

Lichens and lichenicolous fungi in the Madidi region (NW Bolivia)

Los líquenes y hongos liquenícolas de la región de Madidi (NW Bolivia)

Report from a field study

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The lichenological study was conducted during two expeditions to the Madidi region between May 13 and June 14 2006. The main purposes of the study were: 1) initiating a long-term inventory and research of lichens and lichenicolous fungi in the Madidi region, 2) a detailed study of species diversity, and 3) an ecological and phyto-geographical analysis of the studied lichen biota. The survey was conducted in the cooperation with Peter Jørgensen from Missouri Botanical Garden, U.S. – the director of the project “Inventario Botánico de la región de Madidi, Bolivia”. The expeditions to the Madidi region were organized by the staff from Herbario Nacional de Bolivia, La Paz. The first trip was organized by Alfredo Fuentes to the area of Camata, Charazani and Chulina villages (dept. La Paz, province Muñecas) and the second by Alejandro Araujo-Murakami and Leslie Cayola to the area of Azariamas – San Martin within the Madidi National Park (dept. La Paz, province Franz Tamayo). The lichens were collected from the mountainous area of the Madidi region, in the following ecosystems: 1) primary and secondary montane forests, altitude between 2550–3300 m, 2) seasonal montane forest, alt. between 1200–1600 m, and 3) dry forest of the Tuichi river basin, alt. between 700–970 m. In total of *ca.* 2000 lichen specimens were collected from various ecological groups, i.e. corticolous (lichens growing on bark of trees), lignicolous (growing on wood), saxicolous (growing on rocks), terricolous (growing on ground) and foliicolous (growing on vascular plants leaves).

The report is based on preliminary results of field and laboratory studies of Madidi lichens. The collected material is currently under elaboration and future detailed studies will provide more results.

The timberline forest of Chulina above 3000 m a.s.l.

The lichens were collected mainly along the road in rather open sites in the area. The lichens occupies here soil, rocks and bark of shrubs and trees; the corticolous species grow for

example on *Baccharis* sp., *Borella pubescens* and bamboo *Chusquea* sp. (the names of vascular plants occurring in the text were kindly provided by Alfredo Fuentes). The lichens were also collected in the secondary forest, from the trees and shrubs, e.g. from *Calonia myrtinoides*, *Senna* sp. and *Sipho-campylus* sp. The collected lichens represent all known growth forms, i.e. foliose, fruticose, squamulose, leprose and crustose thalli.



Fig. 1. Botanists from the Herbario Nacional de Bolivia, La Paz during the field work of Madidi project. From the left, *upper row*: Alfredo Fuentes, Tatiana, Abraham Poma, A. Fuentes, guide from Camata; *middle row*: Leslie Cayola, Gualberto Chive, Alejandro Araujo-Murakami, Isabel Loza; *lower row*: Sandra Paredes, Vania Torrez, Edwin Ticona.

Among the **terricolous** lichens the genera *Cladonia*, *Peltigera* and *Stereocaulon* play a dominant role. On the road banks abundantly grows *Dictyotema glabratum* – a lichenized basidiomycetes restricted to tropical regions. The **saxicolous** lichens are represented here by the species of the genera, e.g. *Peltigera*, *Placopsis*, *Xanthoparmelia*, and species *Normandina*



Fig. 2. Terricolous lichens of the genera (from the left) *Stereocaulon*, *Cladonia*, *Multiclavula*.

pulchella. The sterile form of *Normandina pulchella* is widespread in the world, while its fertile form is reported only from the tropics. The vertical rock walls are largely covered by the species of the genus *Stereocaulon*; the species produces the 15 cm tall shrubby, white thallus. The **corticolous** lichens are represented by the various genera, e.g. *Caloplaca*, *Heterodermia*, *Lecanora*, *Placynthiella*, *Rinodina*, and many species from the family *Parmeliaceae*. The ground around the bases of trees is frequently covered with cyanolichens, e.g. *Collema*, *Leptogium* or *Peltigera*.

In total 205 specimens of lichens were collected in this habitat.

The secondary montane forest, shrubby vegetation and grassland in the area of Camata village, alt. 1750–2550 m

Along the transect through the secondary forest the **corticolous** lichens were collected, especially from the family *Graphidaceae* and *Parmeliaceae*, and the genera *Candelaria*, *Teloschistes* and *Pyrrhospora* (on trees *Freziera lanata* and *Myrcia* sp.). **Saxicolous** taxa occur on single rocks or on stone fens, e.g. species from the family *Parmeliaceae*, and genera *Caloplaca* and *Teloschistes*. The latter two genera belong to the family *Teloschistaceae*, which is very richly represented in tropics.

In total 105 specimens of lichens were collected in this ecosystem.



Fig. 3. Saxicolous lichens of the genus *Caloplaca* (upper row), and the genera *Pheophyscia*, *Collema* and *Dibaeis* (lower row).

The montane forest of the area Siete Vueltas, S of Camata, alt. 2700–2900 m

This ecosystem is very diverse in lichens. The lichens grow on a wide spectrum of substrate, i.e. bark, wood, bryophytes, vascular plants leaves, plant debris, soil and rock. Both macro- and microlichens are richly represented in this type of forest and they represent all growth forms, i.e. crustose, leprose, squamulose, foliose and fruticose thalli.

Among the **terricolous** group of lichens the genus *Cladonia* is the most speciose in the studied area; various species grow abundantly on soil and also on rooting wood. Moreover, the species of the genera *Peltigera* and *Stereocaulon* have numerous representatives here. On the clay soil occur, e.g. *Dibaeis* spp., *Dictyonema glabratum*, *Multiclavula* sp. and *Phyllobaeis imbricata*. The **corticulous** lichens are dominated by representatives of the families *Parmeliaceae* (especially genera *Alectoria*, *Parmelia*, *Menegazzia* and *Usnea*), *Loberiaceae* (e.g. genera *Pseudocyphellaria*, *Sticta* and *Lobaria*), *Physciaceae* (e.g. genera *Heterodermia* and *Physcia*) and *Teloschistaceae*. **Saxicolous** lichens abundantly cover the rock outcrops mainly in open sites and are represented by the species of the genera *Peltigera*, *Pheophyscia*, *Placopsis*, *Fuscopannaria* and *Dibaeis*, and also the family *Collema*ceae. To the group of **lignicolous** lichens belong for example *Trapeliopsis* and *Pyrrhospora*. **Foliicolous** lichens are well represented in the studied area. This ecological group of lichens has distribution restricted mostly to tropics. Among the foliicolous species the microlichens

are dominant and they are represented by the taxa of such genera as *Opegrapha*, *Strigula*, *Chroodiscus* and *Porina*.

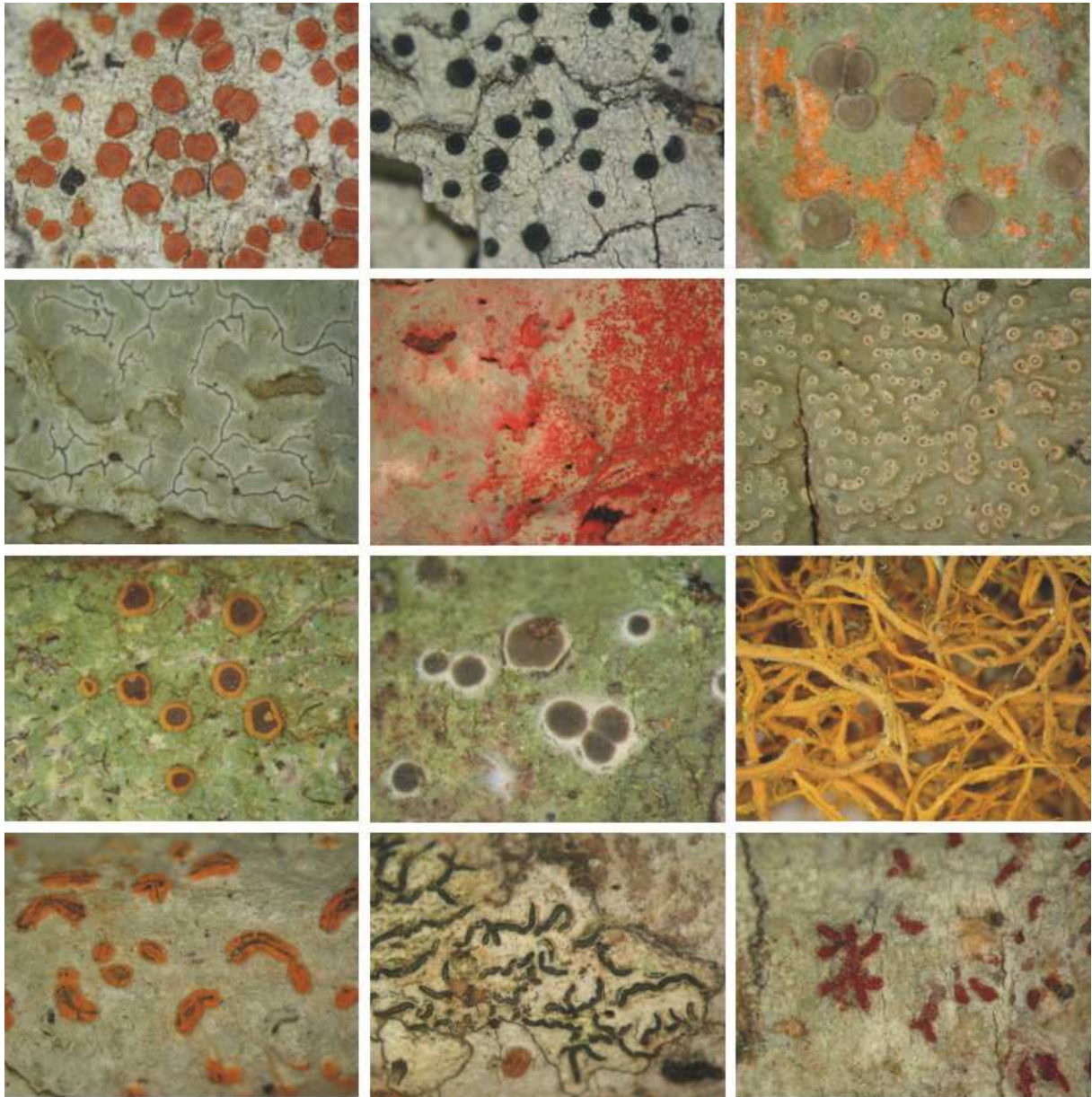


Fig. 4. Corticolous lichens of various genera.

In total 356 lichen specimens were collected during the three days of field work in this ecosystem.

The seasonal montane forest at San Martín, NW of Azariamas, alt. 1200–1600 m

The lichen biota of seasonal montane forest at the altitude between 1200–1600 m is less diverse than high montane Yungas forest. The lichens occupy here mainly bark of trees.

A considerable number of samples were also collected from the vascular plants leaves. The lichens growing on lignum, rock, and soil are considerably less abundant in the area. In general, the crustose lichens are dominant in the habitat. A particularly long stay in this vegetation type allowed me to gather a very representative collection of lichens. Moreover, a pilot survey was made on lichens from the tree canopies. It seems that the niche plays a very important role for lichen diversity in this type of ecosystem.

Corticulous lichen species are represented by the genera *Usnea*, *Ramalina*, *Siccia*, *Coenogonium*, *Cresponia*, *Ocellularia*, *Byssoloma*, *Letrouitia*, *Piccolia*, *Porina*, *Micarea*, *Fuscopannaria*, *Parmotrema*, *Heterodermia*, *Coccocarpia*, *Caloplaca*, and families *Cliciaceae* and *Graphidaceae*. The *Cryptothecia rubrocincta* which grows very abundantly in some places, is a very spectacular tropical lichen producing characteristic, partially red coloured thalli.

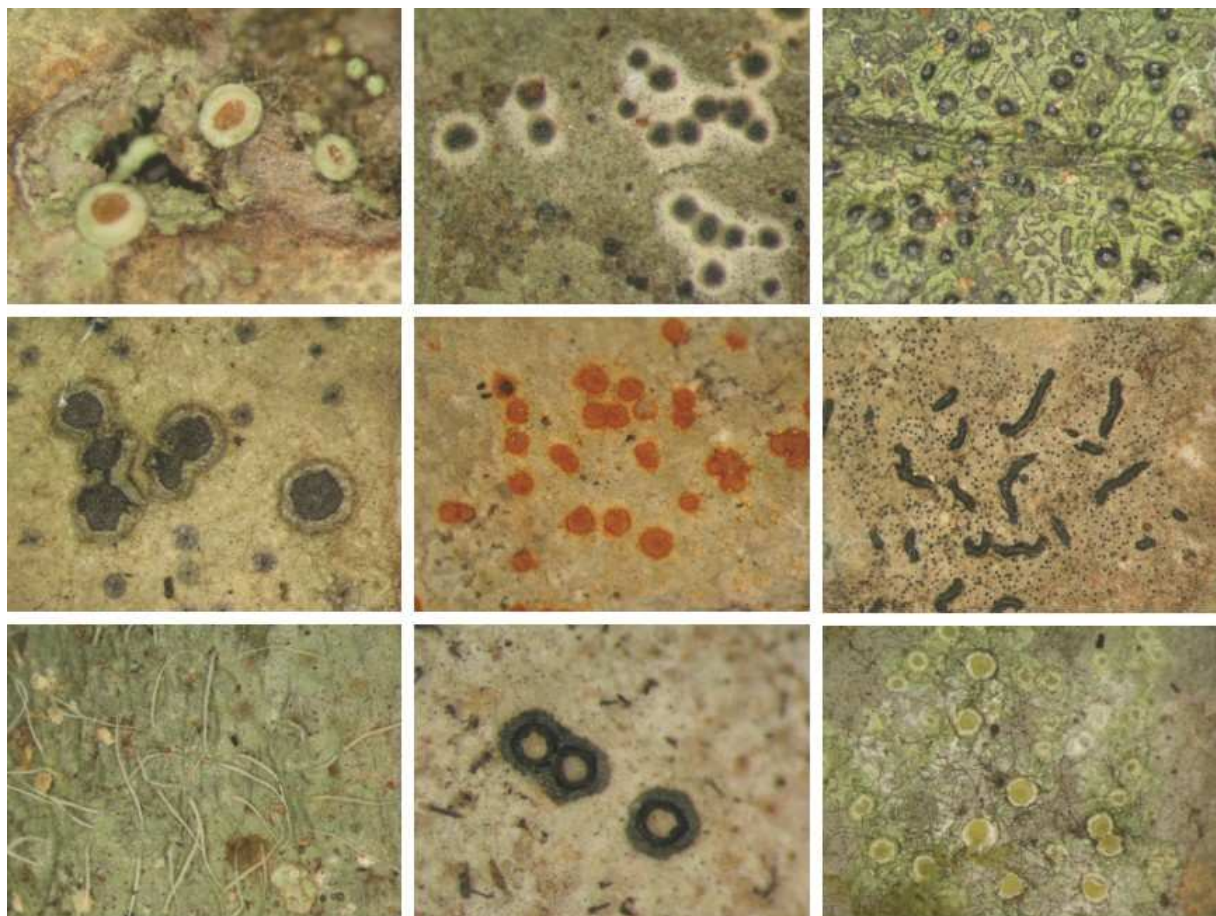


Fig. 4. Foliicolous lichens of various genera.

The genera *Phyllopsora*, *Brigantiaea*, *Crocynia* and *Dichosporidium* are very common in studied area. The fallen trees laying on the forest floor possess an interesting group of

photophytic lichens, e.g. *Caloplaca*, *Briganticea* and *Usnea*. The most notable group of lichens are those that grows on bamboos. The lichens occurring on this substrate are mainly small in size (microlichens) and belong to the genera, e.g. *Byssoloma* and *Trichinaria*; the collected macrolichens are from the family, e.g. *Collema*. In the canopy of trees I found, e.g. *Brigantiaea*, *Caloplaca*, *Cresponea*, *Megalospora*, *Ocellularia*, *Pseudocyphelaria*, *Ramalina*, and the species from family *Arthoniaceae* and *Graphidaceae*. **Foliicolous** lichens are very richly represented in this type of ecosystem. The further study is needed to defined more precisely this group of lichens.

In total more then 900 lichen specimens were collected in the area. The field work was conducted during the 2 weeks.

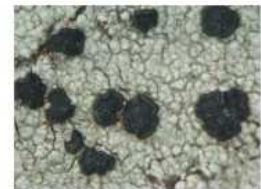
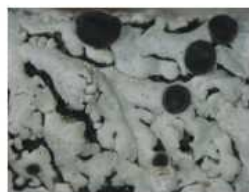
The dry forest of the Tuichi river basin, area of Azariamas, alt. 700–970 m

The dry forest has also less diverse lichen biota than high montane Yungas forest. The lichens occur mainly on bark of trees here. The lichens occurring on rock, vascular plants leaves and wood are very scanty. The interesting group of lichens are those growing on Cactaceae (e.g. on *Praecereus euchlorus*, *Cereus* sp.). On that type of substrate grow species

Lichens on Cactaceae



Cereus cf. acuaralensis



of the genera *Caloplaca*, *Coenogonium*, *Byssoloma*, *Glyphis*, *Graphis*, *Lecanora*, *Porina*, *Candelaria*, *Leptogium*, *Pyxine* and *Ramalina*. Only a few days of field work did not allow me to make a representative collection of lichens. Further investigations of this ecosystem are necessary for a more detail evaluation of the lichen diversity.

In total approximately 400 lichen specimens were collected here.

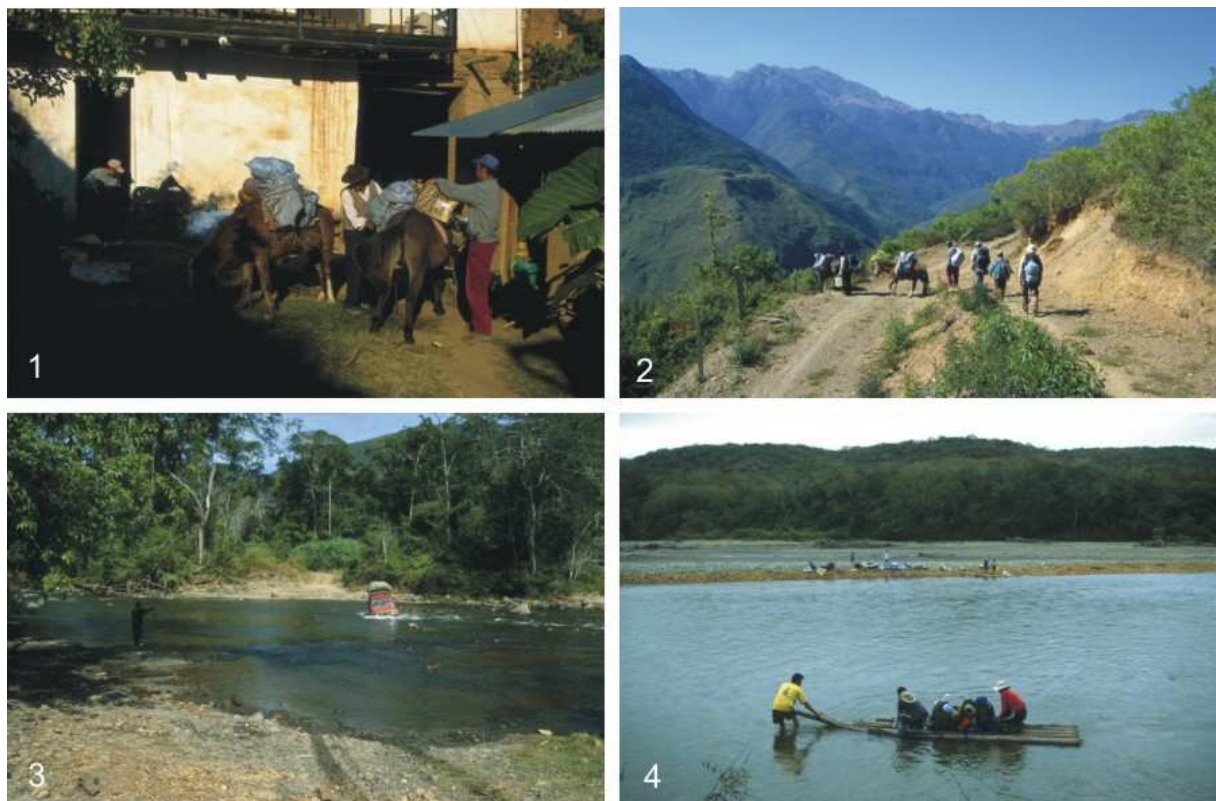


Fig. 5. 1) the preparations before the journey to Siete Vueltas, Camata village; 2) on the track to Siete Vueltas; 3) crossing the river on the track to Azariamas; 4) crossing the Tuichi river in Azariamas.

Summary

The preliminary results indicate the high diversity of lichen species of the Madidi region. Among the studied ecosystems the **high montane Yungas** forest deserves especial attention. High variety of microhabitats and favourable climatic conditions provide lichen developing of all ecological groups. Lichen biota of **seasonal montane forest** is less diverse. The predominant group are corticolous and foliicolous lichens. The interesting group constitutes lichens growing on bamboos. The pilot study of lichens occurring in canopy trees indicate that the habitat play the important role in species diversity formation of that ecosystem. The lichen biota of **inter Andean dry forest** is less diverse then high montane

Yungas forest. The corticolous lichens are dominant in that forest type. The interesting and notable lichens are those growing on Cactaceae.

The lichenological study conducted in the Madidi region contributes considerably to the knowledge of lichen biota on local and country level. Since the lichens of Bolivia are poorly known new records for country are expected (there are ca. 400 species recorded in the country and the estimated number of lichen species is about 2500 species; see http://www.biologie.uni-hamburg.de/checklists/southamerica/bolivia_1.htm).



Tuichi river, Azariamas village, the Madidi National Park