts . *P. gymnocalycina* (Lehm. & Lindenb.) Lindenb.
37. Plants smaller, less than 2 mm wide. Leaves subsymmetrical. Cuticle papillose. Perianth base covered by bracts. West Indies and northern South America but not yet recorded from Brazil ..... [*P. tenuis* Lindenb. (Note 10)]
38. Leaf cells papillose ..... *P. stricta* Lindenb.

38. Leaf cells smooth ..... 39
39. Leaves  $\pm$  ventrad (= leaf surface tilted to the ventral side of the stem; Fig. 1E), distinctly asymmetrical (dorsal margin  $\pm$  straight, ventral margin strongly curved), frequently caducous. Mid-leaf cells 15–30(–35)  $\mu\text{m}$  wide. .... 40
39. Leaves horizontally spreading (Fig. 1B,C), subsymmetrical, not caducous. Mid-leaf cells larger, 25–45  $\mu\text{m}$  wide. .... 41
40. Leaf cells very small, 13-18  $\mu\text{m}$  in diameter in midleaf. Leaves ovate, subtransverse with a short short insertion line, not caducous. Perianth covered by bracts ..... *P. pseudoradicans* Herzog (Note 18)
40. Leaf cells larger, 20-35  $\mu\text{m}$  in diameter in midleaf. Leaves ovate to oblong, not subtransverse, usually caducous. Perianth covered or not covered by bracts ..... 41
41. Leaves ovate, 0.9–1.2 $\times$  as long as wide, strongly caducous. Leaf base with a short vitta of elongate cells. Perianth base covered by bracts ..... *P. punctata* (Taylor) Taylor [Note 19]
41. Leaves more than 1.2 $\times$  as long as wide, caducous or not caducous. Leaf base without vitta. Perianth base “naked”, not covered by bracts..... *P. simplex* (Sw.) Lindenb.
42. Ventral leaf bases longly decurrent. Leaves ovate-oblong, with 20–100 teeth in the upper half. Common in montane forests of the Andes, not yet recorded from Brazil (see Müller *et al.*, 1999)..... [*P. alternans* Lindenb. & Gottsche]
42. Ventral leaf bases not or very shortly decurrent (Fig. 1B). Leaves ovate-oblong to rectangular, with 5–30(–40) teeth in the upper half or all around the margins. Common species of lowland and submontane rain forests ..... *P. subplana* Lindenb.

### Notes on species

(1) *P. subundulata* is an uncommon Brazilian species that has been recorded from Minas Gerais (Angström, 1876), Rio de Janeiro (Serra de Itatiaia, Schäfer-Verwimp 13272, hb. G-00048625) and São Paulo, (Serra do Bocaina, Schäfer-Verwimp 9607, hb. G-00048626). The species grows in dark-green mats on wet rock in rivers and near waterfalls in mountains areas, at ca. 1400-1800 m. The plants are small, ca. 1.5 mm wide, little branched, the leaves are suborbicular, transverse or obliquely spreading, shortly decurrent, with a rounded apex and entire leaf margins except for 1-4 very small teeth (1–2-cells long) at leaf apex, and the leaf cells are subsodiametric, ca. 20-25  $\mu\text{m}$  in diameter in mid-leaf, with small trigones and intermediate thickenings, and a smooth cuticle. A short vitta of larger, more elongate cells is present at leaf base. The species is related to *P. bifaria* but differs by the subentire leaves.

(2) *Plagiochila patula* (= *P. martiana* (Nees) Lindenb., syn. nov.) is a variable species that has been described under many different names. Characteristic are the dichotomous branching and the longly ovate-rectangular, toothed or subentire leaves with a high shoulder and an entire, not or weakly expanded

ventral base. The ventral leaf base may be longly or rather shortly decurrent. Plants with rather shortly decurrent ventral leaf bases were described as *P. martiana* (Nees) Lindenb. and plants with subentire leaves as *P. bunburii* Taylor, which are synonyms. *Plagiochila dubia* Lindenb. & Gottsche, reported from Rio de Janeiro and São Paulo, is a further synonym of *P. patula* (Heinrichs *et al.*, 2002).

(3) Unbranched specimens of *Plagiochila* are rather common in the group of species with intercalary branching but rarely occur in the group of species with terminal-dichotomous branching as well. *Plagiochila hoehnii* Herzog (described from São Paulo), for example, is an unbranched phenotype of *Plagiochila disticha*, a species which normally produces dichotomous-terminal branching. Such unbranched plants may be very difficult to identify. It is recommended to try both leads of couplet 5 for plants without any branches.

(4) *Plagiochila deflexirama* (= *P. bryopteroides* Spruce, syn. nov.) is recognized by the weakly to strongly expanded ventral leaf bases and the dense (bi)pinnate-terminal branching, with numerous terminal branches. All other neotropical *Plagiochilas* with terminal branching are dichotomous (and have few branches) except *P. tamariscina*, which also has densely pinnate-terminal branching. The latter species occurs in the West Indies and has not yet been recorded from Brazil, and is more delicate than *P. deflexirama*, with distant, narrowly elongate leaves (ca. 2-2.5× longer than wide) and not-expanded ventral leaf bases.

(5) *Plagiochila laetevirens* (= *P. micropteryx* Gottsche, syn. nov.) is a variable species that has been described under many different names. It is readily recognized by the rather short ovate-subrectangular leaves (1-1.5× longer than wide) with a high shoulder and coarsely dentate margins, and by dichotomous branching. The ventral leaf base may be slightly expanded or not, and the margin at the ventral base is distinctly recurved.

(6) *Plagiochila crispabilis* was described and illustrated by Gradstein & Costa (2003) and Gradstein & Ilkiu-Borges (2009) under the name *P. patentissima* Lindenb., which is a synonym (Gradstein, in prep.). The species is recognized by dichotomous branching and horizontally spreading, narrow-rectangular leaves (2-4× longer than wide) with ± parallel margins, short-decurrent ventral bases without a shoulder, and rather few teeth near the leaf apex. The species is very common in the Mata Atlântica, has been described under many different names and has often been confused with *P. patula*. The latter species is readily separated from *P. crispabilis* by the characters given in the key.

(7) *Plagiochila husnotii* has been collected once in the state of São Paulo (Apiahy) by Ule (Heinrichs, 2002). This species closely resembles *P. dominicensis*; for differences see under the latter species.

(8) *Plagiochila dominicensis* has been collected in Rio de Janeiro in the 19th century by Raddi and Glaziou (Heinrichs, 2002) but apparently not recently. The

species is recognized by 1) robust plants (5–10 mm wide) with intercalary branching; 2) leaves alternate, asymmetrically elongate-triangular to oblong, ca. 1.5–2× longer than wide, ventral base not amplified, margins with numerous ciliate teeth; 3) leaf margin at dorsal leaf base usually densely toothed, ventral leaf base shortly decurrent, entire; 4) leaf cells large, ca. 35–60 µm wide in mid-leaf; and 5) androecia in a fan-shaped cluster.

*Plagiochila dominicensis* resembles *P. husnotii* and *P. vincentina* in the toothed dorsal leaf bases. However, the ventral leaf bases in the latter two species are strongly toothed (entire in *P. dominicensis*). *Plagiochila vincentina* differs furthermore by the strongly expanded ventral leaf base (not expanded in *P. breuteliana* and *P. husnotii*) and the androecia being singly, not arranged in a fan-shape cluster.

(9) *P. tenuis* (= *Plagiochila bidens* Gottsche, syn. nov.) is not yet known from Brazil but should be expected there as it has been found in Guyana, on the northern slope of Mt. Roraima (*Gradstein* 5378) near to the Brazilian border. The latter material has erroneously been cited as originating from Brazil by Groth *et al.* (2002, as *P. bidens*) and Heinrichs *et al.* (2004a, as *P. bidens*). *Plagiochila tenuis* is readily recognized by: 1) plants delicate, less than 2 mm wide, with few intercalary branches; 2) leaves somewhat distant, ventrad, narrowly oblong, ca. 2× longer than wide, bifid (to 1/5), ventral margin sometimes with a few small, additional teeth; and 3) cuticle finely papillose. By its small size and bifid leaves, *P. tenuis* may be confused with *P. exigua* but the latter species has shorter, ovate leaves (to maximally 1.5× longer than wide) and a smooth cuticle. The record of *P. tenuis* from French Guiana, described and illustrated by Gradstein & Ilkiu-Borges (2009), is erroneous and probably belongs to *P. bifaria* (to be verified).

(10) *Plagiochila subbidentata* is an unusual *Plagiochila* species with large underleaves, to 3 mm long (Heinrichs, 2002). The underleaves are fragile, however, and often broken. The species was originally described from the West Indies but is rather widespread in southeastern Brazil, where it occurs from sea level to 2200 m on Serra do Itatiaia. The species has been recorded from Brazil under many different names, including *P. aurea* Steph. (Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina), *P. grandistipula* Herzog (Minas Gerais), *P. magnistipula* Herzog (Rio de Janeiro) and *P. subabrupta* Herzog (Minas Gerais, Espírito Santo) (Heinrichs, 2002; Gradstein & Costa, 2003).

(11) *Plagiochila heteromalla* has been recorded from Amazonas as *P. sylvicultrix* Spruce (Spruce, 1885), which is a synonym. The principal characters of *P. heteromalla* are 1) leaves subopposite, short-ovate (about as long as wide), with many sharp teeth and a border of thicker-walled cells; 2) leaf cells 25–35 µm wide in mid-leaf, with homogeneous oil bodies (Heinrichs, 2002); 3) androecia singly (not in a fan-shaped cluster of male branches); and 4) perianth base "naked", not covered by bracts. Opposite leaves also occur in *P. flabelliflora* and *P. macrostachya* but the latter two species differ from *P.*

*heteromalla* by leaves distinctly longer than wide, leaf border absent, leaf cells larger (35–60 µm wide in mid-leaf), oil bodies segmented, androecia in a fan-shaped cluster of several male branches, and perianth base covered by bracts.

(12) *Plagiochila flaccida* Lindenb., recorded from Serra do Itatiaia by Dusén (1903), is a phenotype of *P. macrostachya* with caducous leaves (Heinrichs, 2002).

(13) *Plagiochila flabelliflora* is endemic to southeastern Brazil where it occurs in montane forest at rather low elevation, below 1000 m (Heinrichs, 2002). The species resembles *P. macrostachya* in the ± opposite leaves, intercalary branching, leaf margins with numerous ciliate teeth (but dorsal leaf base entire), large leaf cells and terminal, androecia in a fan-shaped cluster, but differs from the latter species by the not-expanded ventral leaf base. *Plagiochila flabelliflora* also somewhat resembles *P. rutilans* but the latter species has alternate leaves, smaller leaf cells and androecia not in a fan-shaped cluster. Fresh material of *P. rutilans* is readily recognized by the strong peppermint smell. *Plagiochila apiahyna* Gottsche *nom. inval.* and *P. puiggarii* Steph. from São Paulo (Stephani, 1901–1905; Herzog, 1925; Schiffner & Arnell, 1964) are synonyms of *P. flabelliflora* according to Heinrichs (2002).

(14) *Plagiochila bifaria* (= *P. fragilis* Taylor, *syn. nov.*) is a common and widespread species that is readily recognized by: 1) stems upright and arising from a creeping stoloniform shoot, unbranched or with flagelliform branches; 2) leaves transverse and appressed to obliquely spreading, ovate-suborbicular, apical and dorsal margins toothed (leaf apex often with 2 larger teeth); 3) leaves often fragmenting and teeth or upper part of leaf broken away; 4) ventral and dorsal bases longly decurrent; 5) leaf cells with large trigones and with a vitta of larger and more elongate cells at leaf base; and 5) cuticle smooth or slightly papillose in the lower half of the leaf. *Plagiochila compressula* (Nees) Lindenb., reported from Brazil by Lemos-Michel (1999), is a synonym of *P. bifaria* according to Heinrichs *et al.* (2004a). *Plagiochila fragilis* Taylor, reported from Espírito Santo (Schäfer-Verwimp, 1991), is a phenotype of *P. bifaria* with fragmented leaves (Gradstein & Costa, 2003; Gradstein, in prep.).

(15) *Plagiochila superba* is a common Andean species that has been recorded a few times from the states of Amazonas, Roraima and São Paulo, at 450–850 m (Heinrichs, 2002). The species is somewhat similar to *P. amicta* but the leaves in *P. superba* are elongate-triangular with a rather narrow apex (ovate-oblong with a broad apex in *P. amicta*), and the teeth on leaf margins in *P. superba* are longer and ± linear (broader triangular in *P. amicta*). *Plagiochila superba* also resembles *P. macrostachya* but the latter species has subopposite leaves (alternate in *P. superba*).

(16) *Plagiochila amicta* is an uncommon Andean species that has been recorded a few times from Rio de Janeiro, São Paulo and Paraná, where it occurs in mountain forests at ca. 1500–2200 m elevation (Heinrichs, 2002). The species is rather similar to *P. superba* (see above). *Plagiochila amicta* also

resembles *P. macrostachya* but the latter species has subopposite leaves (alternate in *P. amicta*). *Plagiochila subbiloba* Herzog described from Morro Açu, Rio de Janeiro, is a synonym of *P. amicta* according to Heinrichs (2002).

(17) *Plagiochila olivacea* is only known from one collection from Apiahy made by Puiggari (Stephani 1905). The species is very close to *P. grandicrista* Steph. from the Andes and the mountains of Central America (for description see Heinrichs 2002), but differs from the latter by the weakly expanded ventral leaf base, which does not form a ventral crest. In *P. grandicrista* the ventral leaf base is very strongly expanded, forming a high ventral crest.

(18) *Plagiochila pseudoradicans* Herzog is a little-known species endemic to SE Brazil that has been collected in the Serra dos Orgãos, Rio de Janeiro (*von Lützelburg* 6929b, type, JE) and near the Estação Biológica "Alto da Serra", São Paulo (*F.C. Hoehne* 684, JE). The species resembles *P. punctata* but differs by smaller leaf cells, less than 20 µm in diameter (midleaf), a narrowly subtransverse leaf insertion, a weaker vitta, and leaves not or hardly caducous. The plants are medium-sized, 3-4 mm wide.

(19) *Plagiochila punctata* was recorded from Minas Gerais and São Paulo (Stephani, 1901–1905) as *P. denudata* Steph., which is a synonym (Heinrichs *et al.*, 2005). The species is readily recognized by: 1) small plants (1–3 mm wide) with strongly caducous leaves, leaving parts of the stem and whole branches sometimes completely denuded; 2) leaves shortly ovate (0.9–1.2× longer than wide), with a straight and entire dorsal margin and arched and toothed ventral margin; 3) leaf cells isodiametrical to somewhat elongate, ca. 20–35 µm wide in mid-leaf, with large trigones and a smooth cuticle; and 4) leaf base with a distinct vitta of larger, elongate cells. *Plagiochila punctata* resembles *P. stricta* but the latter species has not-caducous leaves and a finely papillose cuticle. It also resembles *P. pseudoradicans*; for differences see above (Note 17).

#### List of new synonyms (for details see Gradstein, in prep.).

- Plagiochila aliena* Gottsche = ***P. patula***  
*Plagiochila bidens* Gottsche = ***P. tenuis***  
*Plagiochila bryopteroides* Spruce = ***P. deflexirama***  
*Plagiochila caldana* Steph. = ***P. patula***  
*Plagiochila cava* Steph. = ***P. diversifolia***  
*Plagiochila confertissima* Steph. = ***P. deflexirama***  
*Plagiochila fendleri* Mont. = ***P. simplex***  
*Plagiochila fragilis* Taylor = ***P. bifaria***  
*Plagiochila geniculata* Lindenb. = ***P. bifaria***  
*Plagiochila hoehnii* Herzog = ***P. disticha***  
*Plagiochila incisa* Dugas = ***P. simplex***  
*Plagiochila itatiajensis* Steph. = ***P. simplex***  
*Plagiochila latifolia* Steph. = ***P. macrostachya***  
*Plagiochila lutescens* Steph. = ***P. aerea***

*Plagiochila martiana* (Nees) Lindenb. = ***P. patula***  
*Plagiochila minarum* Herzog = ***P. macrostachya***  
*Plagiochila micropteryx* Gottsche = ***P. laetevirens***  
*Plagiochila oresitropha* Spruce = ***P. heteromalla***  
*Plagiochila patentissima* Lindenb. = ***P. crispabilis***  
*Plagiochila pulchella* Steph. = ***P. simplex***  
*Plagiochila scissifolia* Steph. = ***P. simplex***  
*Plagiochila subcontigua* Herzog = ***P. laetevirens*** (fide J. Heinrichs, in sched.)  
*Plagiochila subcristata* Gottsche = ***P. raddiana***  
*Plagiochila subligulata* Steph. = ***P. crispabilis***  
*Plagiochila thamniopsis* Spruce = ***P. patula***  
*Plagiochila trichomanes* Spruce = ***P. crispabilis***  
*Plagiochila uleana* Steph. = ***P. flabelliflora***

#### Further species recorded from Brazil (not seen).

*Plagiochila kerneriana* S.W. Arnell – São Paulo (Schiffner & Arnell, 1964).  
*Plagiochila laciniosa* Dugas – Brazil, leg. Puiggari (Dugas, 1928). The type material is not in Paris (hb. PC).  
*Plagiochila latitrigona* Schiffn. – São Paulo (Schiffner & Arnell (1964).  
*Plagiochila maximiliana* Gottsche. – Brazil, without loc. (Stephani, 1901–1905). The type material is lost.  
*Plagiochila pastasensis* Steph. – "Brazil", Pastasa river, leg. Spruce (Stephani, 1917-1924). The material is from Ecuador.  
*Plagiochila patulooides* Schiffn. – São Paulo (Schiffner & Arnell, 1964).  
*Plagiochila thyoides* Spruce – São Paulo (Massalongo, 1911).  
*Plagiochila wiemanniana* S.W. Arnell – São Paulo (Schiffner & Arnell, 1964).

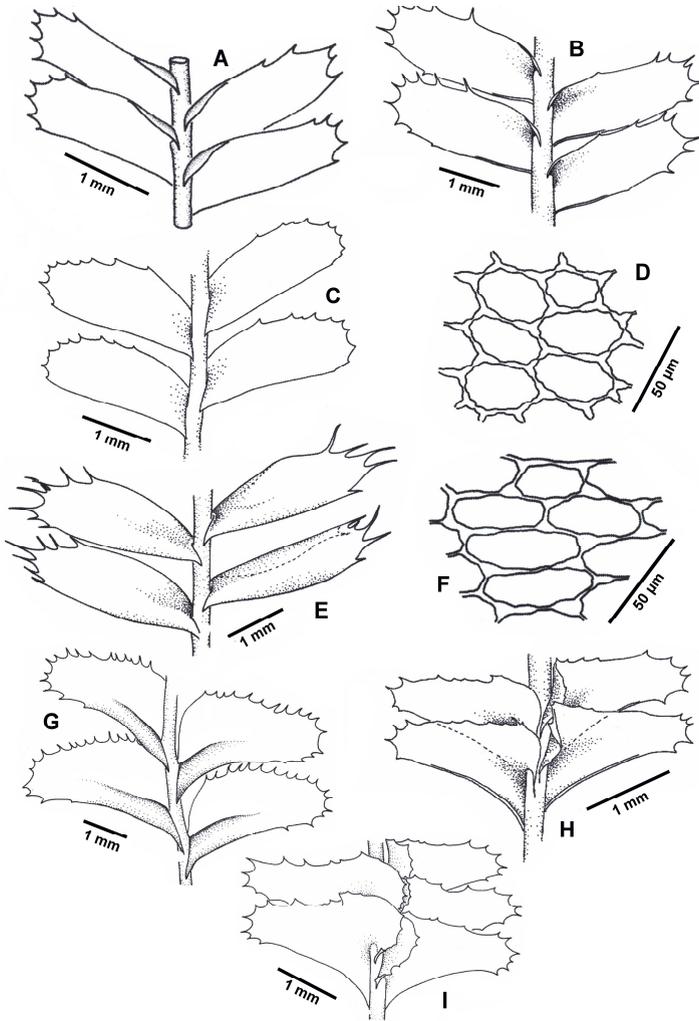
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**Figure 1.** *Plagiochila* species from Brazil. **A** – *P. crispabilis* Lindenb. (= *P. patentissima* Lindenb.), portion of plant in ventral view, showing terminal branching and subsymmetric leaves with  $\pm$  parallel dorsal and ventral margins; **B** – *P. subplana* Lindenb., portion of plant in ventral view; **C,D** – *P. rutilans* Lindenb.; **C** – portion of plant in dorsal view; **D** – mid-leaf cells; **E,F** – *P. aerea* Taylor; **E** – portion of plant in dorsal view; **F** – mid-leaf cells; **G** – *P. adianthoides* (Sw.) Lindenb., portion of plant in dorsal view, showing strongly swollen (“channeled”) leaf surface along the lower part of dorsal margin; **H** – *P. raddiana* Lindenb., portion of plant in ventral view, showing ventral leaf bases expanded and with a high shoulder, and rather longly decurrent; **I** – *P. montagnei* Nees, portion of plant in ventral view, showing ventral leaf bases being strongly expanded, toothed and shortly decurrent. All drawings by A.-L. Ilkiu-Borges.