

CONTRIBUTIONS TO THE MOSS FLORA OF THE AMAZONIAN LOWLANDS OF MADRE DE DIOS, PERU

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ABSTRACT

A recent collection of mosses from the Department of Madre de Dios in the lowlands of southeastern Peru contains 58 different species. Fifty-four taxa are new to the district and four species are reported new to Peru. Previous collections from the district are listed which brings the total species known from the area to 74. This is the first major study of mosses from Madre de Dios, Peru, and it provides a foundation for continued work and production of a field guide for the region.

RESUMEN

Una colección reciente de musgos del Departamento de Madre de Dios en la zona baja del Sureste de Perú contiene 58 especies diferentes. Cincuenta y cuatro taxa son nuevos para el distrito y se citan cuatro especies nuevas para Perú. Se listan las colecciones previas del distrito que elevan el total de especies conocidas del área a 74. Este es el primer estudio amplio de musgos de Madre de Dios, Perú, y aporta un inicio para la continuación del trabajo y la producción de una guía de campo para la región.

INTRODUCTION

The southwestern Amazon of the trinational corner of SW Brazil, NW Bolivia, and SE Peru contains what is probably the largest and least disturbed area remaining of Upper Amazonian and Lower Andean ecosystems (Foster et al. 1994). Threats to the forest occur in the form of hunting, gold mining, timber extraction, impending road construction, and slash and burn agriculture. The Department of Madre de Dios (12°–14.5°S), Peru, dominated by the Madre de Dios River basin and tributaries, is an important geopolitical region in the pristine SW Amazon, which is divided equally between lowland, premontane, and montane forest (Davis et al. 1997). Madre de Dios is located at the southwestern edge of the Amazon basin near the Andean foothills and is covered primarily by lowland tropical/subtropical moist forest (Gentry & León 1997). The region has a distinct six month dry season and receives 2000–2500 mm of rain annually (Gentry & León 1997). Madre de Dios has been recognized as an epicenter of botanical diversity and holds world record numbers of other organisms, such as birds, tabanid flies, tiger beetles, damselflies and dragonflies, and butterflies (Stewart 1988).

Botanical research over the past 25 years in Madre de Dios, Peru, has been

important for identifying the extent and significance of the region's plant diversity, producing various publications and datasets (e.g., Gentry 1982; Phillips & Gentry 1993a–b; Foster et al. 1994; Terborgh & Andersen 1998; Pitman et al. 1999, 2001). There have been two geographic areas of botanical investigations in Madre de Dios, with most of the resources focused on quantitative inventory of trees (trunk diameter > 10 cm) in scattered one-hectare forest plots and 0.1-hectare transects. The Cocha Cashu Biological Station in Manu National Park has been the focus of significant field research during the last three decades (Terborgh 1994), producing one of the most comprehensive plant checklists for the region. The Tambopata-Candamo Reserved Zone (Foster et al. 1994) in lower Madre de Dios near the Peru-Bolivian border has been the focus of long-term monitoring of one-hectare forest plots and complementary 0.1-hectare transect work (Phillips et al. 2003), plus associated programs of general botanical collection.

Despite the research that has been focused on these selected areas, there has been no major, long-term systematic inventory of plants and habitats, and no flora has been published for the region. Between July 11 and August 19, 2002, as part of a long-term program of botanical inventory and monitoring, the authors conducted expeditions in the Amazonian lowlands of the Department of Madre de Dios. Led by the first author, cryptogamic collections were made from several localities in the region (Table 1, Fig. 1). Fifty-eight species of mosses were identified from approximately 226 collections. Of the 58 taxa identified, 54 are new records for the district and four of these are new records for Peru (Table 2).

The only previously published records of moss collections for Madre de Dios, as far as we know, were made by Vargas (1974) and recorded in a checklist of mosses for Peru by Menzel (1992). Vouchers of the Vargas material were searched for but not located in either of the two larger Peruvian herbaria—the Herbarium of the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos (USM) and the Herbario Vargas, Facultad de Ciencia Biológicas, Universidad Nacional San Antonio Abad del Cuzco (CUZ).

We conclude that future work should be focused on comparative studies of the diversity of mosses and other bryophytes in time and space between different sites in the lowlands of Madre de Dios, and along the altitudinal gradient from the lowlands up the slopes of the Andes into the Department of Cusco. This work is produced as a component of long-term botanical exploration and collaboration in the Andes-Amazon region of southeastern Peru and it will serve as a foundation for the production of field guides to serve the multidisciplinary science, education, and conservation programs that are ongoing in the region.

ANNOTATED LIST OF SPECIES

Species are listed alphabetically by family. New records for the country are marked with an asterisk (*). The nomenclature for the species follows Crosby et al. (2000). Voucher collections are deposited at NY. Duplicates of some taxa are

TABLE 1. Summary of nine collection sites in Madre de Dios, Peru, and the corresponding moss collections made between July 11 and August 19, 2002.

Locality	Elevation	Geographic Coordinates (P. Majestyk)	Collection Numbers
1. Manu Province, Puerto Maldonado	300 m	12°36' S, 69°11' W	3720-3727
2. Manu Province, Los Amigos field station, ca. 3 km N of the jct of the Madre de Dios and Los Amigos rivers.	280 m	12° 34' S, 70° 06' W	3728-3902; 3951.5-4178; 4301-4364
3. Manu Province, Community of Boca Amigo, ca. 1.6 km N of the jct of the Los Amigos and Madre de Dios rivers on the W side of the river	220 m	12° 36' S, 70° 05' W	3903-3951
4. Tambopata Province, E side of the Los Amigos River	300 m	12° 28' 50" S, 70° 11' 01" W	4179-4209
5. Tambopata Province, E side of the Los Amigos River, small waterfall emptying into river	300 m	12° 27' 48" S, 70° 13' 09" W	4210-4215
6. Tambopata Province, E side of the Los Amigos River	300 m	12° 25' 37" S, 70° 15' 35" W	4218-4231
7. Tambopata Province, E side of the Los Amigos River, from banks of river to inland	230–250 m	12° 31' 52"- 12° 32' 05"S 70° 05' 24"- 70° 05' 29"W	4240-4265
8. Manu Province, Inambari River ca. 2 km from jct of Madre de Dios River	220 m	12°43'87" S, 69°45'51" W	4266-4267
9. Manu Province, ca. 13 km W of Puerto Maldonado in small park dominated by <i>Mauritia flexuosa</i> L (Arecaceae).	300 m	12°40' S, 69°20' W	4268-4300

also deposited at BRIT, CUZ, MO, SMF, and the first author's personal herbarium. Numbers following the species name are the first author's collection numbers.

Bartramiaceae

Philonotis uncinata (Schwägrichen) Bridel; 3743, 3820, 3876, 3882, 3885, 3997, 4145, 4165, 4180, 4213, 4215, 4231, 4267

Brachytheciaceae

Rhynchostegium conchophyllum (Taylor) A. Jaeger; 4220

Bruchiaceae

Trematodon longicollis Michx.; 4245

Bryaceae

Bryum apiculatum Schwägrichen; 3875, 3888, 3995, 4134, 4151

**Bryum renauldii* Röll ex Renauld & Cardot; 4212

Calympereaceae

Calymperes afzelii Swartz; 3948, 4205, 4303, 4310, 4314

Calymperes palisotii Schwägrichen; 4336

Syrrhopodon cryptocarpus Dozy & Molkenboer; 3825, 3984, 4120

Syrrhopodon incompletus Schwägrichen; 3838, 3981, 3982, 3985, 4017, 4018, 4108, 4110, 4141, 4168, 4264, 4301

Syrrhopodon parasiticus (Swartz ex Bridel) Bescherelle; 4038, 4309

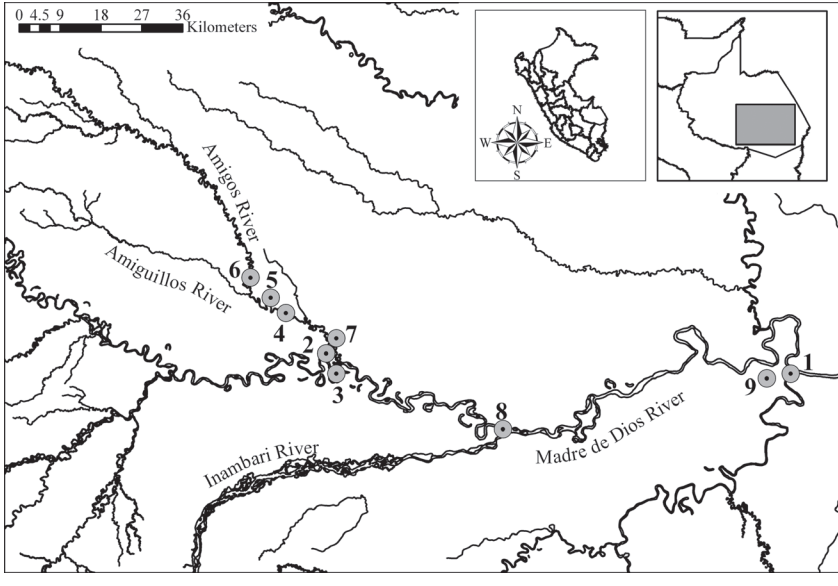


Fig. 1. Map showing nine collection sites where the study was focused in Madre de Dios, Peru. Table 1 provides descriptions of these localities by the corresponding number of each site.

Dicranaceae

Dicranella hilariana (Montagne) Mitten; 3722, 3728, 3730, 3781, 4102, 4130, 4197

Ditrichaceae

Ditrichum rufescens (Hampe) Hampe; 4118, 4202

Fissidentaceae

Fissidens guianensis Montagne; 3939, 4023, 4036, 4041.5, 4061, 4062, 4096, 4100, 4101, 4109, 4119, 4125, 4195, 4262

Fissidens flaccidus Mitten; 4211, 4226

Fissidens intramarginatus (Hampe) Mitten; 3750

Fissidens pellucidus Hornschuch; 3756, 3881, 4246

Fissidens prionodes Montagne; 3777, 3783, 3966, 4162

Fissidens submarginatus Bruch; 3873, 4138, 4259

Fissidens zollingeri Montagne; 3871, 3928, 4132, 4139

Hypnaceae

Chryo-hypnum diminutivum (Hampe) W.R. Buck; 4188

Isopterygium subbrevisetum (Hampe) Brotherus; 4067, 4116, 4192

Isopterygium tenerum (Swartz) Mitten; 3751, 3775, 3780, 3828, 3852, 3973, 4004, 4277, 4286, 4302

Mittenothamnium reptans (Hedwig) Cardot; 4358, 4359

Rhacopilopsis trinitensis (C. Müller) E. Britton & Dixon; 4169, 4252

Vesicularia sp.; 4344. We were unable to identify this collection from South American material in NY. This species has branch leaves measuring ca. 2.5 mm in length. It is perhaps a new species but we cannot without further study of the genus make that decision now.

Vesicularia vesicularis (Scwägrichen) Brotherus var. *vesicularis*; 3784, 3877, 4072, 4104, 4183

Vesicularia vesicularis var. *rutilans* (Bridel) W.R. Buck; 4064

Leucobryaceae

Leucobryum martianum (Hornschuch) Hampe ex C. Müller; 3847, 3861, 4149, 4153, 4159, 4167, 4328

**Leucobryum subobtusifolium* (Brotherus) B.H. Allen; 4092

TABLE 2. A summary of moss collections made by family, species, and localities in Madre de Dios, Peru.

Family	Number of Species	Number of Collections	Collection Localities (see map, Fig. 1)
<i>Bartramiaceae</i>	1	13	1,2,4,5,6,8
<i>Brachytheciaceae</i>	1	1	6
<i>Bruchiaceae</i>	1	1	7
<i>Bryaceae</i>	2	6	2
<i>Calymperaceae</i>	5	23	2,4,7
<i>Dicranaceae</i>	1	7	1,2,4
<i>Ditrichaceae</i>	1	2	2,4
<i>Fissidentaceae</i>	7	31	2,3,4,5,6,7
<i>Hypnaceae</i>	8	25	2,4,7,9
<i>Leucobryaceae</i>	5	28	2,4,7
<i>Meteoriaceae</i>	2	9	2,3,4,7
<i>Neckeraceae</i>	2	7	2
<i>Othotrichaceae</i>	2	2	2
<i>Pilotrichaceae</i>	4	18	2,4
<i>Pottiaceae</i>	2	2	6
<i>Pterobryaceae</i>	2	5	2,3
<i>Sematophyllaceae</i>	7	23	2,3,4,7,9
<i>Splachnobryaceae</i>	1	2	2
<i>Stereophyllaceae</i>	1	9	2
<i>Thuidiaceae</i>	3	12	2
Total	55	212	

Octoblepharum albidum Hedwig; 3738, 3755, 3778, 3859, 3965, 3969, 4013, 4081, 4121, 4155, 4201, 4299, 4291, 4253

Octoblepharum cylindricum W.P. Schimper ex Montagne; 4075

Octoblepharum pulvinatum (Dozy & Molkenboer) Mitten; 3874, 3961, 4005, 4107, 4161

Meteoriaceae

Zelometeorium patulum (Hedwig) Manuel; 3724, 3917, 4099, 4115, 4117, 4200, 4204, 4254

Zelometeorium recurvifolium (Hornschuch in Martius) Manuel; 3950

Neckeraceae

Neckeropsis disticha (Hedwig) Kindberg; 3935, 4207

Neckeropsis undulata (Hedwig) Reichardt; 3762, 3909, 4078, 4085, 4249

Othotrichaceae

Groutiella tomentosa (Hornschuch) Wijk & Margadant; 3880

Schlotheimia rugifolia (W.J. Hooker) Schwägrichen; 4307

Pilotrichaceae

Callicostella pallida (Hornschuch in Martius) Ångström; 3757, 3759, 3869, 3872, 3968, 4026, 4097, 4103, 4136, 4184, 4186, 4203, 4315, 4322

Crossomitrium patrisiae (Bridel) C. Müller; 4187

Lepidopilum affine C. Müller; 4179, 4190

Lepidopilum surinamense C. Müller; 3752

Pottiaceae

Barbula indica (W.J. Hooker) Sprengel in Steudel; 4223

Dolotortula mniifolia (Sullivant) R.H. Zander; 4225

Pterobryaceae

Henicodium geniculatum (Mitten) W.R. Buck; 3930, 3988, 4127, 4137

Pirella pohlii (Schwägrichen) Cardot; 4152

Sematophyllaceae

**Potamium lonchophyllum* (Montagne) Mitten; 4251

**Sematophyllum adnatum* (Michx.) E. Britton; 4242, 4289

Sematophyllum subpinnatum (Bridel) E. Britton; 3737

Sematophyllum subsimplex (Hedwig) Mitten; 3827, 3952, 3960, 3967, 4008, 4025, 4329

Taxithelium planum (Bridel) Mitten; 3933, 3934, 4142, 4150, 4206, 4208, 4260, 4317

Trichosteleum cf. *pusillum* (Hornschuch) A. Jaeger; 4027

Trichosteleum subdemissum (Schimper ex Bescherele) A. Jaeger; 4123, 4129, 4279

Splachnobryaceae

Splachnobryum obtusum (Bridel) C. Müller; 3996, 3998

Stereophyllaceae

Pilosium chlorophyllum (Hornschuch) C. Müller in Brotherus; 3956, 4003, 4012, 4034, 4037, 4087, 4256, 4305, 4312

Thuidiaceae

Cyrto-hypnum involvens (Hedwig) W.R. Buck & H. Crum; 3938, 4124, 4147, 4198

Cyrto-hypnum leptocladum (Taylor) W.R. Buck & H. Crum; 4035

Cyrto-hypnum scabrosulum (Mitten) W.R. Buck & H. Crum; 3761, 3857, 3951, 4010, 4084, 4128, 4319.

Taxa recorded in Vargas (1974):

Anomobryum julaceum (Schrader ex P.G. Gärtner, B. Meyer & Scherbius) W.P. Schimper, *Bryum apiculatum* Schwägrichen, *Dicranella hilariana* (Montagne) Mitten, *Entodon jamesonii* (Taylor) Mitten, *Leucobryum martianum* (Hornschuch) Hampe ex C. Müller, *Philonotis longiseta* (Michx.) Britton, *P. uncinata* (Schwägrichen) Bridel, *Pilopogon guadalupensis* (Bridel) Frahm, *Thamnobryum fasciculatum* (Hedwig) I. Sastre, *Sematophyllum subpinnatum* (Bridel) E. Britton, *Sphagnum subsecundum* Nees in Sturm, *Squamidium nigricans* (W.J. Hooker in Kunth) Brotherus.

Taxa listed as occurring in Madre de Dios in the Tropicos database with collector and collection number (mobot.mobot.org/W3T/Search/most.html):

Fissidens allionii Brotherus (Matthews B-86580, MO); *Fissidens lagenarius* Mitten (Matthews B-86577, COLO, PAC); *Fissidens perfalcatus* Brotherus (Matthews B-85860, MO); *Phyllogonium viscosum* (P. Beauv.) Mitten (Chavez 857, MO).

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