

Bryophytes of Alarachi Natural Reserve, Department of Tarija, Bolivia

Steven P. Churchill

Museo de Historia Natural Noel Kempff Mercado, Av. Irala 565, Casilla No. 2489, Santa Cruz, Bolivia and Missouri Botanical Garden, 2345 Tower Grove Avenue, PO Box 299, St. Louis, Missouri 63166-0299, U.S.A. (Steve.Churchill@mobot.org)

Abstract: A bryophyte inventory of Alarachi Natural Reserve in the Province of Acre, Department of Tarija, Bolivia, recorded 154 species distributed among 101 genera and 51 families; for hepatics 35 species, 19 genera, 13 families, and mosses 119 species, 82 genera, 38 families. This study represents the first bryological inventory for southern Bolivia, and provides the first representative subset of bryophytes for the Tucuman-Bolivian montane forest.

Key words: Bryophytes, Alarachi Reserve, Tucuman-Bolivian montane forest

Introduction

Alarachi Natural Reserve is a small, relatively new protected area situated in southernmost Bolivia, along the border of Argentina, separated by the Bermejo River. In mid 2003 PROMETA (Protección del Medio Ambiente Tarija), a private conservation organization, invited two Bolivian institutions to conduct a botanical inventory of the Alarachi reserve, one from Sucre (Herbario Chuquisaca, Universidad Mayor Real y Pontificia de San Francisco Xavier de Chuquisaca) and the other from Santa Cruz (Museo de Historia Natural Noel Kempff Mercado).

Exploration and inventory of Bolivia's Andean bryophytes (including vascular plants), during the late 19th to early 20th centuries focused almost exclusively on the northern puna and Yungas montane forest (Churchill, 2003). Very little was known previously about the diversity and composition of bryophytes from the southern highland region of Bolivia, particularly from the distinctive type of montane forest known as Tucuman-Bolivian. Thus the invitation by PROMETA provided an opportunity not only to inventory the plants (bryophytes, vascular plants) and provide a checklist, but served to provide a preliminary subset of species from the little known Tucuman-Bolivian montane forest.

The Alarachi Reserve (Alarachi Natural Heritage Private Reserve) is in the Province Acre, Department of Tarija. The reserve is ca. 80 kilometers south of the capital city of Tarija. Alarachi was established 8 May 2001, and forms a portion of the international Tariquia-Baritú Ecological Corridor administered by both Argentina and Bolivia (Bluske 2004, PROMETA

2008). The reserve contains 2,562 hectares with Tucuman-Bolivian montane forest as the primary vegetation, and dryer forest elements on the lower slopes and along the Bermejo River. The reserve is characterized by relatively steep slopes, and ranges in elevation from ca. 900 to 2100 meters. The conservation condition of the Alarachi forest could be characterized as good to excellent on steep slopes, to rather poor on more level topography; it is however the intent of the reserve to allow regeneration and preservation of the forest. Additional information and maps can be found on the PROMETA web page both in English and Spanish (<http://www.elgranchaco.com/prometa/>) under 'Protected Areas' and 'Ecological Corridor Tariquia-Baritú.'

During the bryophyte inventory of Alarachi Natural Reserve an attempt was made to collect in all possible habitats and elevational ranges in order to maximize the list of taxa from the area. Field work was conducted during 11–23 September 2004. Approximately 330 bryophyte collections were made from 13 general or transect localities in Alarachi Natural Reserve, including the area of Campamento Sidras, Tariquia Flora and Fauna National Reserve, which abuts the southern border of Alarachi.

A total of 154 species distributed among 101 genera, and 51 families of bryophytes were recorded for the reserve area. Hepatics are represented by 35 species, 19 genera and 13 families. The number of hepatics recorded for Alarachi represents about 8% of the known species presently recorded for Bolivia. There may be at least 50 species for Alarachi, however several genera of hepatics require further study, e.g., *Frullania*, *Lejeunea*, and *Plagiochila*. Mosses are

represented by 119 species, 82 genera and 38 families. Alarachi is particularly rich in moss species, containing ca. 13% of the known Bolivian species.

The five most diverse hepatic families include the Frullaniaceae and Lejeuneaceae each coequal (5 spp.), Lophocoleaceae, Plagiochilaceae and Radulaceae all coequal (4 spp.). The most diverse genera include *Frullania* (5 spp.), *Plagiochila* and *Radula* each coequal (4 spp.). The five most diverse moss families include the Pottiaceae (15 spp.), Brachytheciaceae (11 spp.), Bryaceae (9 spp.), Neckeraceae (8 spp.) and Dicranaceae (7 spp.). Diverse moss genera include: *Fissidens* (6 spp.), *Bryum* (5 spp.) and six genera all coequal with 3 species: *Campylopus*, *Cryphaea*, *Holomitrium*, *Neckera*, *Sematophyllum*, and *Syrrophodon*.

Several of the bryophytes collected at Alarachi represented species newly recorded for Bolivia (Churchill & Fuentes 2005). Three of these species are known only from the reserve: *Braunia reflexifolia*, *Ptychomitrium lindmanii*, and *Radula pocsii*. Several species known previously from the yungas montane forest several hundred kilometers north have been discovered in Alarachi, including *Catagonium brevicaudatum* and *Pilotrichella flexilis*.

Many species of Alarachi were found only from a specific substrate, while others were found on several substrates (generalist), for example *Brachythecium stereopoma*, *Racopilum tomentosum*, *Rhodobryum beyrichianum*. Four substrate categories are recognized for Alarachi: 1) epiphytes (on living woody lianas, shrubs, treelets or trees), 2) logs (in various stages of decomposition), 3) soil, and 4) rocks. The greatest number bryophytes were found as epiphytes, for hepatics 22 species and mosses 58 species. The log substrate for hepatics and mosses was 12 and 44 species respectively. The other categories for hepatics included 7 species on soil and one on logs. For mosses 24 species were equally found on soil and logs.

The inventory of Alarachi Reserve provided the first assessment of Tucuman-Bolivian montane forest for Bolivia. This type of montane forest is less diverse for bryophytes than that of the Yungas montane forest found in northern Bolivia, in part, due to climatic factors, e.g., less precipitation and greater number of dry months. Greater emphasis on inventory of the Tucuman-Bolivian montane forest could provide important information on diversity and component species.

The first set of collections from this study is deposited primarily at HSB or in a few cases at USZ, the first duplicate set is deposited at MO, with additional duplicates distributed to LPB and USZ. All collections have been data based in the Missouri

Botanical Garden system Tropicos (<http://www.tropicos.org/>), and are available to the scientific community. There are now 16,100 bryophyte records for Bolivia, including those from Alarachi. Additional information on tropical Andean mosses and Bolivian bryophytes can be found on the internet at: <http://mobot.mobot.org/W3T/Search/andes/andesintro.htm>.

The following bryophyte list is divided into two groups: hepatics and mosses. Within each group the taxa are alphabetically arranged by family, genus, and species. Following the species name is a short statement referring to the substrate on which the collection(s) was made. Following this is the collection number(s). All collections were made by Churchill. More specific information on the localities of the collections within the study area are referenced by collection number sequence following the checklist. Synonyms or basionyms, if pertinent, are placed in brackets following the accepted species name.

Checklist of the Alarachi Bryophytes

HEPATICS

Aytoniaceae

Plagiochasma rupestre (G. Forst.) Steph. – On rocky soil and vertical rock. 23266, 23337.

Frullaniaceae

Frullania arecae (Spreng.) Gottsche var. *arecae* – On fallen branches. 23301.

Frullania beauverdii Steph. – On shrub branches. 23373-A.

Frullania brasiliensis Raddi – On branches of *Acacia*. 23315-A.

Frullania ericoides (Nees ex Mart.) Mont. – On rocks and trunk of tree. 23263-A, 23290.

Frullania kunzei Lehm. & Lindenb. [*F. neesi* Lindenb.] – On trunk of tree. 23264.

Herbertaceae

Herbertus juniperoideus (Sw.) Grolle subsp. *acanthelius* (Spruce) Feldberg & J. Heinrichs – On trunk of tree. 23413 (det. K. Feldberg).

Lejeuneaceae

Bryopteris filicina (Sw.) Nees – On rocks and trunk of tree. 23345, 23470.

Drepanolejeunea sp. – On leaves. 23233.

Lejeunea spp. – On soil, sandy soil and sandstone rocks. 23253, 23320, 23467-A, 23489, 23502.

Omphalanthus filiformis (Sw.) Nees – On trunk of tree. 23454-A.

Taxilejeunea pterigonia (Lehm. & Lindenb.) Schiffl. – On vertical rock. 23467.

Lepidoziaceae

Bazzania hookeri (Lindenb.) Trevis. – On base of tree. 23354.

Lophocoleaceae [Geocalyceae]

Chiloscyphus latifolius (Nees) J.J. Engel & R.M. Schust. [*Lophocolea bidentata* (L.) Dumort. non *Chiloscyphus bidentata* Steph.] – On rocks and logs. 23246, 23355, 23392, 23488.

Chiloscyphus mandonii (Steph.) J.J. Engel & R.M. Schust. [*Lophocolea mandonii* Steph.] – On rocky soil. 23255.

Chiloscyphus platensis (Steph.) J.J. Engel & R.M. Schust. [*Lophocolea platensis* Steph.,] – On rocks in stream. 23469.

Leptoscyphus expansus (Lehm.) Grolle [*L. difficilis* (Steph.) Fulford] – On trunk of tree. 23416.

Marchantiaceae

Dumortiera hirsuta (Sw.) Nees – On soil and soil covered rocks. 23222, 23422, 23419.

Marchantia plicata Nees & Mont. – On soil covered rocks. 23279.

Metzgeriaceae

Metzgeria myriopoda Lindb. – On rocks. 23353 (det. verif. D.P. Costa).

Metzgeria parviinvoluta Kuwah. – On shrub branches. 23368, 23426 (det. D.P. Costa).

Monocleaceae

Monoclea gottschei subsp. *elongata* Gradst. & R. Mues. – On soil. 23466.

Pallaviciniaceae

Symphyogyna brongniartii Mont. – On logs. 23357.

Symphyogyna podophylla (Thunb.) Mont. & Nees – On soil. 23389.

Plagiochilaceae

Plagiochila bifaria (Sw.) Lindenb. – On trunk of tree. 23481-A.

Plagiochila corrugata (Nees) Nees & Mont. – On trunk of liana. 23260.

Plagiochila patula (Sw.) Lindenb. – On base of tree. 23231 (det. J. Heinrichs).

Plagiochila rutilans Lindenb. – On trunk of treelet. 23210.

Porellaceae

Porella crispata (Hook.) Trevis. [*Porella crispata* var. *subciliata* (Lehm. & Lindenb.) Swails] – On trunk of *Podocarpus*. 23254, 23379.

Porella reflexa (Lehm. & Lindenb.) Trevis. – On trunk of treelets and trees. 23218, 23232, 23317, 23471.

Porella swartziana (F. Weber) Trevis. – On rocks and trunk of trees. 23302, 23310, 23338, 23477.

Radulaceae

Radula espiscia Spruce – On rocks. 23390, 23450 (det. K. Yamada).

Radula pocsii K. Yamada – On sandstone rocks. 23340, 23444 (det. K. Yamada).

Radula tectiloba Steph. – On trunk of tree. 23249, 23295.

Radula voluta Taylor – On trunk of tree. 23366, 23454.

MOSSES

Bartramiaceae

Philonotis uncinata (Schwägr.) Brid. – On soil and rocky soil. 23258, 23259.

Brachytheciaceae

Aerolindigia capillacea (Hornsch.) M. Menzel – On branches of treelet and trunk of Asteraceae. 23432, 23472.

Brachythecium plumosum (Hedw.) Schimp. – On rocks in stream. 23396.

Brachythecium stereopoma (Spruce ex Mitt.) A. Jaeger – On leaf litter covered rocks, soil, and base of tree. 23235, 23281, 23491.

Eurhynchium aff. *semiscabrum* E.B. Bartram – On soil with leaf litter. 23427, 23436.

Meteoridium remotifolium (Müll. Hal.) Manuel – On trunk and branches of treelets and trees. 23208, 23430, 23481.

Palamocladium leskeoides (Hook.) E. Britton – On roots of tree fern. 23406-A.

Platyhypnidium aquaticum (A. Jaeger) M. Fleisch. – On rocks in stream. 23434.

Rhynchostegium serrulatum (Hedw.) A. Jaeger – On soil. 23242.

Squamidium brasiliense (Hornsch.) Broth. – On rocks, fallen branches, more common on trunk and branches of treelets and trees. 23252, 23325-A, 23327, 23329, 23409-A, 23423, 23445.

Squamidium macrocarpum (Spruce ex Mitt.) Broth. – On branches of *Brunfelsia* (Solanaceae). 23409-B.

Zelometeorium ambiguum (Hornsch.) Manuel – On rocks, logs and trunk and branches of trees. 23211, 23215, 23239, 23286, 23251, 23292.

Bruchiaceae

Trematodon sp. – On rocky soil. 23288.

Bryaceae

Brachymenium exile (Dozy & Molk.) Bosch & Sande Lac. – On sandy soil. 23294, 23297-A.

Brachymenium radiculosum (Schwägr.) Hampe – On fallen branches and branches of trees. 23446, 23468.

Bryum andicola Hook. – On dead upright tree trunk, with *B. richardsii*. 23378-A.

Bryum argenteum Hedw. – On concrete drain. 23293-B.

Bryum coronatum Schwägr. – On soil. 23291.

Bryum limbatum Müll. Hal. – On sandstone rocks. 23217.

Bryum richardsii Sharp – On dead upright tree trunk, with *B. andicola*. 23378.

Epipterygium immarginatum Mitt. – On soil, with *Plagiochasma*. 23266-A.

Rhodobryum beyrichianum (Hornsch.) Müll. Hal. – On rocks, soil, leaf litter, inclined tree trunk. 23303, 23456, 23503.

Calymperaceae

Syrrophodon gaudichaudii Mont. – On rocks and trunk of trees including *Crinodendron*. 23283, 23324, 23377.

Syrrophodon incompletus Schwägr. var. *incompletus* – On base of tree. 23480, 23487.

Syrrophodon parasiticus (Sw. ex Brid.) Paris – On dead upright tree trunk. 23495.

Catagoniaceae

Catagonium brevicaudatum Müll. Hal. ex Broth. – On trunk of tree fern (*Alsophila*). 23452.

Cryphaeaceae

Cryphaea apiculata Schimp. – On branches of *Acacia*. 23314-A.

Cryphaea patens Hornsch. ex Müll. Hal. – On trunk of tree. 23263-B.

Cryphaea rhacomitrioides Müll. Hal. – On shrub branches and tree trunk. 23263, 23314, 23309.

Schoenobryum concavifolium (Griff.) Gangulee – On trunk and branches of trees including *Acacia*. 23263-C, 23312, 23314-C.

Daltoniaceae

Daltonia trachyodonta Mitt. – On shrub branches and nodes of *Chusquea*. 23395, 23402.

Dicranaceae

Bryohumbertia filifolia (Hornsch.) J.-P. Frahm – On sandstone rocks. 23398.

Campylopus fragilis (Brid.) Bruch & Schimp. – On dead upright tree trunk and logs. 23376, 23458, 23497.

Campylopus heterostachys (Hampe) A. Jaeger – On rocks and logs. 23344, 23414, 23460.

Campylopus pilifer var. *lamellatus* (Mont.) Gradst. & Sipman – On sandstone rocks. 23399.

Holomitrium antennatum Mitt. – On fallen branches. 23375-A.

Holomitrium arboreum Mitt. – On rocks. 23351.

Holomitrium crispulum Mart. – On fallen branches. 23375.

Entodontaceae

Entodon jamesonii (Taylor) Mitt. – On shrub branches 23408.

Entodon micans Herzog – On rocks. 23298.

Erythrodontium longisetum (Hook.) Paris – On rocks. 23261.

Fissidentaceae

Fissidens asplenioides Hedw. – On soil and rocks. 23234, 23273, 23425.

Fissidens elegans Brid. – On soil. 23238.

Fissidens intramarginatus (Hampe) A. Jaeger – On soil bank. 23229 (det. R.A. Pursell).

Fissidens pallidinervis Mitt. [*F. minutus* Thwaites & Mitt.] – On logs. 23299.

Fissidens rigidulus Hook. f. & Wilson – On wet rocks. 23326.

Fissidens weirii Mitt. var. *weirii* – On trunk of tree. 23485.

Fissidens weirii var. *hemicraspedophyllus* (Cardot) Pursell – On rocky soil. 23205.

Funariaceae

Funaria cf. *calvescens* Schwägr. – On concrete drain. 23293-A.

Grimmiaceae

Ptychomitrium lindmanii (Broth.) Paris – On rocks. 23325.

Ptychomitrium sellowianum (Müll. Hal.) A. Jaeger – On rocks. 23351-A.

Hedwigiaceae

Braunia exserta Müll. Hal. – On branches of treelet and fallen tree branches. 23382, 23384.

Braunia reflexifolia (Müll. Hal.) E.B. Bartram – On branches of tree. 23367.

Hypnaceae

Chryso-hypnum elegantulum (Hook.) Hampe – On soil and logs. 23199, 23475.

Isopterygium byssobolax (Müll. Hal.) Paris – On logs and base of tree trunk. 23198, 23486, 23498.

Isopterygium tenerum (Sw.) Mitt. – On logs and trunk of lianas. 23335, 23479.

Mittenothamnium reduncum (Schimp. ex Mitt.) Ochyra – On rocks along small stream. 23394.

Mittenothamnium reptans (Hedw.) Cardot – On logs. 23385, 23440.

Hypopterygiaceae

Hypopterygium tamarisci (Sw.) Brid. ex Müll. Hal. – On inclined trunk of tree and logs. 23214, 23348.

Lembophyllaceae

Orthostichella pachygastrella (Müll. Hal. ex Ångstr.) B.H. Allen & Magill – On trunk of treelets and trees, also on rocks. 23216, 23282, 23300, 23442.

Pilotrichella flexilis (Hedw.) Ångstr. – On shrub branches. 23362.

Leptodontaceae

Forsstroemia producta (Hornsch.) Paris – On fallen branches. 23237.

Leskeaceae

Pseudoleskea andina Schimp. ex E. Britton – On shrub branches. 23381.

Leucobryaceae

Leucobryum antillarum Schimp. ex Besch. – On rocks. 23349.

Leucobryum crispum Müll. Hal. – On base of tree. 23453.

Leucodontaceae

Pterogoniadelphus assimilis (Müll. Hal.) Ochyra & Zijlstra [*Felipponea*] – On rocks. 23274.

Macromitriaceae

Macrocoma tenuis subsp. *sullivantii* (Müll. Hal.) Vitt – On branches of *Acacia*. 23314-B.

Macromitrium punctatum (Hook. & Grev.) Brid. – On trunk of fallen tree and trunk of trees. 23370, 23374.

Schlotheimia jamesonii (Arn.) Brid. – On trunk of fallen tree. 23306.

Schlotheimia rugifolia (Hook.) Schwägr. – On rocks. 23262.

Meteoriaceae

Meteorium deppei (Hornsch. ex Müll. Hal.) Mitt. [*Meteorium illecebrum* Sull.] – On rocks, trunk and branches of trees, also shrubs. 23221, 23339, 23409, 23478.

Meteorium laevifolium Mitt. [*Papillaria laevifolia* (Mitt.) Broth.] – On fallen branches, shrubs and trunk of treelets. 23211-A, 23435, 23461.

Mniaceae

Plagiomnium rhynchophorum (Hook.) T.J. Kop. – On rocks and logs. 23234-B, 23293, 23330, 23439, 23497.

Myriniaceae

Helicodontium capillare (Hedw.) A. Jaeger – On branches of treelet. 23501.

Neckeraceae

Neckera andina Mitt. – On trunk of tree. 23407.

Neckera chilensis Schimp. ex Mont. – On trunk of tree. 23443.

Neckera scabridens Müll. Hal. – On trunk of liana and trees. 23244, 23380.

Neckeropsis undulata (Hedw.) Reichardt – On rocks, trunk of treelets and trees. 23207, 23283, 23431.

Porotrichodendron bertrandii (Renauld & Cardot) Broth. – On base of tree. 23369, 23406.

Porotrichum filiferum Mitt. – On rocks. 23226, 23220, 23343, 23420, 23421.

Porotrichum mutabile Hampe – On trunk of treelets and trees. 23209, 23218-A, 23476.

Thamnobryum fasciculatum (Sw. ex Hedw.) I. Sastre – On sandstone rocks along stream. 23437.

Octoblepharaceae

Octoblepharum albidum Hedw. – On rocks and trunk of trees. 23316, 23496.

Orthotrichaceae

Zygodon oeneus Herzog – On trunk of *Podocarpus*. 23358 (det. G. Calabrese).

Pilotrichaceae

Cyclodictyon albicans (Hedw.) Kuntze – On sandy soil and logs. 23202, 23447.

Lepidopilidium cf. *divaricatum* (Dozy & Molk.) Broth. – On rocks and trunk of trees. 23459, 23463, 23473.

Thamniopsis langsdorffii (Hook.) W.R. Buck – On rocks. 23465.

Polytrichaceae

Atrichum polycarpum (Müll. Hal.) Mitt. – On soil. 23360.

Pogonatum campylocarpon (Müll. Hal.) Mitt. – On soil. 23359.

Polytrichum juniperinum Hedw. – On humic sandy soil. 23241, 23296, 23361.

Pottiaceae

Anoetangium aestivum (Hedw.) Mitt. – On rocks. 23204, 23332.

Barbula indica var. *gregaria* (Mitt.) R.H. Zander – On concrete drain. 23297-C.

Bryoerythrophyllum campylocarpon (Müll. Hal.) H.A. Crum – On soil covered rock. 23393.

Hymenostylium recurvirostre (Hedw.) Dixon – On rocks. 23336.

Leptodontium brachyphyllum Broth. & Thér. – On rocks. 23391.

Leptodontium viticulosoides (P. Beauv.) Wijk & Margad. var. *viticulosoides* – On trunk of liana and rocks. 23342, 23365.

Pseudocrossidium linearifolium (Müll. Hal.) J.A. Jiménez & M.J. Cano – On sandy soil. 23297 (det. J.A. Jiménez).

Rhexophyllum subnigrum (Mitt.) Hilp. – On trunk of tree and fallen branch. 23384-A, 23411-A.

Scopelophila ligulata (Spruce) Spruce – On rocks, with *Campylopus*. 23323-A.

Streptopogon calymperes Müll. Hal. – On branches of shrubs and treelets. 23371, 23473.

Streptopogon erythrodontus (Taylor) Wilson – On branches of shrubs. 23372.

Syntrichia amphidiacea (Müll. Hal.) R.H. Zander – On trunk of tree. 23243.

Syntrichia sp. – On upright trunk of tree. 23411.

Tortella humilis (Hedw.) Jenn. – On soil covered rock. 23236.

Trichostomum brachyodontium Bruch – On rocky soil. 23271, 23334.

Trichostomum tenuirostre (Hook. & Taylor) Lindb. – On logs. 23464.

Weissia controversa Hedw. – On soil. 23257.

Prionodontaceae

Prionodon densus (Sw. ex Hedw.) Müll. Hal. – On trunk of tree. 23404.

Pteryobryaceae

Calyptothecium duplicatum (Schwägr.) Broth. – On trunk of tree. 23305, 23500.

Orthostichopsis tenuis (A. Jaeger) Broth. – On trunk of fallen tree. 23240

Pterobryon densum Hornsch. – On shrub branches, trunk of treelets and trees. 23341, 23415, 23470, 23483, 23499.

Pterobryopsis stolonacea (Müll. Hal.) Broth. – On rocks and trunk of trees. 23234-A, 23245, 23256.

Racopilaceae

Racopilum tomentosum (Hedw.) Brid. – On rocks, soil, logs, base and trunk of treelets and trees. 23200, 23201, 23223, 23322, 23490.

Rigodiaceae

Rigodium toxarion (Schwägr.) A. Jaeger – On rocks and base of tree. 23400, 23412.

Sematophyllaceae

Sematophyllum galipense (Müll. Hal.) Mitt. – On logs. 23219.

Sematophyllum subpinnatum (Brid.) E. Britton – On trunk of tree. 23248.

Sematophyllum swartzii (Schwägr.) W.H. Welch & H.A. Crum – On logs. 23347, 23401.

Stereophyllaceae

Stereophyllum radiculosum (Hook.) Mitt. – On rocks. 23280.

Thuidiaceae

Pelekium leptocladum (Taylor) Touw [*Cyrto-hypnum*] – On base of tree. 23212.

Rauiella praelonga (Schimp. ex Besch.) Wijk & Margad. – On rocks and logs. 23272, 23285, 23331.

Thuidium tomentosum Schimp. – On rocky soil, sandstone rocks and logs. 23227, 23267, 23429.

Acknowledgements. I would like to thank those that accompanied the author in the field: Lilian Apaza V. and Felipe Jacinto A. from PROMETA (Tarjia), Oscar Colque, Claribel Ojeda and Daniel Villarroel from USZ (Santa Cruz), and Martha Serrano and Jeanneth Villalobos from HSB (Sucre). For the determination of specific bryophytes the author is grateful to Drs. G. Calabrese (*Zygodon*), D.P. Costa (*Metzgeria*), K. Feldberg (*Herbertus*), J. Heinrichs (*Plagiochila*), A. Jiménez (*Pseudocrossidium*), R.A. Pursell (*Fissidens*), and K. Yamada (*Radula*). A special thanks to Lilian Apaza V. and PROMETA for providing the logistics and opportunity to collect and study the bryophytes of the Alarachi Natural Reserve, and finally to our infallible and knowledgeable field guide Felipe Jacinto A. Specific funds involving fieldwork were provided by PROMETA, laboratory and herbarium studies were supported by a grant from the National Science Foundation (DEB-0542422).

References

- Bluske, R.A. 2004.** Áreas Protegidas del Departamento de Tarija. PROMETA., Tarija.
- Churchill, S. P. 2003.** Briófitas. Pages 96–100. *En:* P. L. Ibisch & G. Mérida (eds.). *Biodiversidad: La Riqueza de Bolivia*. Editorial FAN, Santa Cruz.
- Churchill, S. P. & A. Fuentes. 2005.** Additions, combinations, and synonyms for the Bolivian moss flora. *Tropical Bryology* 26: 119–131.
- PROMETA (Protección del Medio Ambiente Tarija). 2008.** <<http://www.elgranchaco.com/prometa/>> See “Alarachi” Natural Heritage Private Reserve. Web page consulted Feb 2008.

Appendix

Alarachi collection localities for S. Churchill
Department of Tarija, Arce Province

23198–23234. Sidras Camp. Tucuman-Bolivian premontane forest. 22°14'57"S, 64°32'58"W. 890 m. 11 Sep 2004.

23235–23293. La Lima, above Los Pinos Stream. Tucuman-Bolivian seasonal semideciduous forest. 22°10'59"S, 64°37'46"W. 1300 m. 12 Sep 2004.

23294–23297. Margin of Río Bermejo. 22°12'18"S, 64°37'47"W. 1140 m. 12 Sep 2004.

23298–23320. Area of Alarachi, Las Lagunitas, above Los Pinos Stream. Tucuman-Bolivian seasonal semideciduous forest. 22°11'09"S, 64°37'32"W. 1340–1500 m. 13 Sep 2004.

23321–23338. Between Alarachi - Tunel Nomi, area of Baden Chico - Cerro Los Tejerinas. Tucuman-Bolivian seasonal semideciduous forest along Río Bermejo. 22°13'S, 64°36'W. 1140–1200 m. 14 Sep 2004.

23339–23365. Alarachi. Baden Chico, along lower slopes of Cerro Los Tejerinas. Tucuman-Bolivian montane forest. 22°12'16"S, 64°36'33"W – 22°11'32"S, 64°36'27"W. 1500–2100 m. 15 Sep 2004.

23366–23399. Area of Alarachi, along median slopes of Cerro Los Tejerinas. Tucuman-Bolivian montane forest. 22°11'13"S, 64°36'27"W. 2000–2200 m. 16 Sep 2004.

23400–23419. Area of Alarachi. Cerro Los Tejerinas. Tucuman-Bolivian montane forest. 22°11'56"S, 64°36'26"W. 1950–2100 m. 17 Sep 2004.

23420. Area of Alarachi, Cerro Los Tejerinas. Tucuman-Bolivian montane forest. 22°12'20"S, 64°36'35"W. 1600 m. 18 Sep 2004.

23421–23449. Area of Cayotal, Río Emborozú Chico. Tucuman-Bolivian premontane forest. 22°14'18"S, 64°34'19"W. 1120 m. 20 Sep 2004.

23450–23481. Area of Cayotal, Río Emborozú Chico. Tucuman-Bolivian premontane forest. 22°14'18"S, 64°34'19"W. 1220 m. 21 Sep 2004.

23482–23494. Area of Cayotal, Río Emborozú Chico. Tucuman-Bolivian premontane forest. 22°14'20"S, 64°34'26"W. 1020 m [23493–23494 at 1700 m]. 22 Sep 2004.

23495–23503. Sidras Camp. Tucuman-Bolivian premontane forest. 22°14'57"S, 64°32'58"W. 920 m. 23 Sep 2004.