Jan-Peter Frahm
Mosses and Liverworts of the Mascarenes and the Seychelles

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an illustrated fieldguide
with 399 photographs

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Contents

Introduction

The are three groups of islands in the Indian Ocean east of Africa, which are very different regarding their size, elevation, geological age and number of mosses and liverworts.
Mauritius is situated 900 km E of Madagascar on 21°S and consists of volcanic rocks which originated about 8 million years ago. The island is relatively small, about 60 km from W to E and 80 km from N to S, and also relatively low with only a few mountains reaching 800 m altitude. Due to massive habitat destruction and deforestation, the natural forest is almost totally destroyed. Already Renauld (1897) stated „l'extension des cultures a forcément diminué la richesse de la vegetation spontanée". The lower altitudes are almost totally converted to sugar cane plantations. The largest semi-natural part of the island is the Black River National Park in the SW of the island, a high plateau with partial swampy forests, which is eroded by deep gorges. The SE flanks face the wind clouds and receive precipitation of up to 4000 mm or more. The NW parts are distinctly drier, particularly the higher mountains in the NW part of the Island (Le Pouce and Pieter Botha). The vegetation in the higher parts consists of a secondary growth of *Sideroxylon* bush which is partially forested with *Pinus* and *Eucalyptus*. A bryophyte flora of Mauritius was published by Tixier & Guého (1997), which is unfortunately no more available. The moss flora was treated by Frahm et al. (2009) and Een (2009). It consists of 238 species, as compared with 158 species of liverworts included in the checklist of the East African Island by Grolle (1995), updated by Wigginton (2009). (For comparison: Madagascar has 372, Réunion 260, Rodriguez 27, the Seychelles 108, the Comores 143 liverwort species).
Réunion is situated 170 km E of Mauritius at the same latitude (between 20° and 21°S). It is with 2511 km^2 only slightly larger as Mauritius but with 3069 m much higher. It is with 2 mya also much younger than Mauritius. Due to the steepness, natural habitats in the interior of the island are in a good state of conservation with the only exception of the coastal and lowland regions, which are densely populated. A checklist of the mosses and liverworts of Réunion was published by Ah-Peng & Bardat (2005), additional notes on the mosses by Frahm (2010). Mauritius and Réunion are comprised as the Mascarenes Islands. Further north are the **Seychelles**, which reach 4° S and thus almost the equator. They consists of 115 Islands, which are dispersed within 400.00 m^2 in the Indian Ocean north of Réunion and Mauritius. They are usually divided into the Inner and Outer Islands. The Outer Islands comprise of the Amirantes; Alphonses; Farquhar Islands and Aldabra Islands. Only six species of mosses are known from some of the Aldabra Islands. The Inner Islands consists of 42 granitic islands and two coral islands (Bird Island, Denis Island). The granitic islands are part of the former Gondwana continent and have never been submerged during their geological history. After the split of the Gondwana continent, the Seychelles remained attached to India until 65 mya. Amongst the granitic islands, Mahé, Praslin, Silhoutte and La Digue are the largest and the most visited ones by bryologists, the others are much smaller.
A detailed list of the mosses of the Seychelles was presented by O´Shea et al (1996). This detailed flora with indication of the localities and collectors included 97 species, of which 15 are endemic. For comparison, the liverwort flora consists of 82 species (Grolle 1978, Wigginton & Grolle 1996), and was raised later by Wigginton (2009) to 108. Frahm & Ho (2009) raised the number to 110. A liverwort flora for the Seychelles is lacking. Compared with the moss flora of Mauritius, with a comparable altitude below 900 m which includes 238 species (Frahm et al. 2009) this is a conspicuous small number, which cannot only be explained by a lower

intensity of bryological exploration. Even the bryoflora of Mahé, the island with the highest species numbers, is poor. This concerns also the liverwort flora. Already Grolle (1978) made the interesting remark: „Eine Flora ist nicht nur durch die vorhandenen Taxa charakterisiert, sondern auch durch die fehlenden. Erstaunlich ist vor allem das völlige Fehlen der Marchantiales auf den Seychellen. Weiterhin fehlen *Lepidozia*, *Jungermannia*, *Porella*, *Isotachis*, *Jamesoniella*, *Chandonanthus*, *Gottschelia* und *Notoscyphus*, immerhin Gattungen, die in den Tropen Asiens und Afrikas vorkomen, z.Z. sogar artenreich.“ The same concerns the mosses. There is no one species of *Leucobryum,, Polytrichum* is present with one species (but 4 in Réunion), *Pogonatum* is lacking (but 7 species in Reunion), *Schlotheimia* is lacking (but 11 in Réunion), *Sphagnum* is lacking (even in Mauritius are 5 species).

	Mauritius	Réunion	Seychelles
Size km^2	1865	2511	266
Max. elevation m	828	3069	905
Age (mio years)	8	2	200
Number of mosses	238	366	110
Species of liverworts	158	260	108

A comparison of the moss floras of the islands of the Mascarenes was published by Frahm (2009). The extreme discrepancy of the species numbers of mosses on the Mascarenes Islands (110 – 238 – 366 species) cannot be correlated with factors such as age, size or elevation of the islands. Although the highest island Réunion has the highest number of species, it is the youngest one and the Seychelles as the oldest islands have the lowermost species numbers.

Ah-Peng, C., Bardat, J. 2005. Ckeck list of the bryophytes of Réunion Island. Tropical Bryology 26: 89-118.

Een, G. 2009. Moss Flora of the Island of Mauritius. Tropical Bryology 30: 45-71.

Frahm, J.-P. 2009. A comparison of the moss floras of the Mascarenes. Archive for Bryology 55: 1-13.

Frahm, J.-P. 2010. Additions and corrections to the Moss Flora of Réunion. Archive for Bryology 60: 1-16.

Frahm, J.-P., Ho, B.C. 2009. A new contribution to the moss flora of the Inner Seychelles. Archiv for Bryology 38:

Frahm, J.-P., O´Shea, B.J., Ho, B.C. 2009. The Moss Flora of Mauritius. Archive for Bryology 51: 1-26.

Grolle, R. 1978. Die Lebermoose der Seychellen. Wiss. Z. Friedr. Schiller Univ. Jena Math.-Nat. Reihe 27: 7-17.

Grolle, R. 1995. The Hepaticae and Anthocerotae of the East African Islands. Bryophytorum Bibliotheca 48: 1-178.

O‘Shea, B., Frahm, J.-P., Porembski, S. 1996. Die Laubmoosflora der Seychellen. Tropical Bryology 12: 169-191.

O´Shea, B.J. 2006. Checklist of the mosses of Subsaharan Africa (version 5). Tropical Bryology Research report 6: 1-252.

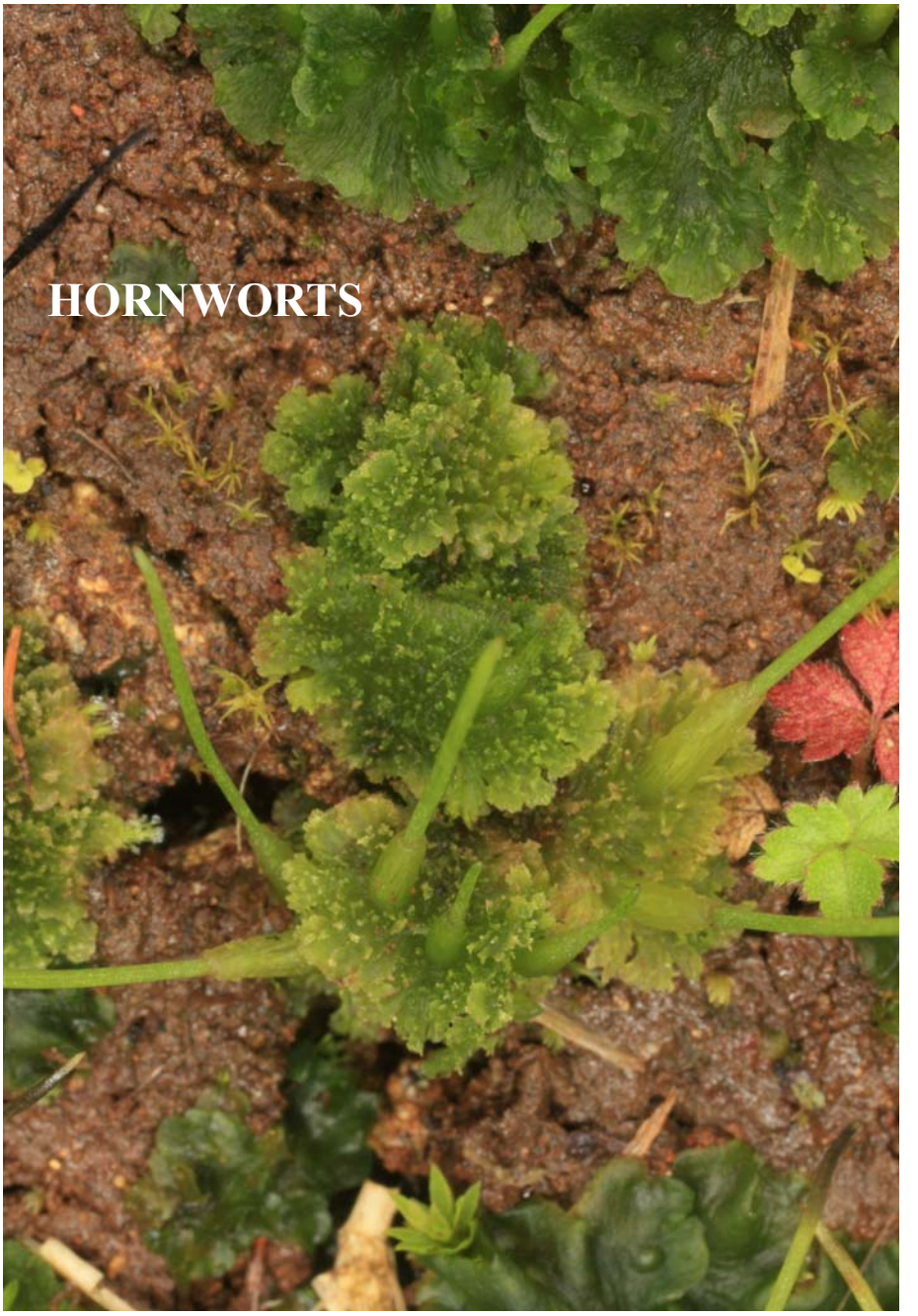
Renauld, F. 1897**.** Prodrome de la flore bryologique de Madagascar, des Mascareignes et de Comores. Monaco.

Tixier, P., Guého, J. 1997.Introduction to Mauritian bryology: a checklist of mosses and liverworts. Mauritius Sugar Cane Research Institute, 233 pp.

Wigginton, M.J. 2009. Checklist and distribution of the liverworts and hornworts of sub-Saharan Africa, including the East African Islands (edition 3, January 2009). Tropical Bryology Research Reports 8: 1-114.

Wigginton, M.J., Grolle, R. 1996 Catalogue of the Hepaticae and Anthocerotae of Sub-Saharan Africa. Bryophytorum Bibliotheca 50: 1-267.

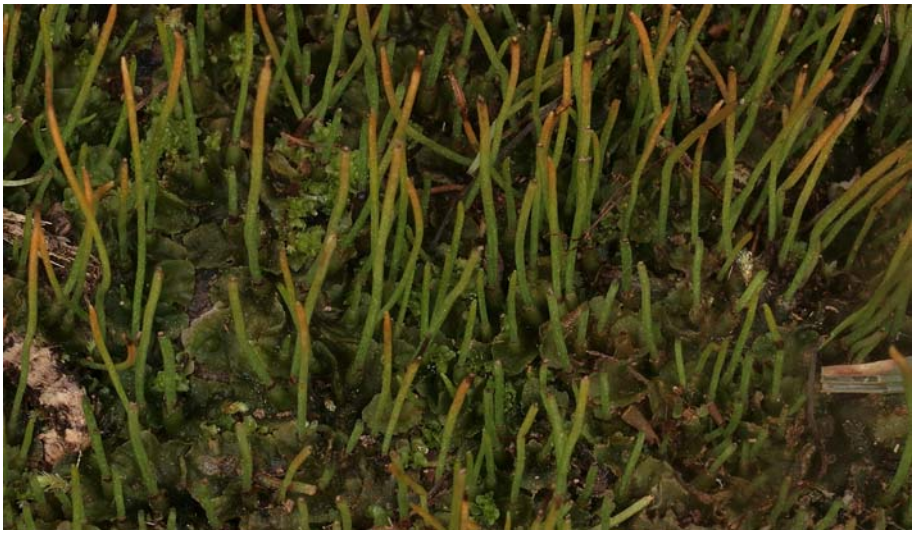
I like to thank Tamas Pócs for the identification of many liverwort species and Boon-Chuan-Ho for several moss species. Brian O´Shea kindly provided his databases, which were also basis for publications on the Seychelles and Mauritius. Felix Schumm took part on the trips to the Seychelles and Réunion and was a pleasant companion. The lichenological results of the Seychelles trip were published in an extensive book (Schumm, F., Aptroot, A. 2010. Seychelles Lichen Guide. 404 pp., available from the author, www.fschumm.de). Claudine Ah-Peng contributed advices for the trip to Réunion.
All pictures were taken during two weeks trips to Mauritius (2007), the Seychelles (2008) and Réunion (2009).



HORNWORTS

Hornworts (Anthocerotophyta) are the smallest division of the bryophytes. They consist of only about 300 species worldwide, mainly in the tropical mountains. The plants look quite archaic like early landplants with flat thallus of not much differentiated tissue. This seems to be supported by the fact that most genera have just one chloroplast per cell, like green algae. The sporophyte, however, consists of a horn-like structure which has a cuticule, stomata and a central conducting tissue as realized in the earliest land plants. It opens with two slits to release the spores.
The male plants produce their sex organs, the globose antheridia, in cavities in the thallus (below). When ripe, they release spermatozoids which swim to the female organs, the archegonia. After fertilization, the horn-like sporophyte is formed
Hornworts grow on bare soil usually along roadside banks and trailbanks, in ditches and other places with bare open soil in humid condition.

There are four genera of hornworts in the Mascarene Islands and the Seychelles with each one species, Anthoceros, Dendroceros, Folioceros and Phaeoceros (ceras = horn). Anthoceros has dissected, crisped thallus margins and blackish spores, Phaeoceros has plane thallus margins and yellow spores. Dendroceros has a midrid and thallus wings and grows as an epiphyte, Folioceros is similar to Anthoceros and often included in the latter but lacks stomata in the sporophytes. There seem to be, however, more species as previously reported, which need further studies.**Anthoceros fusiformis** (middle) is confined to Mauritius. and **Phaeoceros carolinianus** (bottom) to Réunion.



Folioceros fuciformis (left) is confined to Réunion. It grows on very wet soil or seeping rocks. **Dendroceros borbonicus** (right) occurs on all archipelagos. Below are two more unknown hornworts.

THALLOID LIVERWORTS

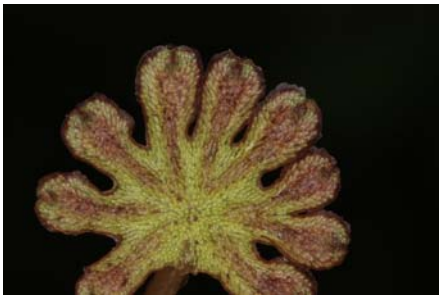
The second division of bryophytes, the liverworts (Marchantiophyta) can roughly be grouped into thalloid and foliose species. The thalloid can be divided into the complex thalloid liverworts (Marchantiidae) and the simple thallolid liverworts (Metzgeriidae), which are systematically not related but have only the non foliose organization in common. The first have a very high organization with a cuticle, epiderm and parenchym, the latter have an unstructered thallus which may have a midrib or not.

The most well known complex thalloid liverwort is Marchantia, the textbook example for a liverwort, although the least typical. The genus is distributed worldwide and represented only on Réunion by Marchantia globosa and M. palaeacea, and in Mauritius by M. globosa. Paradoxically, there are no complex thalloid liverworts on the Seychelles, not even on Mahé, although there are suitable habitats and this archipelago is by far the oldest as compared with the young volcanic islands of Mauritius and Réunion.

The genus Marchantia can be recognized by small cups which are formed on the thallus which produce small lentil-like gemmae for vegetative propagation.

Marchantia globosa (below and right page) grows in Réunion in the montane belt, locally in masses on rocks along forest trails. The female gametangiophors are globose when young and later round, the male ones are asymmetric witgh finger shaped lobes. The reddish dots on their surface mark the antheridia, the male sex organs. The shape of the gametangiophors is just opposit in Marchantia polymorpha, which is common in the temperate regions of the northern hemisphere (and else introduced). It has rounded male gametangiophors and lobed female ones, which can lead to the confusion of sexes.

The underside of the thallus has ventral scales, which function for the water uptake, since the surface of the thallus is covered by a cuticle.



Marchantia palaeacea is distributed almost worldwide and also found in southern Europe. It has reddish thallus margins and differently shaped female gametangiophors (below). The female gametanghiophors are round and notched along the margins. The white dots on the thallus surface mark the air pores.

Wiesnerella denudata is another complex thalloid liverwort of southeast asian distribution, which is also found on wet and shady rocks in Réunion.

Asterella syngenesica is much smaller than the preceeding species of Marchantia. The thalli are only 5 mm wide. The species has four-lobed female gametangiophors, which are warty on the surface, and have each one sporangium in the reddishbrown involucrum. The species grows in Réunion on sheltered rocks.

Dumortiera hirsuta is found on Réunion and Mauritius on shady soil. Male plants produce disc-shaped gametangiophors at the end of the thalli, the female ones are lifted on a 4-6 cm long stalk. The thallus is more simple structred as compared with Marchantia or Asterella. The species is distributed almost worldwide in tropical and subtropical regions, in Europe on the Mcaronesian Islands as well in the Apuanian Alps in Italy.

The simple thalloid liverworts belong to the oldest bryophytes. The earliest known fossils from the Devonian (350 mio years b.p.) belong to this group which seems not to have changed much since.The thalli (the gametophytes) are unstructured or have a midrib, the sporangia on a long, weak stalk (seta) resemble those of the foliose liverworts.

Aneura latissima (below) is known from Mauritius and Réunion. The pictures show fleshy involucrums, in which the young sporophyte developes from the fertilized egg cell. **Aneura pinguis** reported from the Seychelles (bottom left) is a cosmopolitan species. The picture bottom right is from Réunion, from where no Aneura has been reported so far.

Pallavicinia lyellii is widespread in the world in temperate oceanic and tropical montane regions. It is found in the Mascarenes only in Réunion. The thallus is linear, has a midrib and is confusingly similar to Symphyogyna brasiliensis (right page), which is also found in Réunion. Pallavicinia differs by a cup-like involucre with a fringed mouth, whereas Symphyogyna has a scale (right page top).

Sympyogyna podophylla (below) known from Mauritius and Réunion has erect-dendroid thalli.

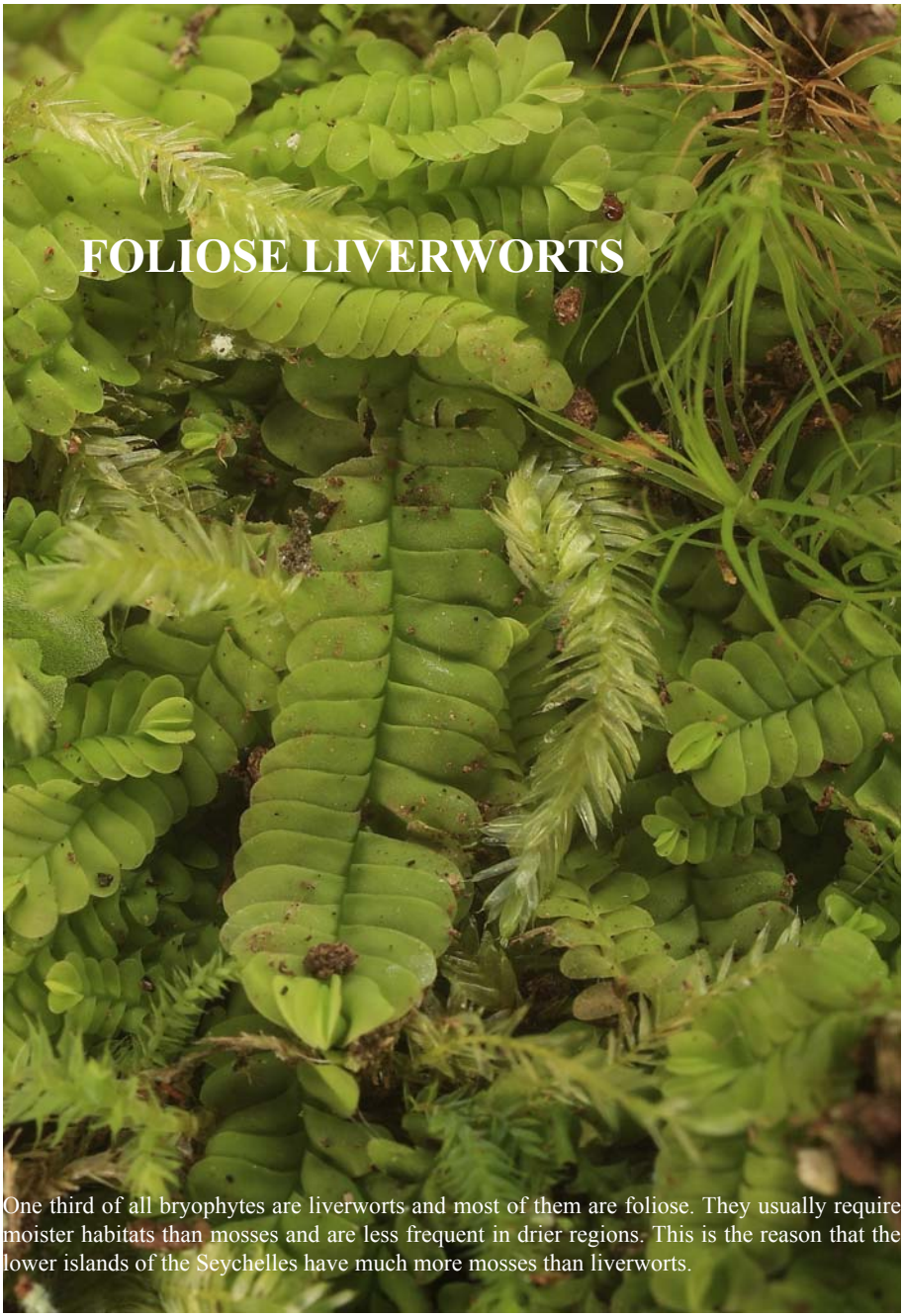
Symphyogyna brasiliensis is a pantropical species which is found in Réunion and Mauritius. It has linear thalli with a midrib and grows on humid soil.

Jensenia spinosa from Mauritius and Réunion is similar erect-dendroid as Symphyogyna podophylla but has spinose thallus margins. The involucre is cup shaped as in Pallavicinia.

The genus **Metzgeria** is represented with seven species on the Mascarene Islands and the Seychelles. The species grow epiphytic but also on rocks.

Six species of Riccardia plus several unknown species are known from the Mascarenes and the Seychelles. **Riccardia longispica (top) i**s a liverwort which grows on all islands on humid soil and rotten wood. The thallus is dendroid. The pictures below belong to an unknown species from Mauritius.

The genus Fossombronia is somehow intermediate between thallose and foliose liverworts. It has a stem with lobes which are undulate to crispate. **Fossombronia wondraczekii** grows on open bare damp soil and is known from Réunion and Mauritius. The species is also common in Europe like F. pusilla from Réunion. Antheridia and Archegonia as well as later spore capsules (picture below) are formed in the stem.



FOLIOSE LIVERWORTS

One third of all bryophytes are liverworts and most of them are foliose. They usually require moister habitats than mosses and are less frequent in drier regions. This is the reason that the lower islands of the Seychelles have much more mosses than liverworts.

Mastigophora diclados grows on rocks and tree trunks in humid forests at higher elevations on all islands with the exception of the dry and low islands of the Seychelles. The species is also found in Central Africa and SE-Asia, where it can form large balls in the canopy of elfin forests.

The Schistochilaceae are an austral family, which is represented in New Zealand and Patagonia with many very conspicuous large species. It is represented on Mauritius and Réunion with two species of the genus Gottschea, **Gottschea neesii** and Gottschea sphagnoides.

The genus Herbertus is characteristic for high montane and subalpine forests, where it grows as an epiphyte or on rocks, even above the forest line. In oceanic regions such as islands it is also found at lower altitudes but still in summit forests. There are three species of Herbertus in the Mascarenes and Seychelles. **Herbertus grossevitatus** (top left) occurs in Mahé and Mauritius The plants have a brownish colour and asymmetric leaves which a deeply 2-lobed. **Herbertus dicranus** (middle left and bottom) is found on Mauritius and Réunion. **Herbertus mascarenicus** (top right) is only found in Réunion.

Isotachis aubertii is a large (5cm) mostly reddish liverworts with spinose dentate leaves and underleaves visible from the ventral side. It is an African element which grows amongst other bryophytes or in pure large mats on banks in very wet forests.

Clasmatocolea vermicularis was only known from Réunion but has also been found on Mauritius

Heteroscyphus splendens (left) known from all islands has large, dentate underleaves. It grows on bark and rolls in when dry. The picture of another species (right) was taken in Réunion.

Ten species of Lophocolea (of hundred worldwide) are found in the Mascarenes and Seychelles, which can be distinguished only by the specialist. They are pale green and have bilobed leaves. The species grow on rotten wood such as **Lophocolea difformis** (below) or another unknown species on soil between other bryophytes (bottom).

Plagiochilaceae

Plagiochila is one of the largest genera of liverworts in the tropics. There are 16 species known from Réunion, of which only three are also found in the Seychelles and eight in Mauritius. A variety of pictures of unnamed species from Mahé is presented here to illustrate the genus and its variability.

The impressive large **Plagiochila repanda** (top) is common on Mauritius but rare in Réunion. **Plagiochila terebrans** (bottom left) occurs on the same islands. More unidentified species from Réunion are shown bottom right and on the next page

Gongylanthus ericetorum grows in the alpine regions of Réunion. It has a perfect adaptation to withstand dry periods on bare soil by folding in the leaf margins. The sporophyte is produced in a pouch (marsupium), which is buried in the ground. The species is also found in the mediterranean region of Europe and South Africa.

The Calypogeiaceae are a family with six species on the islands. **Calypogeia afro-coerulea** (top) has conspicuous blue colour. **Calypogeia bidentula** (bottom left) and **Calypogeia mascarenensis** (bottom right) have incised leaf apices.

There are six species of Bazzania on the Mascarenes and Seychelles, not much as compared to the over 100 species worldwide. They have leaves ending in 3 teeth, and large underleaves with ventral stolons in the leaf axils. The species are difficult to identify, however, **Bazzania nitida** (top) known from all islands has, as expressed by the name, a glossy shine. **Bazzania decrescens** (middle left) and **Bazzania reflexa** (middle right) have incurved leaves. More unidentified species of Bazzania are shown at the bottom of the page and on the next page.

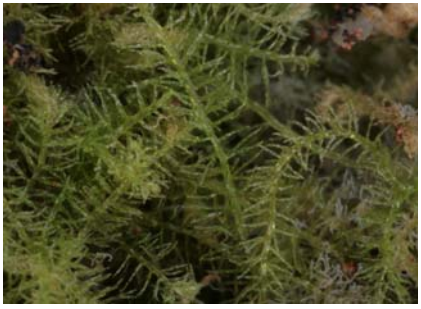








Arachniopsis diacantha is a strange liverwort. It is only 2 mm long, only some micrometer wide and creeps on soil and between mosses. The leaves are reduced to two rows of filaments, one cell wide and up to 7 cells long (there exist even a stronger reduction in the liverwort genus Monodactylopsis, where the leaves consists of only one cell). The species is pantropical and occurs on all islands even at lower altitudes.
Telaranea nematodes is similar but has 3-4 filaments which are two cells or more wide at base.



Jamesoniella contracta from Mauritius and Réunion is a large reddish liverwort growing as an epiphyte, which can be confused with Pleurozia gigantea.
Jamesoniella purpurascens (bottom right) occurs in Mauritius on humid roadbanks and in Réunion in open habitats above the forest line.


Chandonanthus hirtellus grows in the wettest parts of the Mascarenes, in cloud forests on trees and rocks together with species of Herbertus, Mastigophora and others. It is one of the afro-asiatic elements.

Jungermanniaceae are plants with alternate, usually round and undivided leaves with entire margins. **Notoscyphus lutescens** is an afro-asiatic species which is found in damp soil in Mauritius and Réunion.

Nine species of Radula are known from the Mascarenes, only one species, **Radula appressa** (top), is also found in the Seychelles. The dorsal view (middle) shows two rows of leaves, the ventral view (right) the underlobes, part of the leaves which are folded in to form a pocket in which water can be stored. The species names refers to the fact that the species is sometimes appressed to the substrate with a bunch of rhizoids (right).**Radula madagascariensis** (below) lacks on the Seychelles.

The genus Frullania is characterized by water sacs on their ventral side, which are attached to the stem and in fact a modified part of the leaf and which shall function for water storage. The species grow on trees and rocks. Twenty-one species have so far been reported from the islands. **Frullania apicalis** (top) has large spreading plants with large underleaves. **Frullania caffraria** (bottom) from Mauritius and Réunion is appressed to the bark of trees.

Lejeuneaceae is the family with the most species in the tropics. More than hundred species are known from the Mascarenes and the Seychelles. **Lejeunea helenae** (below) is quite common in continental Africa but was just not recorded yet from the Mascarenes, where it seems to be common (T. Pócs). Almost all epiphyllous liverworts (next pages) belong to this family.


Epiphyllous
Liverworts

Liverworts (and rarely mosses) growing on leaves of trees and bushes are characteristic for tropical forests. They need high humidity and evergreen leaves with a life span of two or more years. They have special adaptations to fix on the leaves and to store water to extend the periods of photosynthesis into drier phases of the day.
Epiphyllous liverworts live on the leaves together with fungi, lichens, bacteria, cyanobacteria and algae, a small microcosmos, a miniture habitat, a extraordinary ecological niche. These organisms form a „biofilm“, a small biosphere, a living surface. Bacteria provide the necessary nitrogen for this small ecosystem, in which nutients are in a minimum and else only provided by strange sources such as bird droppings and catarpillar excrements, but also nutrients washed out from the surface of leaves hanging higher (leachates), and also rainwater.
Left. Leaf with epiphylls (Grand Etang, Réunion).

Cololejeunea is a large pantropical genus and a common genus on leaves, usually at lower altitudes. It is recognized by the lack of underleaves. There are sixty two (!) species on the Mascarenes and the Seychelles, **Cololejeunea zenkeri** (right) is one of those.. **Cololejeunea marginata** (left) from Mauritius and Réunion has a hyaline border of dead cells.

Cololejeunea cristata (left) is the only epiphyll on the summit of La Digue. It was so far only known from Mauritius. **Cololejeunea obliqua** (right) is common on all archipelagos. Another species of Cololejeunea is illustrated at the bottom left. The species of Colura (bottom right) are treated in the chapter of carnivorous liverworts.

Drepanolejeunea is another large pantropical genus, preferably at higher altitudes. The plants are tiny, usually less than 0,5 mm wide, and have asymmetric elongate leaves, especially in dry state (top). It is represented on the islands with eight species. **Drepanolejeunea trematodes is** known from Mauritius and Réunion.

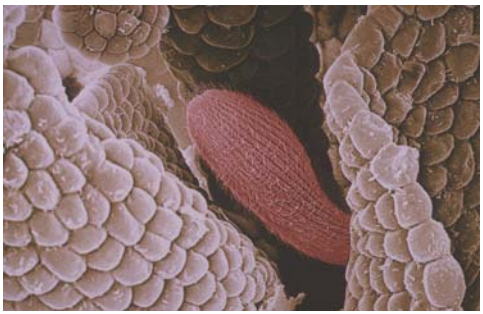
Microlejeunea is another genus of Lejeuneaceae. It has divided underleaves and belongs to the schizostipous genera of the family. The genus can be recognized by the spreading, never overlapping leaves arranged in a zig zag line along the stem. There are only four species on the islands, of which two have not yet been recorded: **Microlejeunea oblongistipula** (top) on Mahé, previously known from Madagascar, and **Microlejeunea inflata** (bottom), previously known from Madagascar and the Comores. The picture below shows an assemblage of different Lejeuneaceae on a leaf, of which Microlejeunea is the smallest.

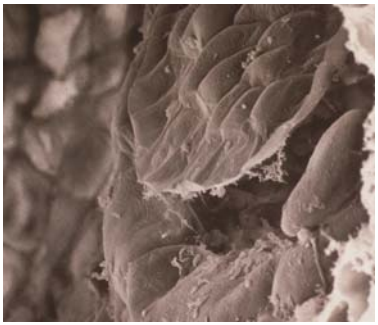

Carnivorous
Liverworts

Some genera of liverworts produce water sacs, modified leaves which are able to store water. Most of them live on bark of trees and can thus retain water after rain fall to extend the period of photosynthesis.

However, the two genera Colura and Pleurozia, very different in size and appearence and systematically not related, possess trap like mechanisms in the water sacs. These are small openings closed by a lid, which open only to the inside. Already more than hundred years ago it was speculated that the water sacs could function as a trap, which was doubted by many specialists and not proven. Feeding experiments with a species of Colura at the university of Bonn in Germany revealed that ciliates are caught in the water sacs. The plants are only a few millimetres long. The ciliates feed on bacteria which live on the surface of the leaves. They move along the leaves and incorporate bacteria (white dots in picture middle right) like a vacuum cleaner. By this way they can get in into a furrow beside the water sac, which leads to the trap (middle left and right). The lid of the trap (bottom left) is pushed forward by the aninal and allows to enter the water sac. Since it opens only to the inside, the animal can no more escape (bottom right). By this way up to 15 ciliates were observed trapped in the water sac. It can be assumed that the same happens in the nature, as supported by observations of protozoa under the microscope in the water sacs of fresh material. Most carnivors amongst the higher plants possess proteases to digest the trapped animals, which is not assumed in the case of liverworts. The animal, however, die within a short time, are digested by bacteria and contribute then to the nutrition of the liverwort, which is especially useful in such habitats poor in nitrogen as surfaces of leaves.
(SEM pictures H.-J. Ensikat, Nees Institute, University of Bonn).

The genus Colura is represented through the tropics with about sixty different species. They grow on leaves as well as small branches of bushes and also bark of tree from the lowlands to the forest line.

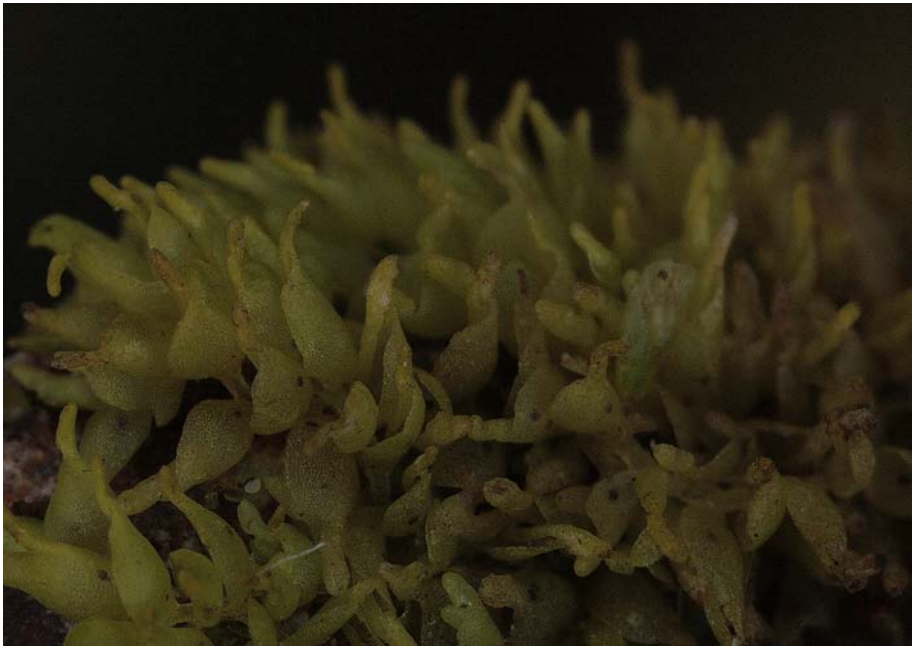




Colura heimii (right and bottom) was named after Ernst-Ludwig Heim (1747-1834), who was physician in Berlin and took medical care for the Humboldt family. By this chance he took the sons Alexander and Wilhelm on fieldtrips and contributed much to the scientific interest of Alexander von Humboldt. This caused that Alexander von Humboldt collected also bryophytes during his famous trip to the aequinoctial regions.

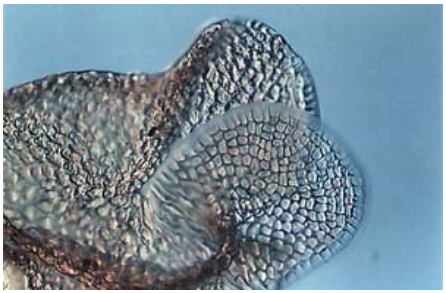
The species grows on tips of tiny branches of bushes in the humid parts of Mauritius. **Colura tenuicornis** (below) from Mahé is epiphyllous.

Colura obvoluta (top) grows on leaves, **Colura digitalis (**bottom) is found on branches of small bushes.

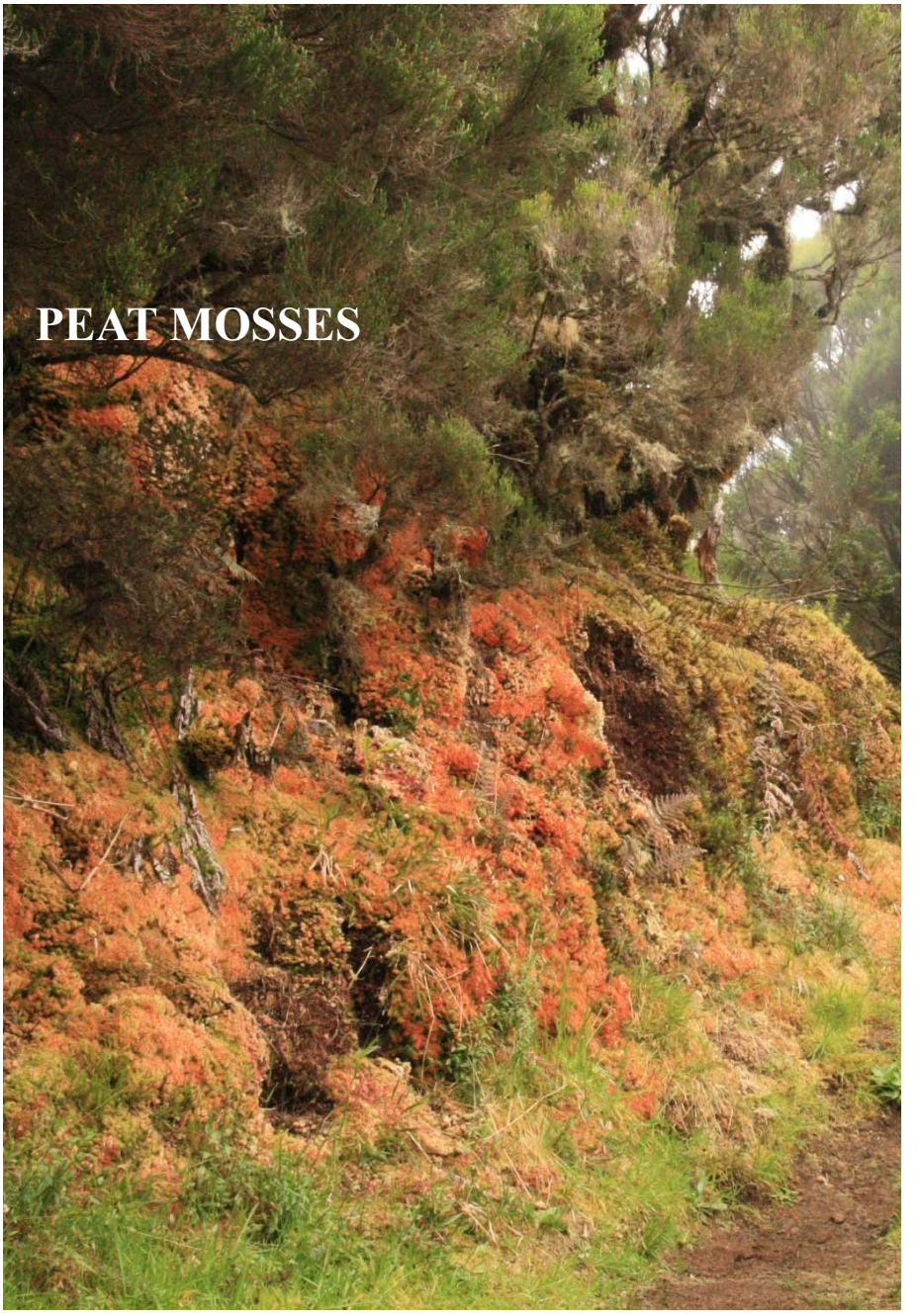


Pleurozia is the second genus with traps in the water sacs. In contrast to Colura these are giant plants, more than 5 cm long and reddish coloured. There are 10-15 species worldwide in the tropics, mainly epiphytic.

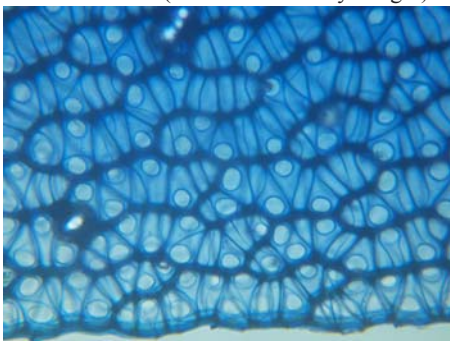
Pleurozia gigantea grows on stems and branches of very humid heath forests ion Réunion (right page top). It is an SE-Asian element which is found also in high montane forests in Indonesia and Borneo. It has curious „water sacs“ (left) in two rows at the ventral side of the plants. On the opposite side it has a trap at the reverse side. It consists of a lid which opens only to the inside (bottom) and if the lid is pushed by an animal, it can enter but no more leave the sac.

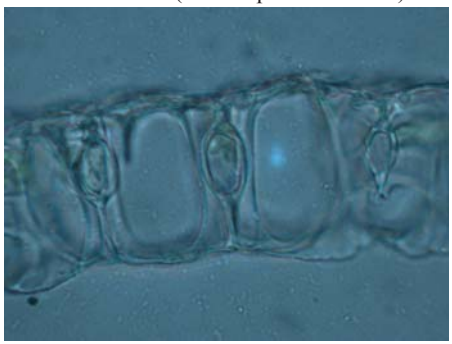


Feeding experiments with ciliates similar to those with Colura by Sebastian Hess proved the hypothesis that also Pleurozia catches ciliates. Colura was formerly positioned at the top of the phylogenetic liverwort system, it shows up now in molecular studies at the base of the phylogenetic trees in the thalloid liverworts. (Pictures previous page bottom right and this page bottom by S. Hess).

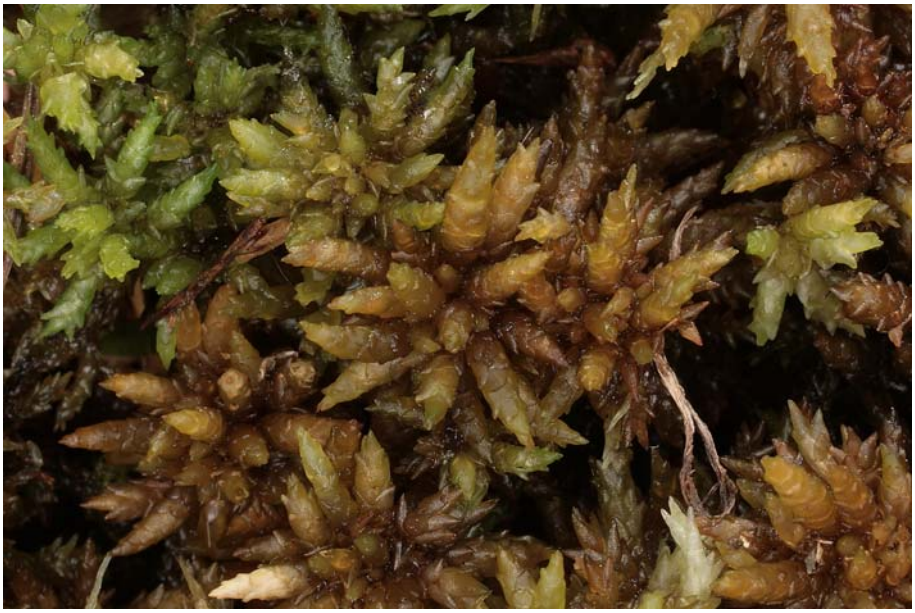

PEAT MOSSES

Peat mosses (subclass Sphagnidae, only one genus Sphagnum with about 300 species) are distinct in several respects. The plants grow consistently on top but decay at the bottom, producing peat. They have a unique structure of their leaves with large dead empty cells which store enormous masses of water (25-30 times of dry weight) and absorb nutrients (stained pictures below).





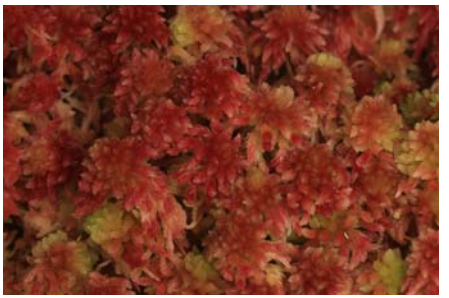
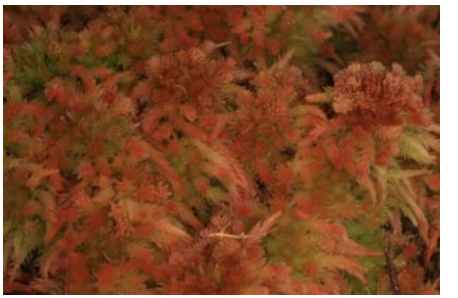
They grow only in acidic habitats and acidify their surroundings by catione exchange. Peat mosses are most common in boreal peat bogs, where they produce more phytomass than all rainforests in the tropics. In the tropics, peat mosses grow in very wet habitats, not only swamps but also seeping rocks, and on wet forest floor especially in acidic heath forests, as in Réunion (see previous page). There are 13 species of Sphagnum reported from Réunion, of which five are also known from Mauritius. There are no peat mosses in the Seychelles. One of the most common species on Mauritius and Réunion are **Sphagnum perichaetiale** (right page top, large brownish and greenish plants short, concave leaves). **Sphagnum violascens** (right page bottom) has a characteristic purplish colour. Sphagnum species are very difficult to identify, even with literature. Beside difficult characters needed for identification such as transverse sections of leaves, the species are very variable in appearence, size and colour. The situation is especially difficult in the tropics. Therefore many specimens remain unidentified. Nevertheless some pictures of Sphagnum species from Réunion are shown here on the overnext page to illustrate the diversity.









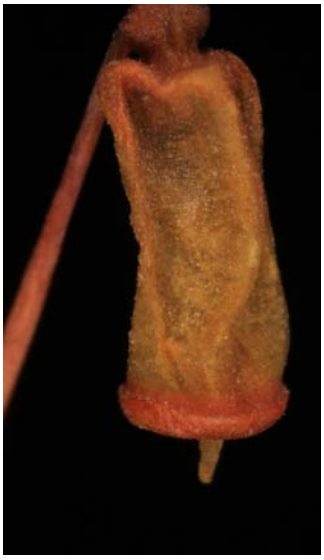

Maidenhair
Mosses

Linnaeus called this group of mossess „maiden hair mosses“, since the cap sitting on the capsules of the species is covered with golden hairs. The name goes back to the mid ages, when people believed that structures of plants cure organs with similar aspect, for instance the lung lichens (Pulmonaria) should cure lung deseases and the liverwort Marchantia looking like a liver should cure liver deseases. Consequently, aqueous extract of maiden hair mosses were used to increase hair growth. The result is not known, Linnaeus weared a wig. But it is known from moss extracts that they increase enzyme activity, one key for their antimicrobial acticity, and so long nobody has tested it, we cannot say whether maiden hair mosses have an effect or not.Below are capsules of **Polytrichum commune** with hairy calyptras covering the young capsule to avoid that it dries up during its development (left) and a young capsule with the detached calyptra (right).

This group of mosses belongs systematically to the family Polytrichaceae, which represent the largest mosses in the world. The largest species is Dawsonia superba known from Borneo to New Zealand. It can reach half a meter. But also some species from the Mascarenes can be as high, but seem smaller since their leaves are not as big.

Polytrichaceae have male and female plants. Male plants of Polytrichum species such as **Polytrichum commune** (right page top) or **Polytrichum subpilosum** (right page bottom) possess small cups formed by comal leaves on the tips of their stems. They surround the male sex organs (antheridia).

There are two species of Polytrichum on the Mascarenes: **Polytrichum commune** (left and bottom) and **Polytrichum subpilosum** (right). They are very similar in appearence and can be identified only by microscopic characters (transverse section of the leaf). Polytrichum commune is also found through the northern hemisphere. Both have conspicuously angular capsules (bottom lrft).



The Polytrichaceae have very robust leaves and stems due to a high anatomical differentiation. The leaves consists almost exlusively of the nerve, which are covered on top with lamellae (bottom right). They are filled up with chloroplasts and function for the assimilation. Water is stored in the gaps betwen the lamellae that the plants can have metabolism also for a period of dry weather.

Polytrichaceae can form large stands along roadside banks. They are colonists and fix the soil against erosion. Some species of Pogonatum have a special trick. Mosses develope from a green filamentous stage, the protonema. Usually the protonema disappears when the moss has grown up. In Pogonatum, many species retain this stage of development which looks as an algae. It covers the soil densely and protects the soil as **Pogonatum gracilifolium** (=rubenti-viride) from Reunion this page).

Pogonatum convolutum from M auritius and Réunion ist the largest species of the genus in the Mascarenes. It can reach 30 cm of length or more. **Pogonatum gracilifolium** (right page top) and **Pogonatum belangeri** (right page bottom) are much smaller. The first is confined to Réunion.

The male plants of **Polytrichum commune** (top) develop a gametangium every year. Afterwards the plants continues growing, ending with another gemetangium. By this way one can count the age of the plant. This is a speciality of Polytrichum species. Plants of Pogonatum such as Pogonatum gracilifolium from Mauritius (below) die up after having produced a gametangium similarly to flowering plants, which do not continue growth after having produced a flower.

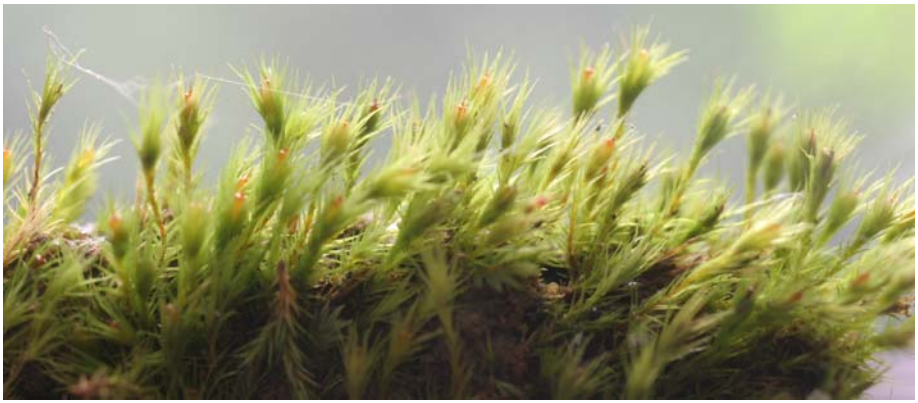
Fissidentaceae are one of the large genera of mosses. It includes about 1000 species worldwide, of which almost all are comprised in the genus Fissidens. Most species occur in the tropics, where they are most characteristic for lowlands. Twenty-four species were so far reported for the Mascarenes. The plants have distichous plane leaves, which makes the genus easy to recognize. The pictures of **Fissidens palmifolius** (below left) and **Fissidens planifrons** (below right) are from Mauritius. **Fissidens asplenioides** (middle) is pantropical distributed. The pictures at the bottom belong to an unnamed species from Réunion.

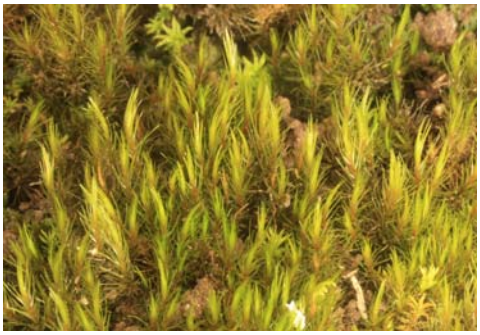





Ditrichum difficile (bottom) is an austral species which has probably reached Mauritius and Réunion by spores. It grows in pioneer habitats such as roadside banks and has always sporophytes. It is locally abundant along roadsides in Réunion. Another species (Ditrichum punctulatum) is recorded from Réunion, but there exist more species of the genus (top, a species with longer capsules and one with shorter capsules from Mauritius) which are not identified.

Garckea phascoides is an SE-Asian species which grows on bare soil, usually laterite along road cuts. The plants are usually very small (below) but much taller on Réunion probably due to the higher humidity. The species can be confused with Aongstroemia filiformis (next page). It has a characteristic comose stem tip.

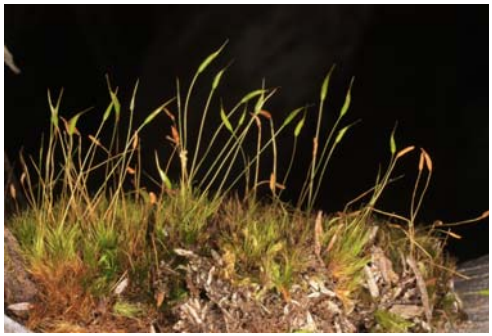




Blindia acuta (left) and Blindia magellanica are very similar and can only be distinguished under the microscope. They grow on wet rocks at higher altitudes on Réunion. Blindia magellanica is an austral species distributed from New Zealand to Patagonia, Blindia acuta is also found in Europe. Species of Blindia have a comparably wide costa and can thus easily be mistaken for a Campylopus species.

Aongstroemia is one of the few genera distributed over both hemispheres. The genus is present only on Réunion with two species, Aongstroemia julicaulis and Aongstroemia filiformis. Both occur also in South Africa. They grow on bare gravelly soil at higher altitudes (which seems to be the reason that they do not occur on the other islands as well). Both are small (up to 2 cm) with appressed foliate stems.
Aongstroemia filiformis (left) looks similar to the common Garckea phascoides but differs by the leaves which are gradually contracted. **Aongstroemia julicaulis** (right) is unmistakable by the julaceus stems.

Atractylocarpus is a genus which is growing worldwide in subalpine forests. **Atractylocarpus madagascariensis** is the only species in the Mascarenes and is found on branches of Philippia at the forest line in Réunion. It has been found there only recently, which underlines that the floristic exploration of these islands is not yet finished, in spite of the high numbers of species known so far from Réunion. It is else only found in Madagascar :

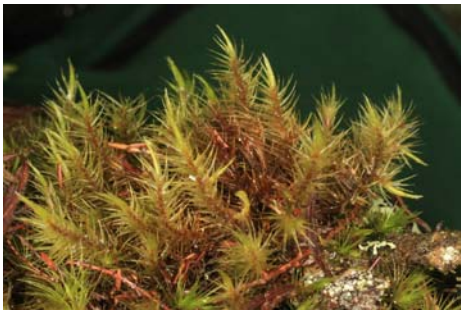


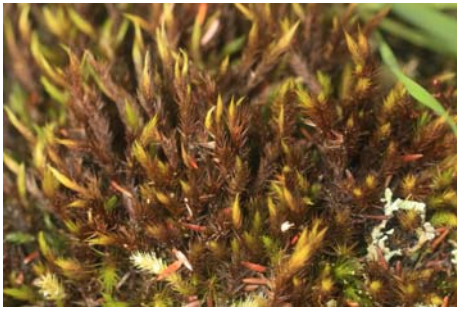
Dicranoloma is a austral genus which resembles Dicranum in the northern hemisphere. The plants are similar to Leucoloma. Two species are only found on Réunion, Dicranoloma borbonicum and Dicranoloma billardieri.

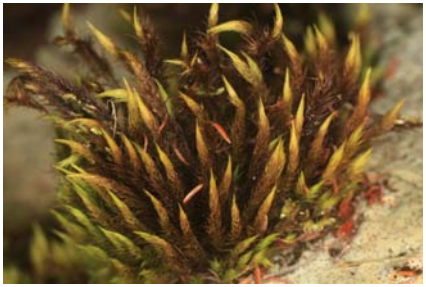
Dicranoloma billardieri forms hugh mossballs in the canopy of moist forests and also on rocks at higher altitudes. It is widespread in temperate rainforests of for example in Chile and New Zealand, but extends north to Central Africa and even to Borneo.

This genus **Holomitrium** with 50 species worldwide is represented in the Mascarenes with three species, Holomitrium borbonicum, H. cylindraceum and H. lepervanchei. They all grow epiphytic in Mauritius and Réunion.

Twenty-four species of **Leucoloma** are found on the Mascarenes and the Seychelles. The genus is similar in appearence to Dicranoloma. The French bryologist Renauld published a monograph of the species from Madagascar, the Comores and Mascarenes in 1909. The genus is pantropical but predominantly found in the southern hemisphere, and includes about 112 species only in Africa, of which 50% are endemic to Madagascar and the Mascarenes. This makes it understandable that a recent taxonomic treatment made the identification of species not easier, in which still new species were described. Here some unnamed species are shown from Mauritius (top left) and Réunion (all other pictures, also on next page), to give an impression of the typical appearence of the genus and its variability.







A conspicuous species is **Leucoloma dichelymoides**, which looks more like a beard lichen than a moss. It grows on thin branches of small trees and bushes in wind swept places such as mountain ridges or summits in Mauritius and Mahé (Seychelles) but lacks in the nearby Réunion, where suitable habitats are available.

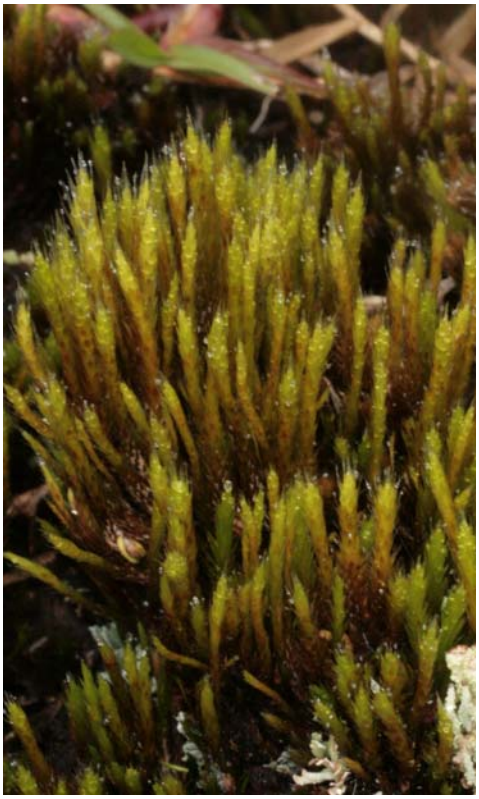
Leucobryaceae are characterized by very wide nerves, which occupy almost the whole leaf width. They look whitish because they have large cells without chlorophyll in the costa (hyalocysts), above and below small chlorophyllose cells (chlorocysts), which are filled with water when wet or air when dried up. The function of this structure is not clear, since the inclusion of the chlorocysts within the hyalocaysts drastically reduces the gas exchange, especially the CO_2 uptake. There are seven species of Leucobryum on Mauritius and Réunion (the genus lacks in the Seychelles!), eight species of Leucophanes and one species of Octoblepharum.

Leucophanes differs from Leucobryum by a bundle of dark small cells (stereids) in the middle of the leaf. The species grow on rock, soil and tree bark in rainforests.Seven species are known from the islands, of which **Leucophanes angustifolium** is the commonest one.

Octoblepharum is a pantropical genus, which is especially found at lower altitudes. The most common species is **Octoblepharum albidum,** the only representative on the Mascarenes and Seychelles, which is found on soil, rocks and tree trunks (especially palm trunks). It has very firm , longly lingulate leaves.

More than 1000 species of **Campylopus** have been described, of which „only“ about 160 survived texonomic revisions. The species are especially numerous in the tropics and in austral regions and accordingly also numerous in the Mascarenes an d the Seychelles, from where 24 species are known. They grow on bare soil and rocks but also on rotten woord or trunk of trees, but always on acidic substrate.

Campylopus julaceus (below) grows on earth covered rocks on all three archipelagos. The name refers to the closely appressed foliate (julaceous) stems. The leaves end in an hyaline hairpooint. The species is found in two subspecies in SE-South America (ssp. julaceus) and SE-Africa (ssp. arbogasti) , which differ by the number of the dorsal lamellae of the costa.



Campylopus julaceus is a good example how important fieldstudies are and that variability of plants cannot only be studied in the herbarium. There was a species named Campylopus brevirameus (pictures on the next page) described as an endemic from Mahé by Dixon based on a single collection. It was later regarded as hybrid between C. pilifer and introflexus, but more collections of the species caused that the species was re-established. During field studies on Mahé, however, mixed stands between „brevirameus“ and „julaceus“ were observed. Gametangia on the julaceous stems indicate that the julaceous plants are male plants of C. julaceus and C. brevirameus are sterile plants of this species.

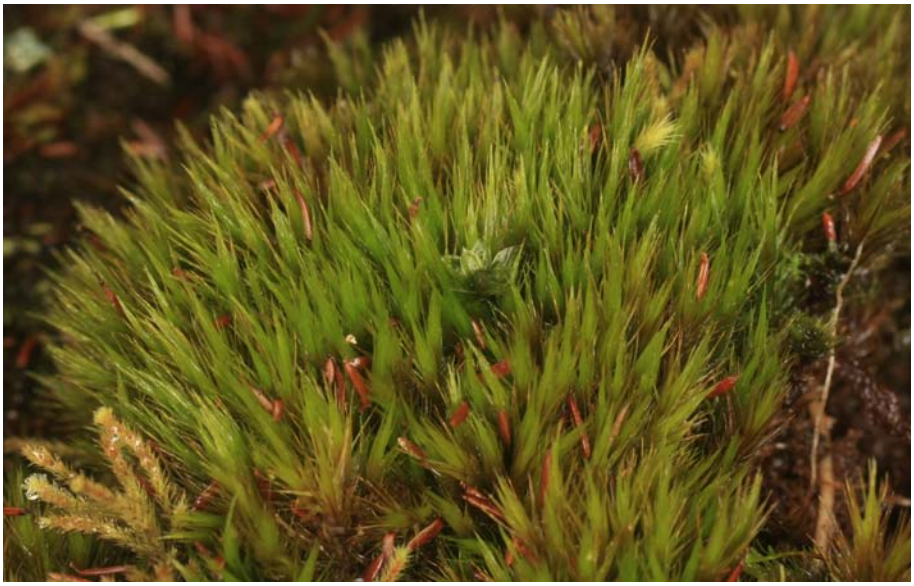




In the morning hours, dew drops are found on the tips of the hairpoints of the sterile plants of **Campylopus julaceus**. This seems to corroborate the argument, that such hairpoints are a protection against insolation. Unpublished studies revealed that the hairpoints cannot conduct the water from the tips in the leaf. They contribute, however, moisture to the plants and the soil similar to the condensation of dew on long needles of conifers.

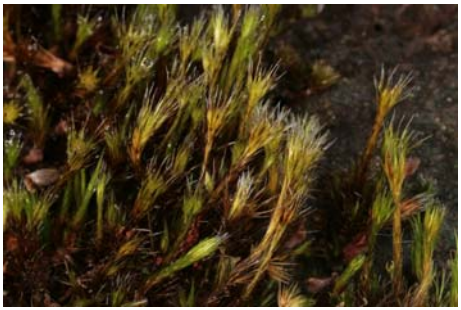
Campylopus schmidii (left page bottom right) is - together with C. pilifer and C. introflexus, one species of a triplet. All three species are closely related and have almost the same areolation in the leaf and nerves ending in hairpoints, but have different ranges. **Campylopus introflexus** (top) has reflexed hairpoints and is found through the austral region (introduced in Europe and North America), C. pilifer has straight hairpoints and 3-4 dorsal lamellae and occurs in South America and Africa, and C. schmidii has erect hairpoints but no lamellae. The latter is a SE-Asian species which goes to Hawaii. In Réunion, the ranges of all species overlap.

Campylopus flavicoma (left, formerly Bryohumbertia flavicoma) is an African species, which is only known within the Mascarenes from Mauritius, The plants form low rosettes which tend to get verticillate foliate if the plants get larger. There are three vicariant species of the former genus Bryohumbertia worldwide, B. filifolia in the Neotropics, B., flavicoma in Africa and B. subcomosa in SE-Asia, which reflects a common origin of all three species.



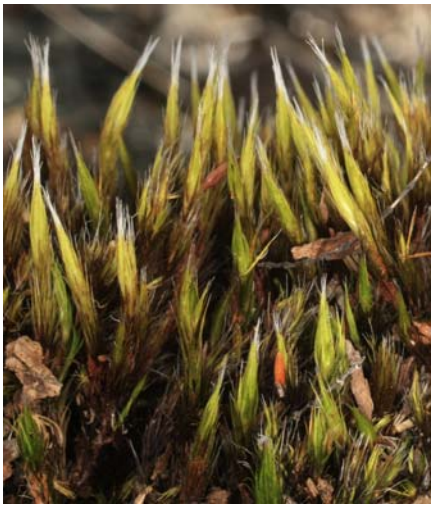
Campylopus arcuatus is a large species reported from all islands. It has a long, narrow entire leaf tip and grows on soil and rotten wood.

Campylopus arctocarpus is an afro-american species. It occurs on both continents in two subspecies, ssp. arctocarpus in the neotropics and ssp. madegassus in tropical Africa. They differ slightly by the cross section of the nerve. This indicates a common origin of both and a long isolation of the populations, probably due to the break up of the continents. It can be identified in the field by the presence of flagelliform branches.



Campylopus aureonitens is the most common species of Campylopus of the Mascarenes. The nerves of the leaves are excurrent in a long serrate hair, which is neither erect nor reflexed as in other species of the genus but recurved.The species grows primarily on volcanic rock on Réunion and Mauritius but also on gravelly soil on road banks and even on asphalt along roads. It is found in through southern Africa from Angola to the Mascarenes.

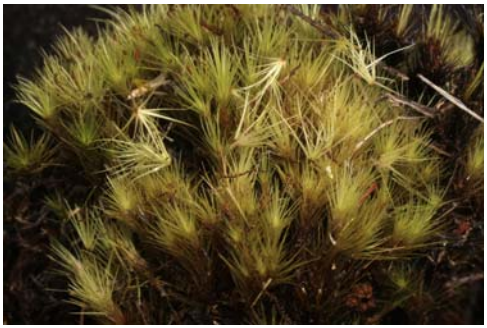
The male plants of Campylopus aureonitens have Antheridia in cup like organs, in which raindrops are collected in which the spermatozoids are released. Another rain drop splashes the spermatozoids to the female plants.



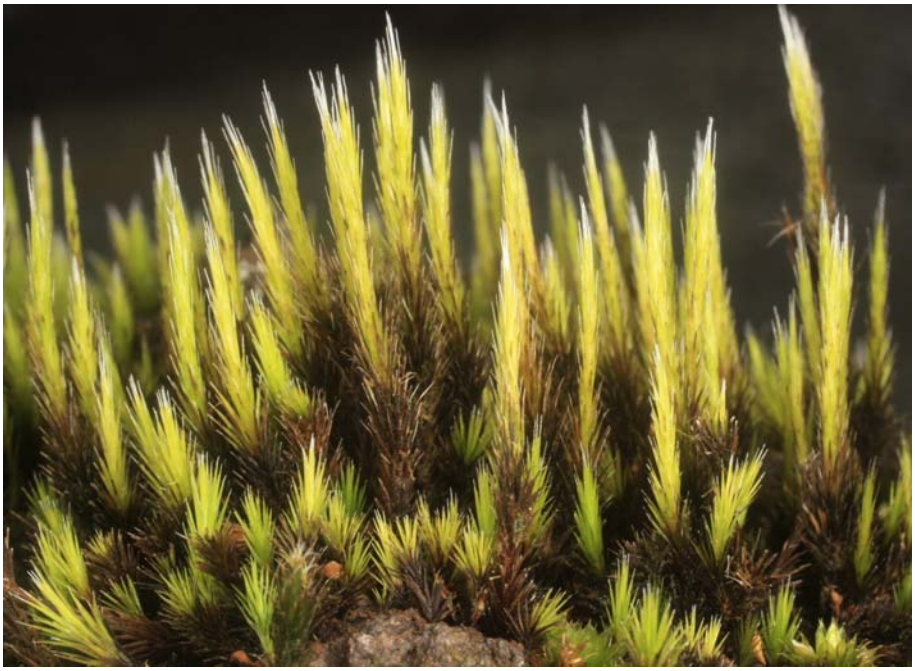
Campylopus crateris is a conspicuously blackish species with hairpoints growing on bare rocks at high altitudes. The type locality is Cratere Commerson in Réunion, where it is still found as well as in the whole area of the Piton de la Fournaise. It is found else only rarely in Kenia, Madagaskar and the Comores (each one record) and has the largest population on Réunion.

Campylopus hildebrandtii is a common African species from higher altitudes, which is only found on Mauritius and Réunion.

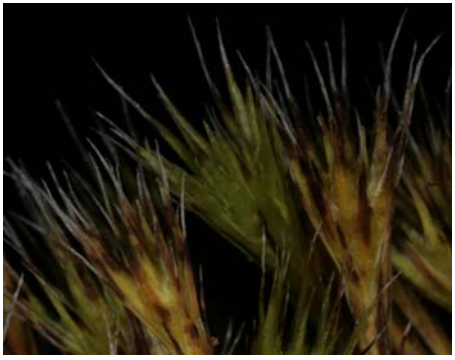
Campylopus flexuosus is also found in the Neotropics and Africa, but in addition (rarely) in North America and more frequent in western Europe. It has flagelliform branches like Campylopus arctocarpus but a different transverse section of the costa and often homomallous leaves. It grows in humid forest on soil and rotten wood on all islands. (this statement generally concerns only the higher islands of the Seychelles, Mahé and Silhouette).



Campylopus nivalis is, as expressed by the name, an alpine species which occurs in the Andes of South America in more than 4000 m altitude and also in the higher mountains of Africa. It is found in Réunion at the highest altitudes in the crater of Piton de la Fournaise. **Campylopus pyriformis** (below) belongs to the austral element. It is widespread and frequent from New Zealand to Patagonia but goes up to southern Brazil, Central Africa and also Réunion. It is one of the few mosses which are found on both hemispheres, in the northern in western Europe but also very rarely in SE North America.



Campylopus pilifer resembles much C. aureonitens and also grows in similar habitats such rocks and gravelly soil but has erect hairpoints. It occurs in the Neotropics and tropical Africa, but also the mediterranean region in Europe. The populations in Africa and the Neotropics are genetically but not morphologically distinct, which supports a long lasting isolation but also the slow evolution of mosses.



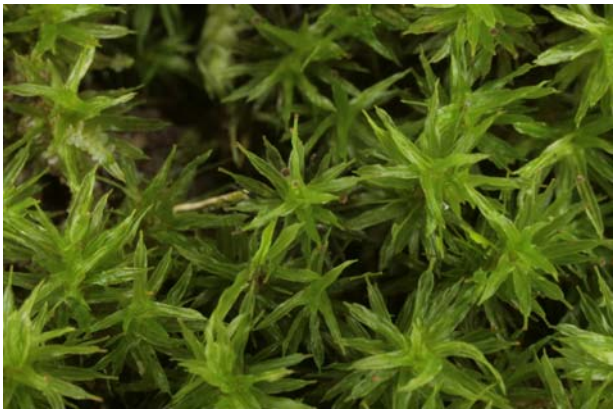
Campylopus jamesonii is a large species up to 10 cm high, which is found at the forest line in South America and the African mountains but also on Réunion. The stems are covered by a dense tomentum.

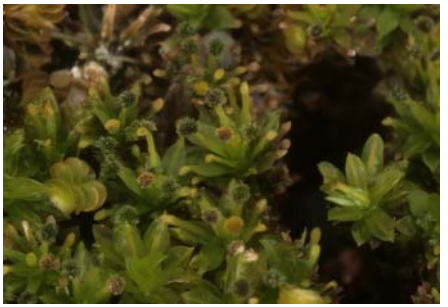
Campylopus robillardei is a species of savannah like habitats in Africa and Australia. It is a southern sister species of the closely related Campylopus savannarum, from which it mainly differs by the cross section of the nerve. The picture shows the vegetative propagation by means of deciduous stem tips, which are disoersed by wind. In dry state, the leaves are appressed.

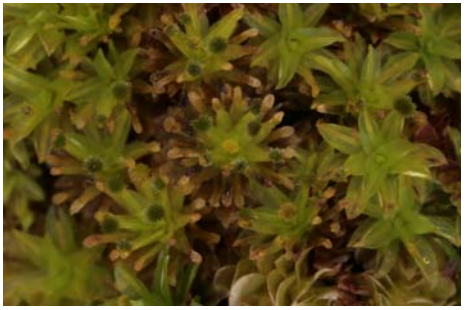
Campylopus trachyblepharon is a large species up to 10 cm high. It can be recognized by the interruptedly foliate stems, which is presumably an adaptation to litter fall. Litter is the most serious enemy of bryophytes, if they are covered by leaves they will die. In this case the stems can grow through the leaf layer and form a new rosette.

The species grows on soil in bushland and is found in SE-Brazil and SE-Africa. It lacks on the Seychelles. The pictures on top show the characteristic curved setae of the genus (Campylopus means curved foot). The young sporophyte grows straight at first, then curves the young capsule with calyptra into the comal leaves, where the sporophyte developes protected against desiccation. When the cpasule is ripe, the seta grows erect again to release the spores. By this way, the setae of Campylopus species are twice (sigmoid) curved. In addition, the setae turn around when moistened. Reason is, that the fibrills in the cell walls are twisted in dry state. If the air is humid, the humidity passes through pores in the cell wall, and is soaked up by the fibrills. By this way the fibrills are widened and will uncoil, which causes that the setae turn around.

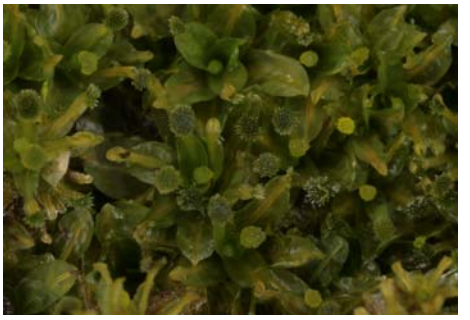
This family Calymperaceae is tropical in distribution and is found mostly in the lowlands. The main genera are Calymperes with 12 species, Syrrhopodon with 15 and Mitthyridium with one species in the Mascarenes and Seychelles. Most species propagate vegetatively by gemmae produced on the shortly excurrent costas. **Calymperes erosum** (below) is a common species on rocks and mostly on bark of trees. **Calymperes tenerum** (next page) has short lingulate leaves and is typical for palm trees, especially coconut.





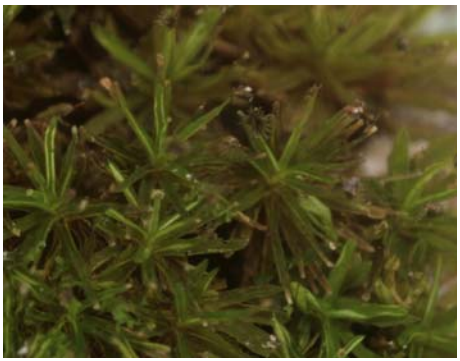





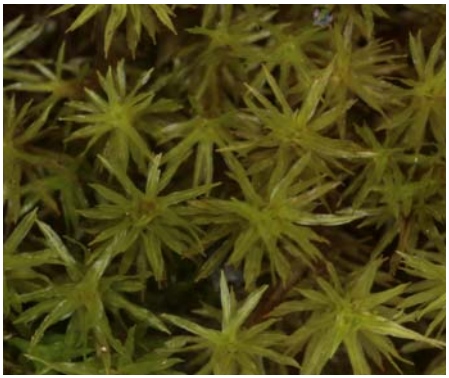


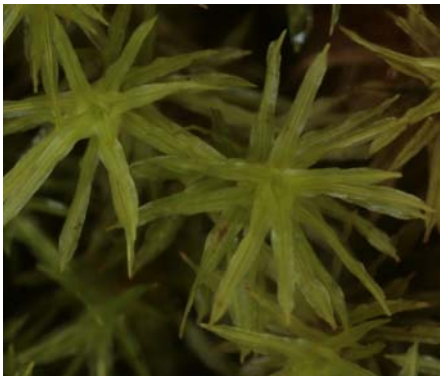
Calymperes motleyi (top) is a SE-Asian species which occurs only in the Seychelles. It is a small species with obtuse leaves. **Calymperes afzelii** (middle left) is also only found in the Seychelles but has very narrow lanceolate leaves. **Calymperes palisotii** is a pantropical species on all islands.






Syrrhopodon involutus (top) is found on all archipelagos. **Syrrhopodon prolifer** (middle) lacks on Mauritius.





Syrrhopodon croceus grows on rocks at higher altitudes of the Seychelles. It can have a conspicuous reddish colour.

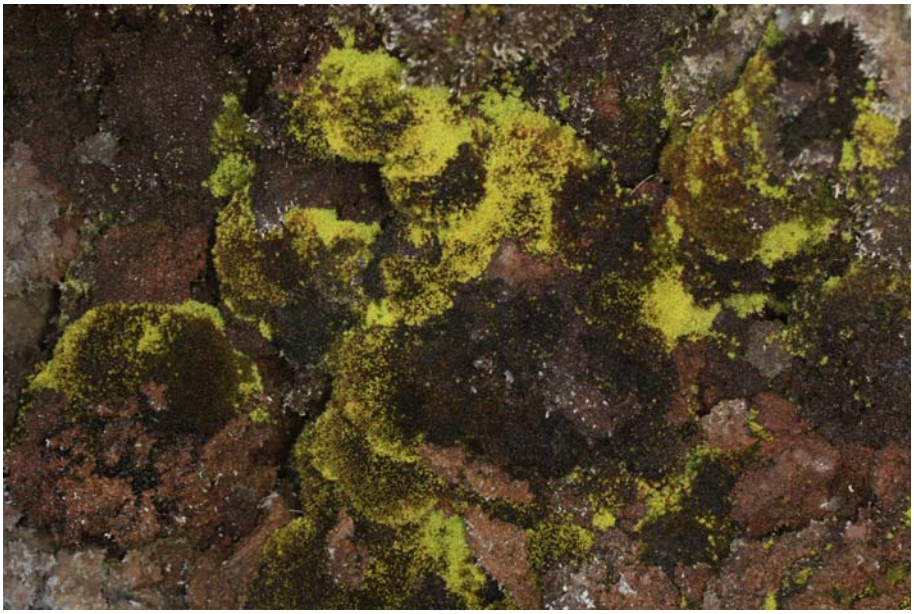
Syrrhopodon mahensis grows epiphytic in moist forests in the Seychelles and Réunion. **Mitthyridium fasciculatum** (bottom) is the only representative of the genus on the archipelagos and is only found on the Seychelles. It has creeping stems.

The Pottiaceae include about 1500 species in 77 genera. The species grow on open bare and often dry soil and for that reason they are not as numerous in the wet tropics.

Barbula indica is a common pantropical weed growing on soil in disturbed places, along roads, footpaths, parking lots or fissures of walls. The plants are minute, with 2-3 mm long leaves. It propagates by means of gemmae in the leaf axils. The species is quite drought resistant and is therefore also found on the lower islands of the Seychelles such as La Digue and Praslin.

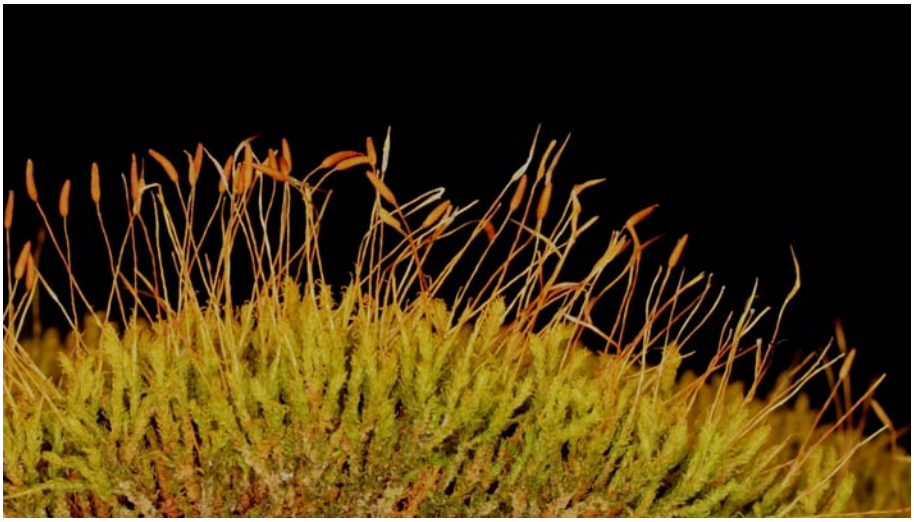
Trichostomum brachydontium is widely distributed through the more arid parts of the tropics and subtropics as well as in the Mediterranean , extending from there to Central Europe. It grows on roadside banks and other open bare soil often in masses. The leaves are lingulate and end in a short apiculus.

There are three species of **Weissia** in Mauritius and Réunion, growing on open soil. One of them, W. controversa, is also common in Europe. The plants have narrow lanceolate leaves which are incurved at tips.



Anoectangium aestivum is also distributed worldwide and is found in the Andes as well as in the Alps or in Réunion and Mauritius. This is the reason that it was described under many different names such as A. borbonense. It grows in compact tufts especially under overhanging lava rocks.

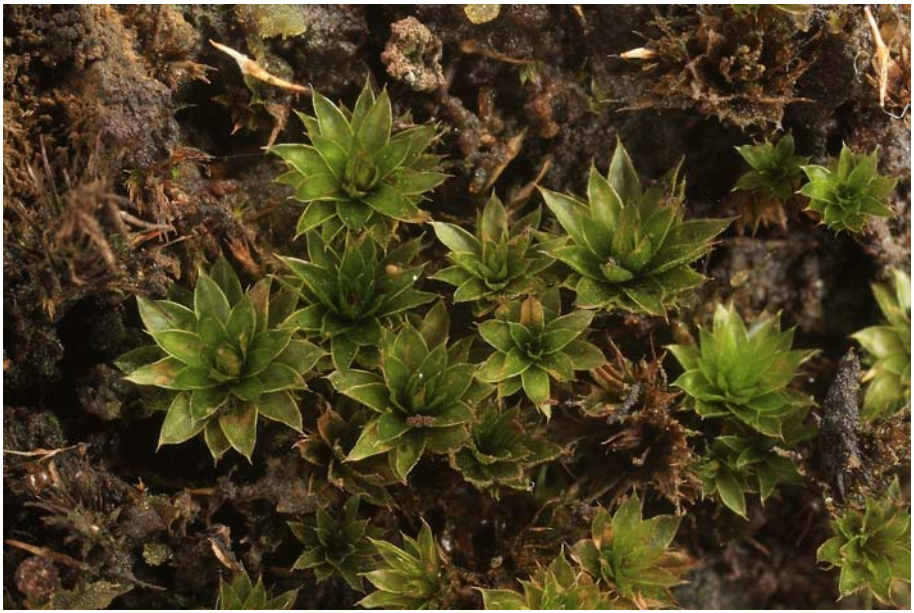

Hyophila involuta is a widespread pantropical species, which is curiously also found at the margins of some Swiss lakes and rivers and in adjacent SW Germany. It grows on humid limestone rocks but more often on secondary habitas such as concrete, even in towns, and on asphalt along roads. It is especially common in the Seychelles. Some decades before it was reported only from few localities but is now everywhere which may indicate a recent extension. The species names refers to the fact that the leaves are involute when dry.

Species of Leptodontium are characteristic for subalpine forests in the tropics. This is the reason that the genus is only found in Réunion. Two of the four species known from Réunion are **Leptodontium viticulosoides** (top) and **Leptodontium longicaule** (bottom). They grow on soil, soil covered rocks and epiphytic in Philippia and Acacia forests. L. viticulusoides is pantropical in distribution, L. longicaule is also found in the Neotropics.

Bryum is a difficult genus with many species, which can be recognized by their pear shaped capsules, here one of thirteen species known from the Mascarenes and Seychelles.

Bryum aubertii (this page) and **Bryum billardieri** (right page top) are very similar i n appearence. The first has larger leaaves (>7 mm) and subterraneous stolons, the latter smaller leaves (<5 mm) and no stolons. Both grow on shady soil in Mauritius and Réunion but lack in the Seychelles. The species have terminal rosettes of leaves. Those with subterraneous stolons are also comprised in the genus Rhodobryum, those without in Bryum subg. Rossulobryum.



Bryum cellulare is a soft, light green species on wet rocks, which can be identified under the microscope by its lax, large leaf cells. It is found only in Réunion.

Eleven species of Bryum are known from the Mascarenes, which are not easy to identify such as the species on this page from Réunion and next page bottom from Mahé.

Anomobryum is characterized by julaceous foliate stems. The only species known from the Mascarenes and Seychelles, **Anomobryum laceratum**, (left) is known from Réunion. It resembles much A. julaceum from Europe.

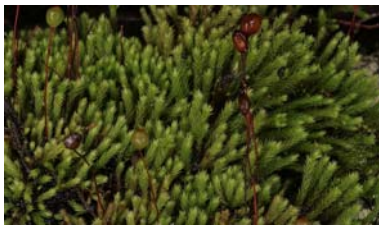
Brachymenium resembles vegetatively Bryum but has a different sporophyte. The genus has eight species in the Mascarenes and Seychelles of which one part grows on bark of trees, the other on soil. **Brachymenium acuminatum** (middle) is very widely distributed in the tropics. It grows on soil in dry habitats.

Mielichhoferia is a worldwide distributed genus with preference for rocks rich in heavy metals. The only species of the Mascarenes and Seychelles is **Mielichhoferia borbonica**, which is endemic to Réunion. The species name refers to Ile Bourbon, a former name of Réunion.

Bryum leptospeiron is not known from Réunion. It grows on sand in coastal areas such as coconut groves and propagates by bulbils in the leaf axils. In resembles much B. dunense from Europe growing in similar habitats.

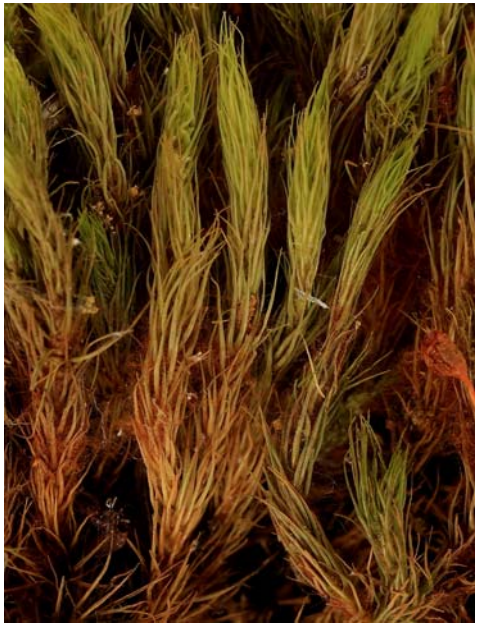
The Funariaceae are represented on the Mascarenes by two genera, Funaria and Entosthodon. Funaria has only one species, the almost cosmopolitan species F. hygrometrica on Réunion and Mauritius. In addition there are three species of Entosthodon reported from the Mascarenes, which are perhaps conspecific. **Entosthodon mauritianus** (top) and **Entosthodon borbonicus** (bottom) shall be distinguished by their sex conditions (E. borbonicus shall be autoicous, E. mauritianus synoicous).





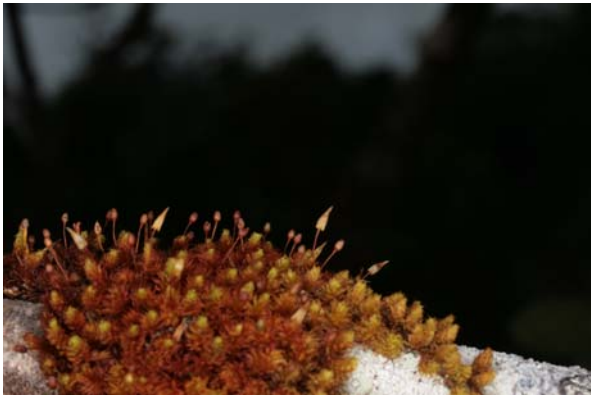
Bartramiaceae have conspicious globose capsules why they are called apple mosses. Philonotis species are characteristic for seeping rocks, waterfalls and wet ditches. Six species are reported from the Macarenes and Seychelles. **Philonotis hastata** (right page), a small pantropical species, is the most common one. The other species are difficult to determine.

Bartramia species grow on acidic rocks at higher altitudes such as **Bartramia gigantea** from Réunion and Mauritius (bottom, wet and dry) and **Bartramia ithyphylla** (top right) from Réunion. The latter occurs also in Europe! **Leiomela bartramioides** (top left) is similar.



Almost 100 Breutelia species grow around the world in tropical subalpine regions but are also found in artificial open habitats such as roadside banks at lower altitudes. The six species are therefore confined to Réunion wth the exception of Breutelia magdalenae. The male plants of B reutelia sp. have conspicuous cup shaped organs at the tip of the stems (top right, bottom left), where the male sex organs (antheridia) are produced as shown by Breutelia gnaphaleaa (bottom). They are also found in Philonotis. **Breutelia stuhlmannii** (top left) is a tropical african element, **Breutelia borbonica** (bottom right) enedmic to Réunion.

There are each a dozen species of Macromitrium and Schlotheimia on the Mascarenes and Seychelles, which all grow epiphytic on tree trunks and branches. They differ mainly by sporophytic characters. **Macromitrium** has a calyptra longly fringed at base and reduced peristome teeth, the calyptra of **Schlotheimia** is only lobed at base and the peristome is often reduced.



The family Hedwigiaceae consists of rock mosses and is represented in the Mascarenes only by the genus Hedwigidium with worldwide only one species, **Hedwigidium integrifolium**. The species occurs only on Réunion, where is grows abundantly on lava rocks at higher altitudes. It is also found in South Africa, the Andes and in western Europe. The plants are very variable in colour.

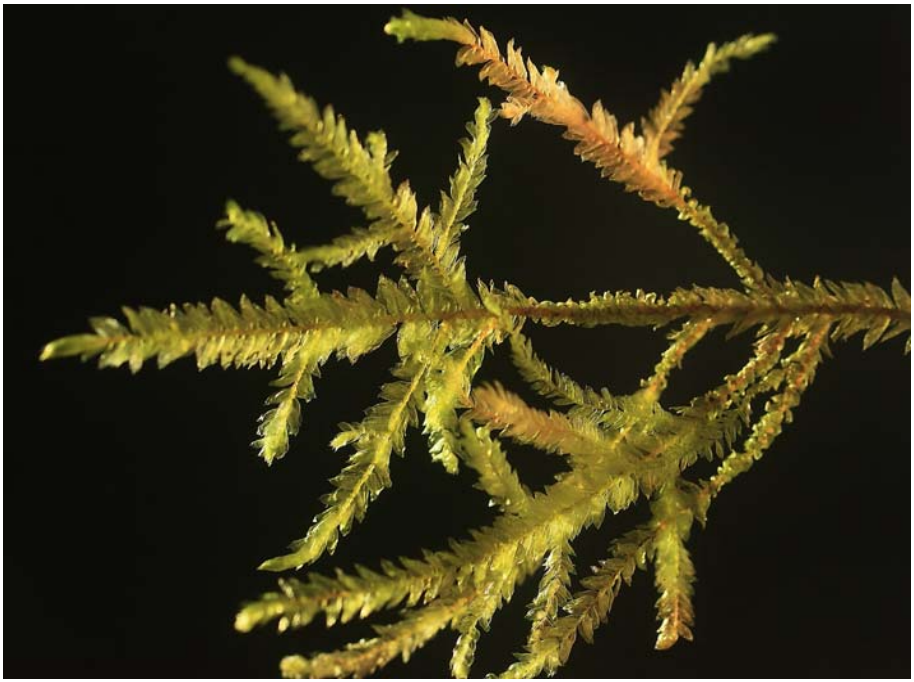
The family Rhizogoniaceae has two genera, Pyrrhobryum and Rhizogonium, which are only found in the southern hemisphere. Only **Pyrrhobryum spiniforme** crosses the equator and is a very common tropical weed. It grows on rotten wood also at lower altitudes on all archipelagos.

Racopilum-species are creeping, have tomentose stems and flattened leaves. These are anisophyllous like some Selaginellas and are dimorphic, with larges (normal) lateral ones and small ventral ones. The nerves are excurrent in an apiculus. Most of the thirty species worldwide are found in the Palaeotropics, six on Mauritius and Réunion but no one in the Seychelles. The plants grow on tree tunks and rocks, prerably at lower altitudes.

The Hypopterygiaceae are of austral origin but some species of the two genera Lopidium and Hypopterygium extend northwards into the tropics of the northern hemisphere.The most widespread species is **Hypopterygium tamarisci**, which is found on the young volcanic islands Réunion and Mauritius but not on the gondwanan Seychelles. It has regularly pinnate plants, and - like Racopilum - differentiated lateral and ventral leaves and creeps with stolons over rocks and rotten wood.

Thamnobryaceae comprise conspicously dendroid mosses. Like Hypopterygium, the plants are in fact branches risen from creeping stolons. They grow on tree trunks and rocks. Homaliodendron has three species on Mauritius, of which **Homaliodendron exiguum** is illustrated here. only one is found in Réunion but no one in the Seychelles.

Porothamnium varifolioides (below) is a species confined to Réunion. **Porotrichum elongatum** (bottom) occurs on all islands.



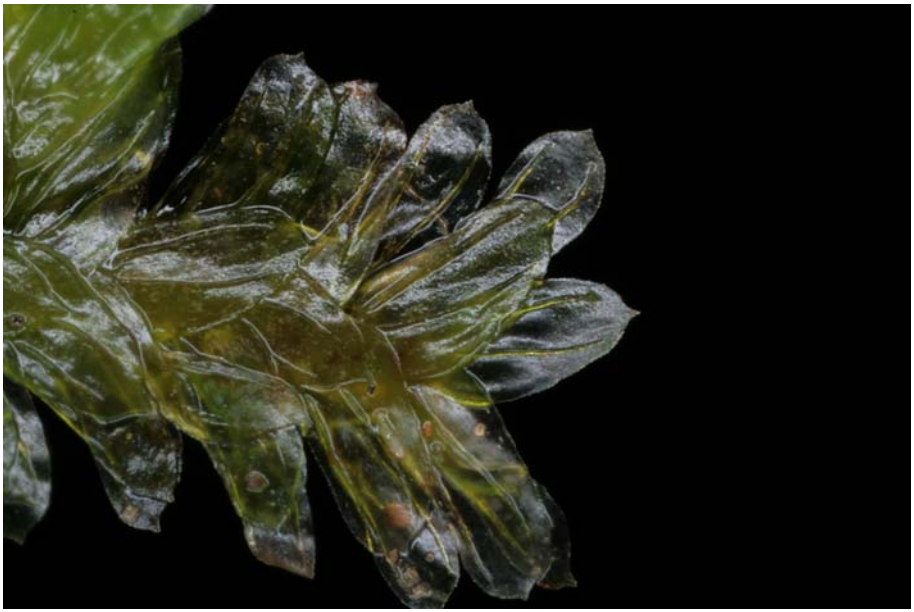
Jaegerina in the Pterobryaceae has also creeping primary stems but the secondary stems are not dendroid but simple, a life form which is called weft. Four species occur on Mauritius, of which **Jaegerina formosa** (left and bottom) is one, only one (**Jaegerina solitaria**, right) is known from Réunion and no one from the Seychelles.

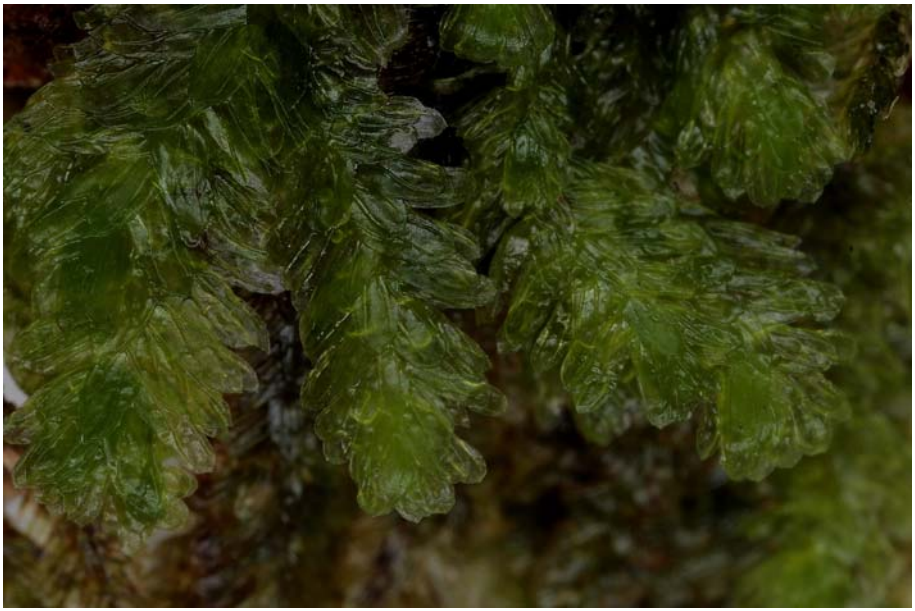
The Phyllogoniaceae are a monotypic family with the only genus Phyllogonium. The three species occur in the Neotropics, only **Phyllogonium viscosum** is also found in South Africa and Réunion, which is difficult to explain. The plants form long, almost unbranched secondary stems and grow pendant from tree trunks. The leaves appear to be two-ranked and are glossy.

The Hookeriaceae is a large tropical family which is now split into various others. **Calyptrochaeta asplenioides** (Daltoniaceae) from Mauritius and Réunion forms large wefts up to 8 cm growing on wet soil and rocks. It has complanate leaves with serrate margins.

Leucomium strumosum (Leucomiaceae) is a widespread pantropical species found on the Seychelles and Réunion. The laminal cells are very large as in many other „Hookeriaceaae“ and visible with a handlens, indicating a moist habitat, with the result that the plants are much shrunken when dry

Callicostella seychellensis (Pilotrichaceae) is one of six cspecies of the genus in the Mascarenes and Seychelles and 60 worldwide. It has complanate unbordered leaves with a double costa.

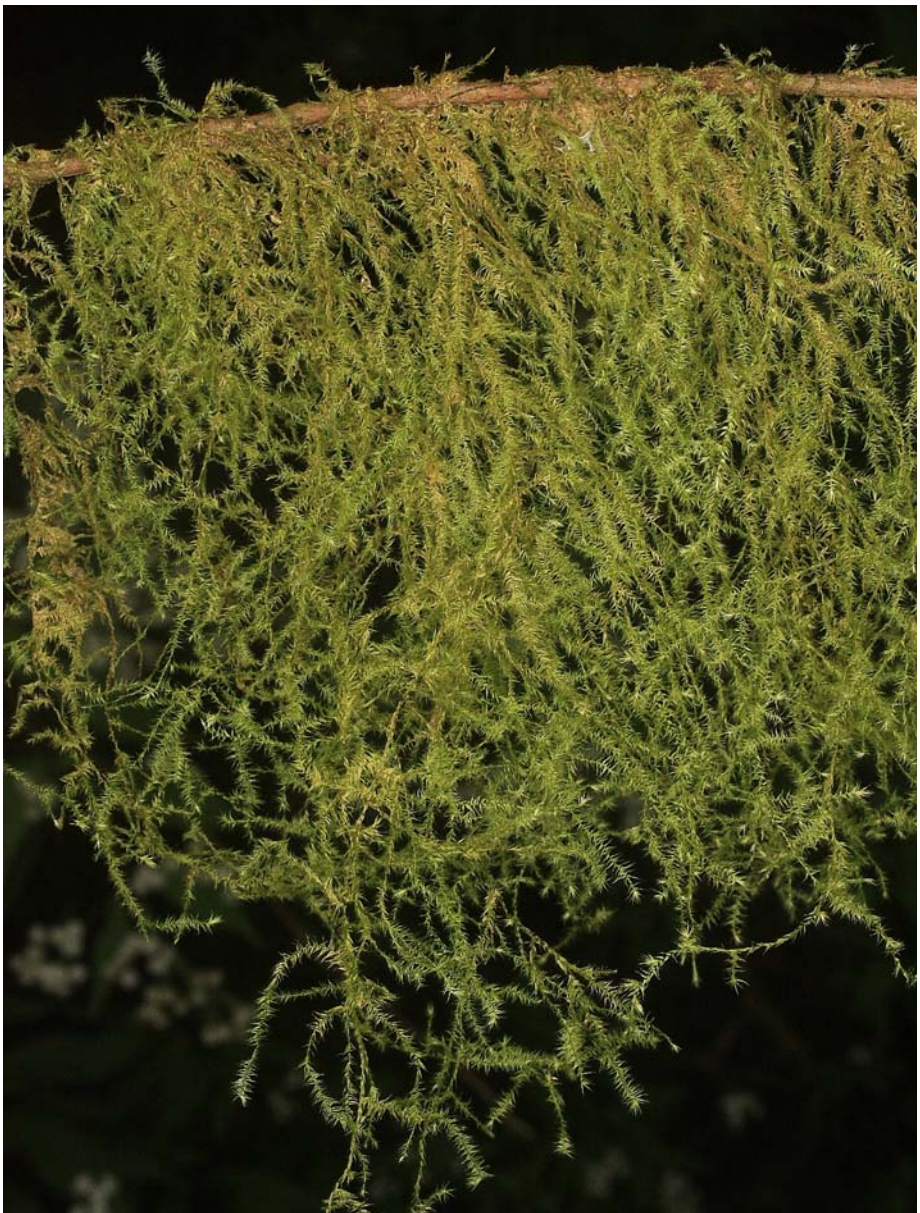




Distichophyllum mascarenicum is the only species of the genus but found on all islands of the Mascarenes and Seychelles. It has bordered leaves and a single costa. The calyptra is extremely fringed at base (bottom right) as in many other related genera, and the seta is warty (top right, the leaves belong to Leucomium strumosum).

The genus Daltonia (Daltoniaceae) is only found in Réunion. **Daltonia angustifolia** is one the three species growing on branches and tree trunks.

The mosses of the family Meteoriaceae mostly grow pendant from twigs and branches, like **Floribundaria floribunda** from Mauritius and Réunion (below). This life strategies allows the uptake of moisture from the air. The mosses can comb the necessary water from the fog, which condenses at the plants. Therefore Meteoriaceae are very characteristic for cloud forests. They indicate also places, where then air cools down over night and the air humidity raises. Is the relative humidity higher than 80%, the mosses can take up water vapour by osmosis. If a beard of mosses is hang up at a balance, one can watch the increase of weight over night.There are relatively few Meteoriaceae on the Mascarenes and Seychelles, which are only found at the higher altitudes.



The Meteoriaceae are represented on the Mascarenes by the genera Aerobryopsis, Floribundaria and Papillaria, a comparably low number as compared with tropical SE-Asia and Africa. It can perhaps be explained by the limited facilities for long distance dispersal.
Aerobryopsis is present with three species, Aerobryopsis capensis on all islands, Aerobryopsis longissima lacks on Réunion and Aerobryopsis cirrhifolia is only found on Mauritius.
Aerobryopsis capensis (top and bottom left) and **Aerobryopsis wallichii** (bottom right) grow less pendant but creep over other bryophytes or between small shrubs. In contrast, **Aerobryopsis longissima** (right page) forms long beards like in the elfin forests at the highest altitudes of Mahé.

Papillaria africana is found in all archipelagos. It can be recognized by the five ranked, very concave leaves with a short apiculus. There are two more species of Papillaria in Mauritius.

Brachytheciaceae are a mainly temperate northern hemispheric family. It is represented in the Mascarenes and Seychelles with six species of Brachythecium, most of which are found in Réunion. **Brachythecium sp.** is shown below as an example.
Pseudoscleropodium purum (bottom) is apparently introduced in Réunion from Europe. It grows in conifer plantations or along roadside banks. The species was also introduced in Newfoundland and New Zealand, probably by sheep.

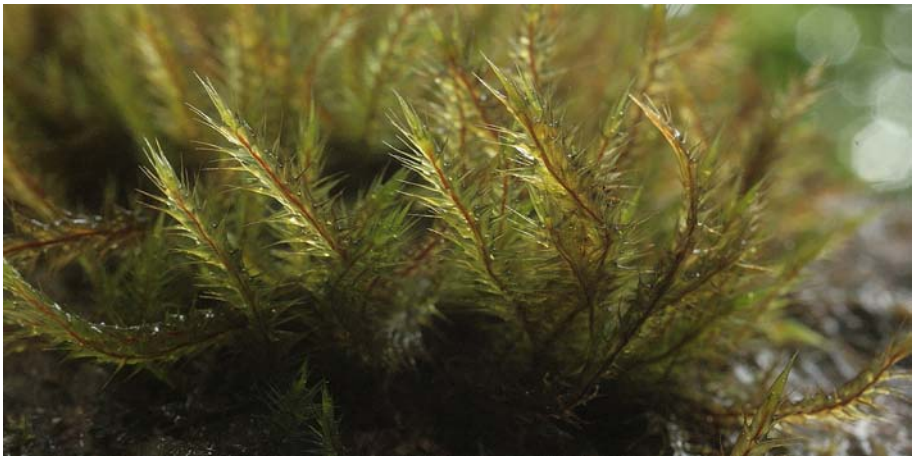
Representatives of the Hypnaceae are the genera **Ectoprothecium** (with 13, right page) and **Hypnum** (with 6 species, some unnamed species below). Both are characterized by prostrate pinnate plants with distinctly curved leaves. Hypnum is a mainly holarctic genus, Ectropothecium is tropical in distribution. The delimitation of both genera is difficult when sterile (capsule cylindrical and curved in Hypnum but ovoid in Ectropothecium)






Ectropothecium chenagonii only known from the Seychelles creeps horizontally on tree trunks. This is a trick to absorb rain water running down. The same trick is used by some other pleurocarpous mosses as well as liverworts.
Ectropothecium perrottii (bottom left) as well as **Ectropothecium brachycladum** (bottom right) are also only known from the Seychelles. They are found on rocks.

The family Sematophyllaceae includes about 40 genera with 800 species and is probably the largest family of pleurocarpous mosses. It is found primarily in the tropics and is especially characteristic for the lowlands. About ten genera are known from the Mascarenes, of which Acroporium is conspicuous because of its cuspidate stem and branch tips. Of the three species, **Acroporium megasporum** (top left) is found on all islands and **Acroporium lamprophyllum** (bottom) and A. diminutum only in the Seychelles. **Clastobryophilum bogoricum** (top right) is also confined to the Seychelles. The species grow on bark of trees, rotten wood and rocks.



Taxithelium is present with four species in the Mascarenes and Seychelles, of which **Taxithelium instratum** (below) is confined to the Seychelles.

Isopterygium gracile (below) is one of five species of the genus known from the Seychelles. It belongs to the Plagiotheciaceae characterized by complanate leaves and grows on shady soil. The genus is also placed in the Hypnaceae.

Register

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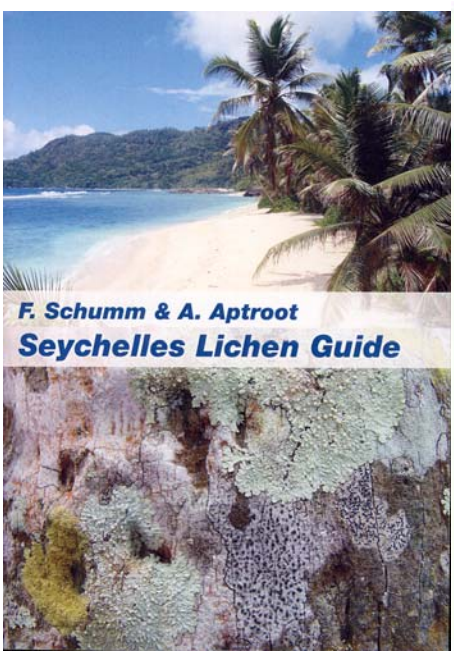

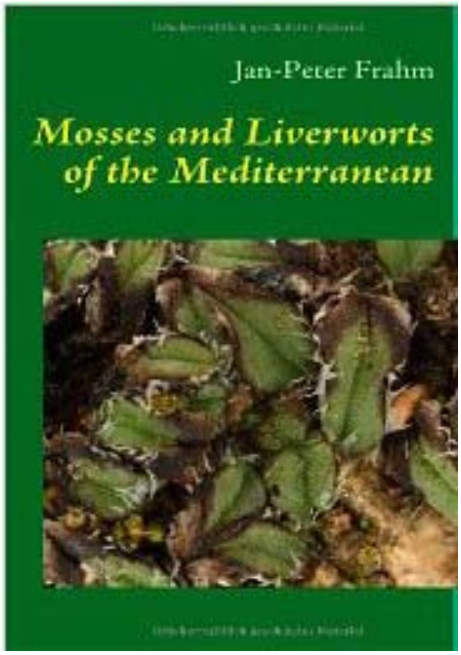

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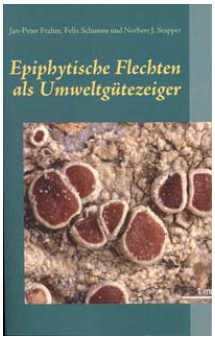

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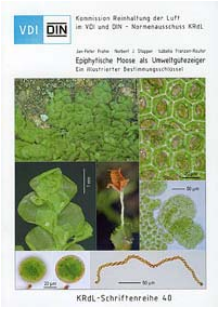

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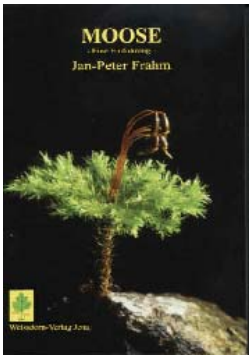

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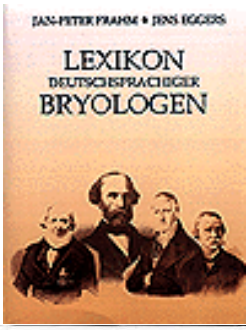

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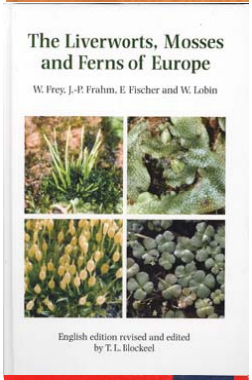

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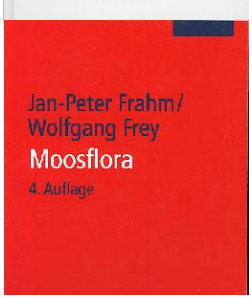

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