

## THE GUARANÍ LAND – CHECKLIST OF HORNWORTS (ANTHOCEROTOPHYTA) AND LIVERWORTS (MARCHANTIOPHYTA) OF PARAGUAY<sup>1</sup>

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**Abstract.** The first ever liverwort and hornwort checklist is provided for Paraguay. Despite the high level of biological diversity in Paraguay, there remain very few intensive collecting efforts for liverworts and hornworts in the region since the late 1800's. We report 2 hornwort taxa and 71 liverwort taxa. The list is based on almost 100 literature references, including monographs, regional studies, and molecular investigations. Given the dramatic loss of habitats in Paraguay coupled with high species diversity in other organisms, further collecting of liverworts and hornworts is critical. There is also the potential to use historical records with contemporary collections to investigate the impact of habitat loss in the area.

**Key words:** Marchantiophyta, Anthocerotophyta, biodiversity, taxa

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### INTRODUCTION

The Republic of Paraguay (hereafter referred to as Paraguay) is situated almost in the center of South America where it is bordered to the south and southwest by Argentina, to the east and northeast by Brazil, and to the northwest by Bolivia. It's main population refer to themselves as Guaraní, which also is the name of one of the official languages and of the currency. Although Paraguay is mostly lowland (the highest point, Cerro Peró, is at 842 m), eastern Paraguay includes one of the worlds 35 biodiversity hotspots, the Atlantic forest. The Atlantic forest is the second largest rainforest of the American continent, once stretching almost continuously along the Brazilian coast and extending inland in the south and into eastern Paraguay and northeastern Argentina (Tabarelli *et al.*

2005). In the last three decades, alarming deforestation rates and the low percentage of Atlantic forest left by the 2000s call for immediate actions to halt the trends of forest loss (Huang *et al.* 2009). Hence, the Atlantic forest in South America has been identified as one of the top priority ecosystems for global biological conservation (Myers 1988; Olson & Dinerstein 2002). While the Atlantic forest in eastern Paraguay only accounts for a small portion of the geographic area of the Atlantic Forest ecoregion, it has an disproportionately high level of species diversity (Huang *et al.* 2009). The number of vascular plant species in eastern Paraguay was estimated at the order of 10,000 (Zardini 1993), while the number of invertebrate species in Paraguay was around 100,000 (Catterson & Fragano 2004).

The only systematic collection of liverworts from Paraguay dates back to the late 1800's, and was carried out by Benjamin Balansa who spent

<sup>1</sup> We dedicate this checklist to our friend and colleague Tamás Pócs. He has probably never been in Paraguay. If he had, the number of known species would have been much higher.

considerable time there. His first stay there was from 1873 to 1877, the second was from 1878 to 1884. He spent most of his time in Asunción and on his estate in the Paraguari province (Fourier 2005). Spruce (1888) reported a list of 28 liverworts based on Balansa's material and he later (Spruce 1890) described the collection publishing 14 new species. We here present the first ever checklist of 73 liverworts and hornworts for Paraguay in an effort to further promote bryological research in the region, and provide a foundation for revisionary studies and floristic research. As a comparison, the moss checklist for Paraguay (O'Shea & Price 2008) includes 240 taxa. This checklist fills a major gap in our knowledge of terrestrial plants from this region. The significance of checklists is summarized by Söderström *et al.* (2008), including outlining the utility of checklists as powerful and important tools, and their applicability to taxonomy, systematics, and conservation. Given the recent massive loss of forest habitats in Paraguay, the checklist may serve for as baseline inquiry with land management implications with further collecting efforts.

#### VEGETATION

Paraguay is dominated by three main vegetation types (Olson *et al.* 2001; Fig. 1). The eastern part of the country is covered by Alto Paraná Atlantic forests and is the most humid part of the country. It is also from here that most species are known (Fig. 2). The central part of the country is covered with Humid Chaco, which consists of xenophile forests mixed with palm savannas. The western part is covered by Dry Chaco which consists of grasslands and thorn forests.

#### METHODS AND PRESENTATION

The present checklist is based on a compilation of all the published records of species and infraspecific taxa of liverworts and hornworts from Paraguay that we are aware of. The Early Land Plant Today (ELPT) database (von Konrat *et al.* 2010) was an important source. The format of the present checklist follows that of the database. Accordingly, confidence levels are provided for each taxon, as follows (Söderström *et al.* 2010;



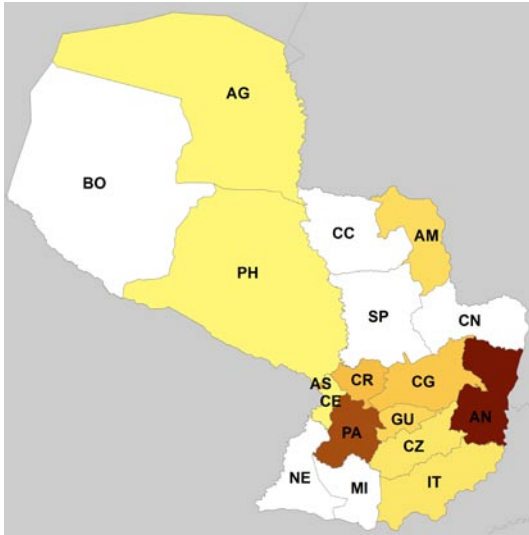
Fig. 1. The main ecoregions of Paraguay.

von Konrat *et al.* 2010): \* – serious doubts about the value of the taxon, \*\* – probably a good taxon, but not studied critically in the framework of a recent revision or monograph, \*\*\* – good taxon as currently understood, studied in the framework of a recent revision or monograph.

No attempt has been made to examine the specimens of the published records and verify the identifications. However, as in the recent checklists in the same series, a distinction is made between primary references (providing details on specimens and/or exact localities) and secondary ones (lacking details). Primary references are in small capitals and secondary ones in normal font.

Nomenclature follows the latest taxonomic opinions as much as possible and author abbreviations are according to the International Plant Names Index (<http://www.ipni.org/index.html>). Taxa doubtfully present in Paraguay and synonyms are listed separately. The list of synonyms only contains names used for Paraguay.

The following abbreviations are used for the provinces: AG (Alto Paraguay, 1 sp.), AN (Alto Paraná, 21 sp.), AM (Amambay, 4 sp.), AS (Asunción, 9 sp.), CC Concepción, CG (Caaguazú, 7 sp.), CZ (Caazapá, 3 sp.), CE (Central, 1 sp.), CR (Cordillera, 8 sp.), GU (Guairá, 5 sp.), IT (Itapúa, 3 sp.), PA (Paraguari, 17 sp.), PH (Presidente Hayes, 1 sp.) and PAR (lack of precise locality information in the cited references). We do not have any reports of hornworts or liverworts for the remaining six provinces. There are a few localities that



**Fig. 2.** Number of species recorded in each province in Paraguay. The darker the more species (max. 21 species). There are no known reports from provinces in white. AG – Alto Paraguay, AN – Alto Paraná, AM – Amambay, AS – Asunción, BO – Boquerón, CG – Caaguazú, CN – Canindeyú, CZ – Caazapá, CE – Central, CR – Cordillera, GU – Guairá, IT – Itapúa, MI – Misiones, NE – Ñeembucú, SP – San Pedro, PA – Paraguari, PH – Presidente Hayes.

we haven't been able to place into a province. They are Cerro de Mbatobi, Cerro de Yaguaroux, Perayubi and Cerro León. They have been recorded as PAR.

#### LIST OF HORNWORTS AND LIVERWORTS RECORDED FOR PARAGUAY

##### ANTHOCEROTOPHYTA

###### *Phaeoceros*

\*\*\* *P. tenuis* (Spruce) Hässel

PAR: SPRUCE (1888, 1890) both as *Anthoceros tenuis*, Stephani (1916) as *A. tenuis*, Schuster (1992) as *A. tenuis*. AS: LECTOTYPE of *A. tenuis*, BONNER (1962) as *A. tenuis*, HÄSSEL DE MENÉNDEZ (1986).

###### *Phymatoceros*

\*\*\* *P. bulbiculosus* (Brot.) Stotler, W. T. Doyle & Crand.-Stotl.

AS: LECTOTYPE of *Anthoceros fructuosus*, STEPHANI (1897, 1916) both as *A. fructuosus*, BONNER (1962) as *A. fructuosus*, HÄSSEL DE MENÉNDEZ (1986) as *Phaeoceros fructuosus*.

##### MARCHANTIOPHYTA

###### *Acanthocoleus*

\*\*\* *A. aberrans* Gradst. var. *laevis* Gradst.

PAR: Crosby & Engel (2006). AN: GRADSTEIN (1994).

###### *Archilejeunea*

\*\*\* *A. auberiana* (Mont.) Steph. ex A. Evans

PAR: Dauphin *et al.* (1998). AN: GRADSTEIN (1994).

\*\*\* *A. parviflora* (Nees) Schiffn.

GU: GRADSTEIN (1994).

###### *Asterella*

\*\*\* *A. venosa* (Lehm. et Lindenb.) A. Evans

PAR: BISCHLER-CAUSSE *et al.* (2005).

###### *Bryopteris*

\*\*\* *B. diffusa* (Sw.) Nees

PAR: Schäfer-Verwimp & Pócs (2009). AN: GRADSTEIN (1994).

###### *Calypogeia*

\* *C. amazonica* (Spruce) Steph.

PAR: HUSNOT (1887) as *Kantia amazonica*, STEPHANI (1908), BISCHLER (1962), Bonner (1963), Fulford (1987).

###### *Caudalejeunea*

\*\*\* *C. lehmanniana* (Gottsche) A. Evans

AN: GRADSTEIN (1994).

###### *Cheilolejeunea*

\*\*\* *C. clausa* (Nees & Mont.) R. M. Schust.

AN: REINER-DREHWALD (1998). CG: REINER-DREHWALD (1998). PA: STEPHANI (1897) as *Euosmolejeunea opaca*, REINER-DREHWALD (1998).

\*\*\* *C. rigidula* (Nees ex Mont.) R. M. Schust.

PAR: Bastos (2012). AN: REINER-DREHWALD (1998).

###### *Chiloscyphus*

\*\*\* *C. martianus* (Nees) J. J. Engel & R. M. Schust.

PAR: TYPE of *Lophocolea paraguayensis*, SPRUCE (1888, 1890) both as *L. paraguayensis*, STEPHANI (1906)

as *L. paraguayensis*, GEISSLER & BISCHLER (1985) as *L. paraguayensis*. CR: STEPHANI (1897) as *L. martiana*.

### **Cololejeunea**

\*\*\* *C. camillii* (Lehm.) A. Evans

PAR: Dauphin *et al.* (2006) as *Aphanolejeunea camillii*, Alvarenga *et al.* (2008) as *A. camillii*, Schäfer-Verwimp & Pócs (2009). AN: REINER-DREHWALD (1995a) as *A. misionensis*.

\*\*\* *C. cardiocarpa* (Mont.) A. Evans

AN: REINER-DREHWALD (1994a).

\*\*\* *C. clavatopapillata* Steph.

PAR: Dauphin *et al.* (1998) as *Aphanolejeunea clavatopapillata*, Lüth & Schäfer-Verwimp (2004) as *A. clavatopapillata*, Schäfer-Verwimp & Pócs (2009). AN: REINER-DREHWALD (1995a) as *A. clavatopapillata*.

\*\*\* *C. minutissima* (Nees & Mont.) R. M. Schust. subsp. *myriocarpa* (Nees & Mont.) R. M. Schust.

PAR: Morales *et al.* (2008). GU: REINER-DREHWALD (1994a).

\*\*\* *C. paucifolia* (Spruce) Bern.-Lück. & Pócs

PAR: LECTOTYPE of *Lejeunea paucifolia*, SPRUCE (1888, 1890) both as *L. paucifolia*, Stephani (1916) as *Physocolea paucifolia*, Reiner-Drehwald (1999) as *L. paucifolia*, Vital & Visnadi (2000) as *Aphanolejeunea paucifolia*. PA: GEISSLER & BISCHLER (1987) as *L. paucifolia*, REINER-DREHWALD (1995a) as *A. paucifolia*.

### **Dumortiera**

\*\*\* *D. hirsuta* (Sw.) Nees

PAR: HUSNOT (1887), SPRUCE (1888), Evans (1919), HÄSSEL DE MENÉNDEZ (1963), Schuster 1992, Schäfer-Verwimp & Pócs (2009). AM: BISCHLER-CAUSSE *et al.* (2005). AN: BISCHLER-CAUSSE *et al.* (2005). CE: BISCHLER-CAUSSE *et al.* (2005). CR: STEPHANI (1897). GU: BISCHLER-CAUSSE *et al.* (2005). PA: BISCHLER-CAUSSE *et al.* (2005).

### **Fossombronina**

\*\*\* *F. porphyrorhiza* (Nees) Prosk.

IT: STEPHANI (1897) as *Noteroclada porphyrorhiza*.

### **Frullania**

\*\* *F. cyparioides* (Schwägr.) Nees

IT: STEPHANI (1897).

\*\*\* *F. ericoides* (Nees) Mont.

PAR: ORIGINAL MATERIAL of *F. squarrosa* var. *subjulacea*, SPRUCE (1888) as *F. squarrosa* var. *subjulacea*, Schiffner (1898) as *F. squarrosa*, Stephani (1910) as *F. julacea*, Miller *et al.* (1983) as *F. squarrosa*. CG: TYPE of *F. julacea*, SPRUCE (1890) as *F. julacea*, BONNER (1965) as *F. julacea*, REINER (1988).

\*\*\* *F. tetraptera* Nees & Mont.

PAR: SPRUCE (1888) as *F. conferta*, Stephani (1910) as *F. conferta*. IT: YUZAWA (1991). PA: LECTOTYPE of *F. conferta*, SPRUCE (1890) as *F. conferta*, BONNER (1965) as *F. conferta*, REINER (1988) as *F. conferta*.

### **Frullanoides**

\*\* *F. liebmaniana* (Lindenb. & Gottsche) van Slageren

AM: GRADSTEIN (1994).

### **Lejeunea**

\* *L. adpressa* Nees

PAR: HUSNOT (1887) as *L. drymophila* ('*drymophylla*'), BISCHLER (1966) as *L. drymophila*.

\*\* *L. diaphana* Spruce

PAR: HUSNOT (1887) erroneously as '*Lophocolea*'.

\*\*\* *L. glaucescens* Gottsche

PAR: HUSNOT (1887), SPRUCE (1888), BISCHLER (1966).

\*\*\* *L. grossitexta* (Steph.) M. E. Reiner & Goda

PAR: Holz *et al.* (2001), Alvarenga *et al.* (2008), Santos (2008), Schäfer-Verwimp & Reiner-Drehwald (2009). AN: REINER-DREHWALD (2000), REINER-DREHWALD & GODA (2000).

\*\*\* *L. laetevirens* Nees & Mont.

PAR: Schäfer-Verwimp & Pócs (2009). AN: REINER-DREHWALD (2000). CG: REINER-DREHWALD (2000) also as *L. lepida*. PA: REINER-DREHWALD (2000).

**\*\* *L. phyllobola* Nees & Mont.**

PAR: SPRUCE (1888) as *L. cephalandra* and *L. polycephala*, Stephani (1915) as *Microlejeunea cephalandra* and *L. polycephala*, BISCHLER (1966) as *L. polycephala*, Reiner-Drehwald (1999) as *L. cephalandra* and *L. polycephala*, Schäfer-Verwimp & Pócs (2009). AN: REINER-DREHWALD (2000). CG: REINER-DREHWALD (2000). CR: LECTOTYPE of *L. cephalandra*, SPRUCE (1890) as *L. cephalandra*, GEISSLER & BISCHLER (1987) as *L. cephalandra*. PA: LECTOTYPE of *L. polycephala*, SPRUCE (1890) as *L. polycephala*, GEISSLER & BISCHLER (1987) as *L. polycephala*.

**\*\* *L. ptosimophylla* C.Massal.**

PA: REINER-DREHWALD (2000).

**\*\*\* *L. trinitensis* Lindenb.**

AN: REINER-DREHWALD (2000).

**\* *L. trochantha* Spruce**

PAR: SPRUCE (1888), Stephani (1915), BISCHLER (1966), GEISSLER & BISCHLER (1987), Reiner-Drehwald (1999). CR: LECTOTYPE, SPRUCE (1890), GEISSLER & BISCHLER (1987).

NOTE: *Lejeunea trochantha* is a *Cheilolejeunea* species of uncertain affinity (Reiner-Drehwald 2006).

***Leptolejeunea*****\*\*\* *L. exocellata* (Spruce) A. Evans**

AN: REINER-DREHWALD (1995b).

***Lophocolea*****\* *L. coadunata* (Sw.) Mont.**

PAR: SPRUCE (1888). PA: FULFORD (1976).

***Marchantia*****\*\*\* *M. chenopoda* L.**

AM: BISCHLER-CAUSSE *et al.* (2005).

**\*\*\* *M. papillata* Raddi**

PAR: HUSNOT (1887), SPRUCE (1888), STEPHANI (1899a), Svihla (1941), Engel (1990). PA: EVANS (1917), HÄSSEL DE MENÉNDEZ (1963), BISCHLER (1984).

**\*\*\* *M. papillata* subsp. *papillata***

CE: Bischler-Causse *et al.* (2005). PA: Bischler-Causse *et al.* (2005).

***Marchesinia*****\*\*\* *M. brachiata* (Sw.) Schiffn.**

PAR: Schäfer-Verwimp & Pócs (2009). AN: GRADSTEIN (1994).

***Mastigolejeunea*****\*\*\* *M. auriculata* (Wilson & Hook.) Schiffn.**

PAR: EVANS (1908), Pagán (1939b), Schuster (1980), Fulford & Sharp (1990). AM: GRADSTEIN (1994). AN: GRADSTEIN (1994). AS: STEPHANI (1897). CG: REINER-DREHWALD (1993).

***Metzgeria*****\*\*\* *M. convoluta* Steph.**

PAR: Santos (2008). PA: COSTA (2008).

**\*\*\* *M. furcata* (L.) Corda**

PAR: ORIGINAL MATERIAL of *M. planiuscula*, SPRUCE (1888) as *M. planiuscula*, GEISSLER & BISCHLER (1985) as *M. planiuscula*.

**\*\*\* *M. myriopoda* Lindb.**

AN: COSTA (2008).

***Microlejeunea*****\*\* *M. globosa* (Spruce) Steph.**

PAR: SPRUCE (1888) as *Lejeunea globosa*, Stephani (1915), Arnell (1961), GEISSLER & BISCHLER (1987) as *L. globosa*, Reiner-Drehwald (1999) as *L. globosa*, Chuah-Petiot & Pócs (2003), Lüth & Schäfer-Verwimp (2004), Morales *et al.* (2008). PA: LECTOTYPE of *L. globosa*, SPRUCE (1890) as *L. globosa*, GEISSLER & BISCHLER (1987) as *L. globosa*.

***Monoclea*****\*\*\* *M. gottschei* Gradst. & Mues subsp. *elongata* Gradst. & Mues**

PA: Bischler-Causse *et al.* (2005).

***Noteroclada*****\*\*\* *N. confluens* (Hook.f. & Taylor) Spruce**

PAR: Váña & Engel (2013). CR: CRANDALL-STOTLER *et al.* (2010).

***Oxymitra*****\*\*\* *O. incrassata* (Brot.) Sérgio & Sim-Sim**

PAR: HUSNOT (1887) as *O. pyramidata*, SPRUCE (1888) as *O. pyramidata* [with a ?], Stephani (1898c)

as *Ruppinia pyramidata*, HOWE (1914) as *Tessellina pyramidata*, Casares-Gil (1919) as *T. pyramidata*, Persson & Imam (1960) as *O. paleacea*, Hässel de Menéndez (1963) as *O. paleacea*, Schuster (1992) as *O. paleacea*. AS: BISCHLER-CAUSSE *et al.* (2005). PA: BISCHLER-CAUSSE *et al.* (2005).

### **Plagiochasma**

\*\*\* *P. rupestre* (J. R. Forst. & G. Forst.) Steph.

PAR: Bischler (1979), Miller *et al.* (1983). CR: EVANS (1925)

### **Plagiochila**

\*\*\* *P. corrugata* (Nees) Nees & Mont.

PAR: Schäfer-Verwimp & Pócs (2009), CG: HEINRICHS *et al.* (2004).

\*\*\* *P. raddiana* Lindenb.

PAR: Schuster (1980) as *Plagiochila guilleminiana*. PA: STEPHANI (1897) as *Plagiochila guilleminiana*.

### **Porella**

\*\*\* *P. brasiliensis* (Raddi) Schiffn.

PAR: Spruce (1888).

\*\*\* *P. reflexa* (Lehm. & Lindenb.) Trevis.

AN: So (2005).

\*\*\* *P. swartziana* (F. Weber) Trevis.

AN: So (2005).

### **Radula**

\*\* *R. javanica* Gottsche

PAR: HUSNOT (1887) as *Radula amazonica*. AN: REINER-DREHWALD (1994b) as *Radula macrostachya*.

\*\* *R. tectiloba* Steph.

PAR: SPRUCE (1888) as *R. aurantii*, Stephani (1910) as *R. aurantii*, Yamada (1981, 1988, 2000), GEISSLER & BISCHLER (1990) as *R. aurantii*, Holz *et al.* (2001), Schäfer-Verwimp & Pócs (2009). AN: REINER-DREHWALD (1994b) as *R. aurantii*. AS: LECTOTYPE of *R. aurantii*, SPRUCE (1890) as *R. aurantii*, CASTLE (1964, 1969) both as *R. aurantii*, GEISSLER & BISCHLER (1990) as *R. aurantii*. CG: SYNTYPE of *R. aurantii*, SPRUCE (1890) as *R. aurantii*, CASTLE (1964, 1969) both as *R. aurantii*, GEISSLER & BISCHLER (1990) as *R. aurantii*, REINER-DREHWALD (1994b) as *R. aurantii*. CR: CASTLE (1964, 1969)

both as *R. aurantii*. GU: CASTLE (1964) as *R. aurantii*, REINER-DREHWALD (1994b) as *R. aurantii*. PA: REINER-DREHWALD (1994b) as *R. aurantii*.

### **Riccardia**

\*\* *R. cataractarum* (Spruce) Schiffn.

PAR: SPRUCE (1888) as *Aneura cataractarum*, Stephani (1893) as *A. cataractarum*, STEPHANI (1899b) as *A. cataractarum*, Bonner (1962) as *A. cataractarum*, MEENKS (1987), Santos (2008), Oliveira & Bastos (2009), Schäfer-Verwimp & Pócs (2009). PA: LECTOTYPE of *A. cataractarum*, SPRUCE (1890) as *A. cataractarum*.

\*\*\* *R. tenuicula* (Spruce) Schiffn. *ex* Meenks

PAR: HUSNOT (1887) as *Aneura 'tenuicaule'*. PA: BONNER (1962) also as *A. 'tenuicaula'*.

### **Riccia**

\*\*\* *R. brasiliensis* Schiffn.

GU: JOVET-AST (1991).

\*\*\* *R. cavernosa* Hoffm.

PAR: Bischler-Causse *et al.* (2005).

NOTE. Bischler-Causse *et al.* (2005) apparently regard Spruce's (1888) report of *Riccia crystallina* as referring to this species, although they do not explicitly say so.

\*\*\* *R. curtisii* (Austin) Austin

PAR: STEPHANI (1898b) as *Riccia subsimilis*. CZ: TYPE of *Ricciella subsimilis*, STEPHANI (1897) as *Ricciella subsimilis*, GEISSLER & BISCHLER (1990) as *Ricciella subsimilis*, BISCHLER-CAUSSE *et al.* (2005).

\*\*\* *R. lindmanii* Steph.

AS: TYPE, STEPHANI (1897, 1898a), HÄSSEL DE MENÉNDEZ (1963), GEISSLER & BISCHLER (1990), JOVET-AST (1991), BISCHLER-CAUSSE *et al.* (2005).

\*\*\* *R. paraguayensis* Spruce

PAR: SPRUCE (1888) as *Riccia paraguayensis*, GEISSLER & BISCHLER (1990) as *Riccia paraguayensis*. AS: LECTOTYPE also of *Ricciella macropora*, STEPHANI (1897) as *Ricciella macropora*, STEPHANI (1898b), HÄSSEL DE MENÉNDEZ (1963), GEISSLER & BISCHLER (1990) also as *Ricciella macropora*, VIANNA (1992), BISCHLER-CAUSSE *et al.* (2005).

\*\*\* *R. planobiconvexa* Steph.

PAR: Jovet-Ast (1981). CZ: LECTOTYPE of *R. tenuilimbata*, STEPHANI (1897, 1898a) both as *R. tenuilimbata*, HÄSSEL DE MENÉNDEZ (1963), JOVET-AST (1981, 1991), GEISSLER & BISCHLER (1990) as *R. tenuilimbata*, BISCHLER-CAUSSE *et al.* (2005).

\*\*\* *R. stenophylla* Spruce

PAR: Spruce (1888), Jovet-Ast (1981), Schuster (1992), Damsholt (2002). AS: TYPE, Spruce (1890), Hässel de Menéndez (1963), Geissler & Bischler (1990), Bischler-Causse *et al.* (2005). PH: Bischler-Causse *et al.* (2005).

\* *R. subtilis* (Steph.) Steph.

PAR: STEPHANI (1898b), GEISSLER & BISCHLER (1990) as *Ricciella subtilis*, BISCHLER-CAUSSE *et al.* (2005). CZ: TYPE of *Ricciella subtilis*, STEPHANI (1897) as *Ricciella subtilis*.

NOTE. The type specimen of *Ricciella subtilis* is sterile and Bischler-Causse *et al.* (2005) did not know where to refer it.

\*\*\* *R. vitalii* Ast

PAR: JOVET-AST (1991), BISCHLER-CAUSSE *et al.* (2005).

\*\*\* *R. weinionis* Steph.

PAR: Jovet-Ast (1981) ('*Wainionis*').

***Schiffneriolejeunea***\*\*\* *S. polycarpa* (Nees) Gradst.

CR: GRADSTEIN (1994).

***Symphyogyna***\*\*\* *S. aspera* Steph. ex F. A. McCormick

PAR: Pagán (1939), Osakada & Lisboa (2004), Schäfer-Verwimp & Pócs (2009). CR: EVANS (1925). PA: URIBE & AGUIRRE 1995.

\*\*\* *S. brasiliensis* Nees et Mont.

PAR: SPRUCE (1888).

\*\*\* *S. sinuata* (Sw.) Nees & Mont.

PAR: HUSNOT (1887), SPRUCE (1888), STEPHANI (1900). CR: STEPHANI (1897).

***Taxilejeunea***\*\*\* *T. obtusangula* (Spruce) A. Evans

PAR: Schäfer-Verwimp & Pócs (2009.) AN: REINER-DREHWALD (2000).

\*\* *T. terricola* (Spruce) Steph.

PAR: SPRUCE (1888) as *Lejeunea terricola*, BISCHLER (1966), GEISSLER & BISCHLER (1987 as *L. terricola*, 1990), Reiner-Drehwald (1999 as *L. terricola*, 2000). AS: LECTOTYPE of *L. terricola*, SPRUCE (1890) as *L. terricola*, GEISSLER & BISCHLER (1987) as *L. terricola*.

## DOUBTFUL TAXA

***Riccia***\*\*\* *R. crystallina* L.

PAR: SPRUCE (1888), Hässel de Menéndez (1958). This taxon needs confirmation according to Bischler-Causse *et al.* (2005), but they apparently treated the report by Spruce (1888) as *Riccia cavernosa*.

\*\*\* *R. fluitans* L.

AS: STEPHANI (1897) as *Ricciella fluitans*. The report was doubted by Bischler-Causse *et al.* (2005).

## SYNONYMS

*Aneura cataractarum* Spruce ≡ *Riccardia cataractarum*

*Aneura tenuicula* Spruce ≡ *Riccardia tenuicula*

*Anthoceros fructuosus* Steph. = *Phymatoceros bulbiculosus*

*Anthoceros tenuis* Spruce ≡ *Phaeoceros tenuis*

*Aphanolejeunea camillii* (Lehm.) R. M. Schust. ≡ *Cololejeunea camillii*

*Aphanolejeunea clavatopapillata* (Steph.) M. E. Reiner = *Cololejeunea clavatopapillata*

*Aphanolejeunea misionensis* M. E. Reiner = *Cololejeunea camillii*

*Aphanolejeunea paucifolia* (Spruce) M. E. Reiner ≡ *Cololejeunea paucifolia*

*Euosmolejeunea opaca* (Gottsche) Steph. = *Cheilolejeunea clausa*

*Frullania conferta* Spruce *nom. inval.* = *Frullania tetraptera*

*Frullania julacea* Spruce = *Frullania ericoides*

*Frullania squarrosa* (Nees) Nees = *Frullania ericoides*

*Frullania squarrosa* var. *subjulacea* (Mont.) Spruce = *Frullania ericoides*

*Kantius amazonicus* Spruce ≡ *Calypogeia amazonica*

*Lejeunea cephalandra* Spruce = *Lejeunea phyllobola*

*Lejeunea drymophila* Spruce = *Lejeunea adpressa*

*Lejeunea globosa* Spruce ≡ *Microlejeunea globosa*

*Lejeunea lepida* Lindenb. & Gottsche = *Lejeunea laetevirens*

*Lejeunea paucifolia* Spruce ≡ *Cololejeunea paucifolia*

*Lejeunea polycephala* Spruce nom. inval. = *Lejeunea phyllobola*

*Lejeunea terricola* Spruce ≡ *Taxilejeunea terricola*

*Lophocolea martiana* Nees ≡ *Chiloscyphus martianus*

*Lophocolea paraguayensis* Spruce = *Chiloscyphus martianus*

*Metzgeria planiuscula* Spruce = *Metzgeria furcata*

*Microlejeunea cephalandra* (Spruce) Steph. = *Lejeunea phyllobola*

*Noteroclada porphyrorhiza* (Nees) Mitt. ≡ *Fossombronia porphyrorhiza*

*Oxymitra paleacea* Bisch. = *Oxymitra incrassata*  
*Oxymitra pyramidata* (Willd.) Huebener = *Oxymitra incrassata*

*Phaeoceros fruticosus* (Steph.) Hässel = *Phymatoceros bulbiculosus*

*Physocolea paucifolia* (Spruce) Steph. ≡ *Cololejeunea paucifolia*

*Plagiochila guilleminiana* Mont. ex Lindenb. = *Plagiochila raddiana*

*Radula amazonica* Spruce = *Radula javanica*

*Radula aurantii* Spruce = *Radula tectiloba*

*Radula macrostachya* Lindenb. & Gottsche = *Radula javanica*

*Riccia subsimilis* (Steph.) Steph. = *Riccia curtisii*

*Riccia tenuilimbata* Steph. = *Riccia planobiconvexa*

*Ricciella fluitans* (L.) A. Braun ≡ *Riccia fluitans*

*Ricciella macropora* Steph. = *Riccia paraguayensis*

*Ricciella subsimilis* Steph. = *Riccia curtisii*

*Ricciella subtilis* Steph. ≡ *Riccia subtilis*

*Ruppinia pyramidata* (Willd.) Corda nom. illeg. = *Oxymitra incrassata*

*Tessellina pyramidata* (Willd.) Dumort. = *Oxymitra incrassata*

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