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**Taiwan Biodiversity Research Institute,
Jiji Township, Taiwan. 13-15 October 2025**



The 2025 International Association of Bryologists Conference will be held from October 13 to 15, 2025, in Jiji Township, Nantou County, Taiwan. The conference theme is "Bryological Advances in Asia and Beyond". This event aims to bring together bryologists, ecologists, conservationists, and plant scientists from around the world to share recent research developments, foster interdisciplinary collaboration, and discuss future directions for bryophyte studies and conservation, particularly for the Asia region.

The conference will focus on recent advances in taxonomy, systematics, molecular biology, ecology, conservation, and biogeography of bryophytes. By bringing together researchers from diverse regions and disciplines, the conference aims to highlight regional discoveries, cross-border collaborations, and the global relevance of bryophyte studies. Through sharing cutting-edge research and innovative approaches, the conference seeks to foster dialogue, inspire future research directions, and contribute to a deeper understanding of bryophyte diversity and its ecological significance.

Organizing committee:

The Bryological Society of Taiwan

Taiwan Biodiversity Research Institute (TBRI)

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Abstracts of oral presentations

Land plant evolution – insights from bryophytes

[Silvia Pressel](#)

Natural History Museum, London, UK

Since bryophytes share common ancestry with tracheophytes, approximately 500 MYA, they have long provided unique insights into the evolution of key innovations that allowed the earliest plants to establish and diversify on land. Interpretations of the evolution of key traits of plant terrestrial adaptation have shifted considerably in the last decades, reflecting changing hypotheses on the phylogenetic relationships among bryophytes and with the tracheophytes. Recent phylogenomic studies have provided support for hornworts as the sister group to a mosses-liverworts clade, Setophyta, with some arguing for bryophytes as having undergone reductive evolution from a more complex ancestral land plant. Embedded in this hypothesis is the notion of a last common ancestor of living land plants already equipped with several tracheophyte novelties, including actively controlled, angiosperm-like stomata. I will discuss how our latest experimental evidence on the morphology and function of moss stomata, together with earlier data from hornworts, disagrees with this proposed evolutionary scenario and instead supports the alternative hypothesis of a gradual acquisition of active stomatal regulation. In this context, I will also consider evolutionary insights from other bryophyte characters and how comparative studies of these with fossils are advancing our understanding of the nature of the first land floras.

***Riccia*: A new phylogeny testing past hypotheses, taxonomies and relationships across this megadiverse genus using a target enrichment approach**

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Riccia is the most diverse genus within the complex thalloid liverwort order Marchantiales with over 200 species worldwide. Building on target enrichment data recently generated by Rabeau (unpublished) through the GoFlag project, for 116 samples mainly from the *Riccia* hotspot regions of southern Africa and the western Indian Ocean islands, we have combined an additional 193 Australian and 13 non-Australian taxa along with 25 mainly European samples from the Royal Botanic Garden Edinburgh to obtain an unprecedented 347 samples of *Riccia* from across the world. This has allowed us to test classifications put forward by Na-Thalang, Schuster, Jovet-Ast and Perold as well as hypotheses on character evolution and relationships within the genus. Is there evidence to support from two to eight subgenera within the genus as proposed at various times by the four authors? Are species such as *Riccia caroliniana* with its ventral photosynthetic layer, an ancestral species or more recently evolved? Are the predominantly southern African species with multi-layered epidermal cells a monophyletic group or polyphyletic? This phylogeny has gone some way to answer these questions and many more.

Elements of an ancient bryosphere: Cyanobacterial moss symbiosis from the Cretaceous of Antarctica

[Zane Walker](#), Alexander C. Bippus, Ari Iglesias, Selena Y. Smith, Brian A. Atkinson

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The bryosphere consists of living and dead moss tissue which hosts diverse microbial communities, often including nitrogen-fixing cyanobacteria. N-fixing symbiotes may contribute up to 50% of N input to some ecosystems (boreal) which in turn significantly influence global nutrient cycles. An exceptionally preserved permineralized moss gametophyte from the Cretaceous (82-80 Ma) of Antarctic provides the first evidence of a cyanobacteria-moss symbiotic association from the fossil record. Nostoclean cyanobacterial filaments are found within the leaf axils and perichaetium similar to extant associations. Two cyanobacterial morphotypes are present which both have tentative double walled and spheroidal heterocysts. The moss consists of a single unbranched shoot with leaves terminated by a perichaetium. The dioicous gametophyte contains several archegonia, including an archegonium containing an ovum with a nucleus and another with a possible developing embryo. Preservation of these delicate, ephemeral reproductive structures indicate that little decay had occurred prior to fossilization and reveals a new level of anatomical preservation possible for bryophytes. Our results indicate that moss-cyanobacteria associations existed in Late Cretaceous forests of Antarctica. Such associations may have played an important role in the nitrogen cycle for high latitudinal forests which experienced significant restructuring during the early diversification of angiosperms.

Cryopreservation of Bryophytes from Tropical Montane Cloud Forest in Taiwan: A Case from the Dr. Cecilia Koo Botanic Conservation Center (KBCC)

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³Department of Biological Science, National Sun Yat-sen University, Taiwan

The Dr. Cecilia Koo Botanic Conservation Center (KBCC) in Taiwan is dedicated to conserving tropical and subtropical plants including bryophytes through ex situ strategies. While maintaining living collections is a valuable approach, developing cryopreservation techniques are essential to ensure the long-term preservation and genetic stability of species. Therefore, cryopreservation protocols were explored using Tropical Montane Cloud Forest (TMCF) bryophytes. While different cryopreservation protocols have been examined, most previous research focused on temperate and arctic mosses, excluding TMCF's bryophytes. Fifty-nine TMCF bryophytes, including mosses, liverworts, and hornwort were tested with the direct-cryopreservation protocols; 50 species regenerated and 16 species even showed a 100% regeneration rate (RR). Also, the longer cryo-period did not affect RR; hence, the direct cryopreservation protocol is applicable for long-term storage. The high RR bryophytes often grow on branches and dead trunks, while the low RR bryophytes are often found on the forest floor. Cryoprotectants were evaluated to determine if indirect cryopreservation can improve RR. The RR of using cryoprotectants was remarkably high. Comprehensive cryopreservation suggestions for TMCF bryophytes will contribute greatly to the ongoing TMCF bryophytes conservation projects.

Good days and bad days: What weather patterns promote carbon gain in tropical bryophytes?

[Maaïke Y. Bader](#)¹, Nada Nikolic¹, Louise Guerrot¹, Sarah Brach^{1,2}, Jörg Bendix¹, Gerhard Zotz², Philipp Porada³, Monica Berdugo¹

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The amount of carbon bryophytes take up or give off during a 24-h period can vary strongly with weather patterns, especially light and moisture conditions. Under unfavourable weather, the balance of diel gains and losses can easily become negative, an outcome that can lead to starvation if sustained for too many days. In the warm tropics, bryophytes tend to develop little biomass, and it has been hypothesized that this is due to warm conditions and unfavourable timing of moisture inputs and light leading to low carbon balances. With the carbon-balance model PoiCarb, we studied what weather patterns lead to positive or negative carbon balances for tropical-rainforest canopy bryophytes, based on canopy climate data and species-specific environmental responses. Carbon balances were highest on sunny days with some rain, preferably in the morning, and lowest on wet days with very low light levels. Few days had positive carbon balances, emphasizing the marginality of this tropical lowland climate for bryophytes. Changes in weather patterns under climate change might further compromise bryophyte carbon balances. The PoiCarb model provides a tool to predict such effects, which are likely non-linear and species-specific, and we therefore encourage the collection of more high-quality ecophysiological data on tropical bryophytes.

From form to function: How mosses respond to engineered drought stress

[Eliza Hayse](#)

Lund University, Sweden

Bryophytes are particularly sensitive to environmental stressors, making them ideal models for studying plant responses to abiotic stress. Further, the chemical complexity of bryophytes remains unknown. By cultivating bryophytes in controlled bioreactor systems, we can systematically assess the effects of specific stress conditions such as light intensity, water availability, and allelopathic interactions. In this study, we focus on the impact of drought stress using a novel immersion-type bioreactor setup. This approach allows for consistent, repeatable immersion cycles that simulate natural flooding events. We compared the responses of two major morphological groups of mosses—acrocarps and pleurocarps—evaluating differences in growth rates, morphological adaptations, chemicals released, and gene expression profiles under different 'drought' conditions. This work not only advances our understanding of bryophyte stress physiology but also showcases the utility of bioreactors as powerful tools for experimental plant biology.

Taxonomy, Diversification & Biogeography of Asian *Meteorium* Species

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Meteorium Dozy & Molk. is a pantropical moss genus consisting of many epiphytic species with a center of diversity in Asia. Together with *Papillaria* Lorentz., they form a major clade Meteorioideae subfamily in the Meteoriaceae family. The confusion between the two genera are resolved (Huttunen *et al.* 2004, Quandt *et al.* 2004), and while *Papillaria* has been treated systematically (de Olivera *et al.* 2020), taxonomy, evolution and phylogenetic relationships within the genus *Meteorium* remain ambiguous although the generic delimitation is clear. Hence, our project aims to provide a fundamental systematic framework including taxonomic solutions, evolutionary and biogeographical knowledge for the genus *Meteorium*. We combine morphological taxonomical revision with molecular data from four gene regions (nuclear ITS1-5.8S-ITS2, genomic 3A3, trnL-F & rpl16 chloroplast regions) to reveal and clarify evolutionary history, specific diversification and biogeography within the genus. The data resolved all American species in a clade within a monophyletic *Meteorium*. Within Asian *Meteorium* accessions, fourteen species are recognized. The analysis also shows that the genus *Meteorium* has continental Asian origin (China, Nepal, Bhutan, etc.) and further diversification in south in the Indonesian archipelago, Philippines, Papua New Guinea and Australia.

Integrative taxonomic revision of *Leucobryum* (Leucobryaceae, Dicranales) in the Malagasy Region

[Quentin Dejonghe](#)

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Leucobryum (Leucobryaceae, Dicranales) remains taxonomically understudied in Africa, particularly across the western Indian Ocean islands. In this study, an integrative approach combining morphological and molecular data was applied to revise species delimitations within this genus in the region. Morphological analyses were performed on both type specimens (PC, MNHN, Paris) and field collections gathered between 1994 and 2019, resulting in the identification of thirteen morphological clusters. Molecular data were obtained for three barcode markers, and multiple species delimitation methods (ASAP, bPTP, GMYC) were applied. The use of Conspecificity Matrices (CoMa) within this integrative framework supported the recognition of nine well-delimited species (*L. acutifolium*, *L. boivinianum*, *L. boryanum*, *L. cambouei*, *L. cucullatum*, *L. galinonii*, *L. madagassum*, *L. parvulum*, *L. perrotii*), while four additional taxa (*L. sancta-mariae*, *L. isleanum*, *L. comorense*, *L. mayottense*) exhibited insufficient morphological and molecular divergence, supporting their synonymization. These findings highlight the continued taxonomic ambiguity within *Leucobryum* and the need to expand integrative taxonomic efforts across continental Africa.

Morphological traits evolution in the moss genus *Aptychella* (Bryophyta, Pylaisiadelphaceae) based on molecular phylogenetics

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The moss genus *Aptychella* exhibits considerable morphological variation, complicating species delimitation and evolutionary interpretation. This study integrates molecular phylogenetics, divergence time estimation, and morphological trait mapping to investigate trait evolution in *Aptychella*. Using 72 samples and three chloroplast markers (*rbcL*, *rps4*, *trnL-F*), phylogenetic trees were reconstructed via ML, MP, and Bayesian inference. The genus is supported as monophyletic, comprising two major clades. Divergence dating suggests an Oligocene origin, with rapid diversification during the Miocene. Five gametophytic traits were mapped onto the calibrated tree. Traits such as costa type and leaf base decurrence were found to be conserved, while branching pattern and leaf shape showed repeated transitions, indicating homoplasy and potential adaptive evolution. These findings highlight the value of integrating molecular and morphological data in moss systematics.

Calymperaceae (Bryophyta) of the Western Ghats, India

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The Western Ghats, one of the global biodiversity hotspots in the world which passes through the states Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala and extends for more than 1600 km, encompassing an area of about 140,000 km². The unique geographic, climatic and ecological conditions foster a vast variety of organisms, which are endemic to the region.

Calymperaceae has a primarily tropical and subtropical distribution and is considered an important component of the epiphytic flora in most lowland and mid-elevation forests. This family belongs to the acrocarpous mosses and is predominantly corticolous in habitat. The presence of cancellinae, a group of enlarged, hyaline cells with internal and external pores at the leaf bases are distinctive characteristics of this group. Calymperaceae is a significant family of mosses commonly found in tropical rainforests worldwide; however, there remain many gaps in its identification and classification. In this checklist, the members of Calymperaceae reported from the Western Ghats are enumerated. A total of 26 taxa of Calymperaceae including 25 species and one variety belonging to six genera are reported from different parts of the Western Ghats.

Population history of *Sphagnum cuspidatum* in eastern North America, Europe, and Asia

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Peat mosses (*Sphagnum* L.) are widespread group of bryophytes with around 300 species. *Sphagnum* originated in the northern hemisphere and had several independent dispersals to the tropics. *Sphagnum cuspidatum* Ehrh. Ex Hoffm. is a cosmopolitan species that occurs in Europe, North America, and Asia. This work investigated the population history of *S. cuspidatum* using genome scale data (RAD-seq) from specimens collected in Europe, North America, Thailand, and China. Plants from Asia (Thailand and China) form a clade sister to a clade of plants from North America and Europe. Genetic diversity of plants in Asia is much lower compared to plants in Europe and North America. Demographic modeling has shown that plants in Europe have the lowest effective population size but have substantial amount of gene flow from eastern North America. Plants in Asia have the second largest effective population size but have a bottleneck event in the past. Plants in eastern North America have the highest effective population size and were descended from large ancestral population. The results have shown that eastern North America is the diversity hotspot of *S. cuspidatum* and different historical events could have shaped the population history of *S. cuspidatum* around the world.

The why of dung moss: An exploration into the ecology of substrate colonisation in New Zealand Splachnaceae

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Many mosses within the family Splachnaceae are well known for their habit of growing on dung and animal carcasses. While there is some indication of specialisation, the nature of the relationship between these ‘dung mosses’ and their unique substrate remains largely unexplored. In this study, the ecology of substrate colonisation of three different species of New Zealand dung mosses (*Tayloria* Hook.) is explored. In the first part, spore germination of *Tayloria* species is tested across a wide variety of potential substrates. In the second part, rates of germination and colonisation of *Tayloria* spores are compared against germination and colonisation of selected co-occurring mosses in agar infused with substrates of animal origin. Lastly, direct interactions between germinating spores as well as established protonema of *Tayloria* and co-occurring mosses are tested. We found that *Tayloria* can germinate on a wide variety of animal and non-animal substrates while the co-occurring moss species are unable to germinate on animal-based substrates. Competition between protonema on jointly occupied substrate markedly disadvantages *Tayloria* species in comparison with co-occurring mosses. Our results indicate that the use of such animal-based substrates by New Zealand *Tayloria* is facultative suggesting any specialisation is driven by other factors such as dispersal agents.

An infrageneric classification of the genus *Lejeunea* (Marchantiophyta: Lejeuneaceae) using molecular phylogeny and morphology

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The genus *Lejeunea*, with about 375 accepted species, is one of the most species-rich and intricate genera of liverworts. In this study, we present the first integrative, worldwide infrageneric classification of *Lejeunea* based on morphology and maximum likelihood analysis and Bayesian inference of sequences from two chloroplast regions (trnL-trnF, rbcL) and the nuclear ITS region of about 35% of the species. The phylogenetic analyses revealed numerous robust clades within two major lineages, corresponding to subgenera *Lejeunea* and *Crossotolejeunea*. Integrating molecular-phylogenetic and morphological evidence, we describe 15 sections, four in subg. *Lejeunea* (sect. *Glaucoscentes*, sect. *Lamacerinae*, sect. *Lejeunea*, sect. *Macrolejeunea*) and 11 in subg. *Crossotolejeunea* (sect. *Apolejeunea*, sect. *Crossotolejeunea*, sect. *Echinocolea*, sect. *Flavae*, sect. *Heterolejeunea*, sect. *Inflatolejeunea*, sect. *Minutilobae*, sect. *Nanolejeunea*, sect. *Papillolejeunea*, sect. *Sordidae*, sect. *Xenantholejeunea*).

Disentangling the threadwort genera *Telaranea* and *Arachniopsis*: Recircumscribing based on molecular phylogeny

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The large and diverse liverwort family Lepidoziaceae exhibit parallel morphological reductions in at least three lineages. This complicates the taxonomy of several taxa including the threadwort genera *Telaranea* and *Arachniopsis*, with the former previously conserved against the latter. Due to lack of information on the phylogenetic positions of the type species *Telaranea chaetophylla* and *Arachniopsis coactilis*, *Telaranea* has remained problematic even after the transfer of several species to three separate genera. In this study, the positions of these type species were determined based on phylogenetic analyses of 13 genetic markers from 150 species of Lepidoziaceae. With well-resolved trees, both species were revealed to belong to the same clade. The nomenclatural status quo is therefore maintained, with *Telaranea* as the conserved name for this clade. However, the species outside this clade must be transferred to a new genus yet to be described. The findings from this study can provide useful basis of updating liverwort floras and checklists.

Dispersal of the liverwort *Riccia treubiana* in a tropical city

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Bryophyte dispersal in urban environments is poorly understood, particularly in the tropics. A thalloid liverwort, *Riccia treubiana*, exhibits a patchy yet recurring presence in Singapore, a tropical city state situated just 1.03 degrees north of the Equator. This study investigated the liverwort distribution and fragment-based dispersal in Singapore, providing the first experimental evidence of dispersal mechanisms in *Riccia*. Field surveys recorded 34 new occurrences, of which 90% were found in soil-filled gaps between parking lot pavers. Regeneration trials confirmed that both apical and medial fragments have the potential to fully regenerate. Simulated footstep and vehicle-crushing experiments demonstrated that vegetative fragments can be transferred and successfully established via human and vehicular movements. Shoe sole design significantly influenced fragment retention and deposition efficiency, while vehicle tires deposited most fragments within the first meter post-contact. Notably, fragments appeared more often near paver edges, suggesting high-friction interfaces aid initial deposition. Its absence at some older sites may be due to habitat loss from recent surface renovation, reduced disturbance, dense vascular plant competition, or prolonged sun exposure. These findings emphasize how dispersal, microhabitat, and urban renewal interact to shape bryophytes' presence, offering insights for conserving them in tropical cities.

Exploring the ethnopharmacology of sub-Saharan bryophytes: Evidence from traditional healers in Benin

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Bryophytes have long been used in traditional medicine worldwide, yet their use in Africa remains largely undocumented. This study investigates the therapeutic potential of African bryophytes, with a focus on traditional practices in Benin. A literature review revealed that among the 4,257 bryophyte species reported in sub-Saharan Africa, only 129 (3%) are cited in ethnopharmacological uses elsewhere, and just 32 (25%) of these are already used within Africa.

We conducted interviews with 75 traditional healers in Benin. Most were over 65 years old and had no formal education. These healers reported using 33 bryophyte species, including 19 previously known in Africa and 14 newly documented in this context.

We analyzed the diseases treated, species used, and preparation methods. The results suggest that specific bryophyte families and genera are associated with particular health issues. The traditional “Doctrine of Signatures” may partly explain the selection of some species.

This study underscores the rich but underexplored ethnopharmacological knowledge surrounding African bryophytes. Further pharmacological and clinical studies are needed to evaluate the efficacy of these species under controlled conditions, in line with regional and international standards.

Mosses from the Heart of Borneo: Floristic studies in the Upper Baram Hinterland

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This study documents the findings of the Heart of Borneo scientific expeditions to Long Banga, Tama Abu, and Gerenai-Long Mekaba in the Upper Baram region. This sole bryological work uncovered 232 species, two subspecies, and six varieties in 89 genera and 34 families, representing 31% of the 784 taxa documented for Borneo. Remarkably, 13 species and infraspecies are reported new to Borneo Island, and 44 are new records for Sarawak. The study area is best represented by members of the Calymperaceae, consisting of 33 species, followed by Sematophyllaceae with 28 species. The rediscovery of *Cladopodanthus microcarpus*, 93 years after its original discovery is a prominent finding. The discovery of Singaporean endemic *Calohypnum singaporense* in the dipterocarp forests of Upper Baram records the first occurrence of this genus and species in Borneo. The once believed disjunct distribution species, *Syrrhopodon stoneae*, previously limited to Peninsular Malaysia and Australia, marked its confirmed present in area between the two disjunct regions. The Bornean endemic *Distichophyllum kinabaluense* is now known to occupy a broader range within Borneo and not restricted to the tall mountain. Furthermore, rare species like *Neckeropsis beccariana*, *Papillidiopsis bruchii*, *Sclerohypnum littorale*, are frequently encountered, indicating the high conservation importance of this region.

The mossy tales of two hills: Limestone moss flora of Batu Caves and the Takun Hill Complex

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Batu Caves and the Takun Hill Complex are the two southernmost prominent karst outcrops on the Continental Asian mainland. Although only 8.6 km apart, they are subject to differing degrees of urban encroachment from the rapidly expanding Greater Kuala Lumpur region. Between 2018 and 2025, both sites were repeatedly surveyed for bryophytes, with several hundred bryophyte specimens collected and examined alongside historical collections from local herbaria. The results revealed comparable levels of moss diversity: 55 species at Batu Caves and 66 species at Takun Hill. However, the species composition differs significantly between the two sites, suggesting ecological divergence potentially driven by urban-related pressures. Batu Caves, with its greater exposure to tourism, religious activity, and infrastructure development, exhibits signs of ecological disturbance, whereas Takun Hill—although also impacted—retains more intact forest patches in certain areas. This study highlights the impact of urban proximity and land-use intensity on moss diversity and composition in limestone ecosystems. The findings highlight the need for more nuanced conservation planning that considers both biological richness and ecological integrity, particularly for karst landscapes that are increasingly isolated and stressed by metropolitan expansion.

Hidden gems of mist: Diversity and endemism of bryophytes in the Sholas – the southern montane wet temperate forests of the Western Ghats of India

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The sholas, unique montane wet temperate forests nestled within the Western Ghats of India, represent biodiversity hotspots characterized by their distinct stunted evergreen trees and dense undergrowth, often shrouded in mist. While the vascular flora and fauna of these ecosystems have received considerable attention, the bryophyte diversity (mosses, liverworts, and hornworts) remains significantly understudied, representing "hidden gems" crucial to ecosystem functioning. This study aims to explore the species richness, diversity patterns, and levels of endemism among bryophytes inhabiting the shola forests. Through extensive field surveys across various shola fragments and rigorous taxonomic identification, we reveal a remarkably high diversity of bryophyte species, including numerous new records for the region and India. Furthermore, our findings highlight a significant proportion of endemic bryophyte taxa, underscoring the evolutionary distinctiveness and biogeographic importance of the sholas as refugia for ancient lineages. The prevalence of epiphytic and epiphyllous bryophytes, strongly influenced by the high humidity and consistent moisture availability, emphasizes their critical role in hydrological cycling, nutrient retention, and microhabitat creation within these fragile ecosystems. This research not only contributes to a comprehensive understanding of bryophyte biogeography in the Indian subcontinent but also underscores the urgent need for targeted conservation strategies to protect these overlooked yet vital components of the shola ecosystem from increasing anthropogenic pressures and climate change impacts.

Bryoflora of Nelliampathy Hills, in Western Ghats: Diversity and distribution patterns

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The bryophyte flora of Nelliampathy Hills, Kerala, India has been studied, revealing their taxonomic positioning and distribution patterns in relation to the microhabitats, vegetations and altitudinal ranges. The unique geographical influence of the Palakkad Gap, coupled with the region's status as part of the Southern Western Ghats, significantly enriches the species composition of the study area. Notably, the Nelliampathy Hills have proven to be a hotspot for bryophyte discovery. Several new species have been identified, including *Acidodontium indicum* Vineesha, Sajitha, Manju & J.R.Spence, *Pseudoparaphysanthus ghatensis* Sajitha, Manju & Enroth sp. nov. (in edit), a new subspecies *Plagiochila squamulosa* subsp. *tamas-pocsii* Sajitha, Manju & Rawat. and a new variety, *Fissidens crispulus* Brid. var. *nelliampathiae* K.M.Manjula & Manju, has also been documented. Beyond new species, the study also reports new regional records for certain taxa within the Nelliampathy Hills. *Fissidens enervis* Sim, collected from this area represents a new record for Asia. The present study also reports *Entodon luteonitens* Renauld & Cardot as a new record to peninsular India and *Leucobryum glaucum* (Hedw.) Ångstr. as new record to the Western Ghats of India. *Atrichum undulatum* (Hedw.) P.Beauv., *Campylopus gracilis* (Mitt.) A.Jaeger, *Calyptothecium auriculatum* (Dixon) Nog., *Gammiella ceylonensis* (Broth.) B.C.Tan & W.R.Buck, *Pterobryopsis scabriuscula* (Mitt.) M.Fleisch., *Toloxis semitorta* (Müll.Hal.) W.R.Buck and *Wijkia baculifera* (Dixon) H.A.Crum are described as new records from Kerala. A total of 115 Bryophytes including 39 liverworts, 73 Mosses and three hornworts are recorded from Nelliampathy Hills in Western Ghats.

Towards knowledge of the moss flora of north Asia

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This report aims to summarize the results of integrative taxonomic revision of Dicranidae in eastern Europe and north Asia. In 2025, the fifth volume of the Moss Flora of Russia was published; it includes 356 species of mosses earlier classified in the Dicranales s.l. In the course of its preparation, we undertook morpho-molecular revisions of many challenging groups such as *Dicranella*, *Dicranum*, *Didymodon*, *Ditrichum*, *Pleuridium*, *Fissidens*, *Symblepharis*, *Weissia*, etc. It was complemented by DNA barcoding while proceeding collections from the insufficiently studied areas. These efforts allowed us identifying the previously omitted species; also in many lineages we revealed higher or different molecular diversity as compared to western Europe. Further development of the integrative taxonomic studies of mosses calls for setting worldwide collaboration, coordinating laboratory protocols, and encouragement of studies dealing with groups insufficiently covered by DNA data. Also, daily use of DNA markers allowed improving higher level taxonomy of Dicranids, which, at the moment, bases mostly on the plastid DNA sequences and awaits validation by genomic data. Increasing number of the previously not recognized central Asian, east Asian, north Asian and Beringian taxa highlights the need for reassessment of the permafrost area conservation value in the context of climate change.

Clarifying the systematics of the *Conocephalum conicum* complex in North America

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The genus *Conocephalum* includes an uncertain number of morphologically cryptic species in the *C. conicum* complex. In narrowing the circumscription of *C. conicum* s.s., four *Conocephalum* species were described and an additional clade from North America (“types” “A” and “C” of Odrzykoski and Sweykowski, 1991) was identified but not comprehensively studied. The circumscription of the latter clade and its distinction from the Holarctic *C. salebrosum* necessitated further sampling of North American *Conocephalum*. Our preliminary systematic work on *Conocephalum* in North America based on plastid phylogeny and morphology suggests that at least four species should be recognized for the continent. This work is part of a larger ongoing project estimating phylogeny using target-capture methods (“GoFlag 451”) and generating high-quality nuclear genomes. Based on initial data, we find that the type A/C clade includes at least two morphologically distinct allopatric species, which we will formally describe. We confirm that *C. salebrosum* is widespread in North America, overlapping in distribution with members of the type A/C clade. We find that *C. salebrosum* can be identified with a novel qualitative morphological character. Finally, we report another species as new for North America from the Aleutian Islands, Southeast Alaska, and montane regions of southern British Columbia.

Roles of MpMOR1 and MpZWI in air chamber formation in *Marchantia polymorpha*

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Plants are multicellular autotrophs that promote photosynthesis by optimizing water use, light capture, and gas exchange. To support this, they have evolved complex structures that enable efficient gas exchange through intercellular spaces connected to the external environment. While some studies have described how these intercellular spaces develop, the molecular mechanisms underlying their formation remain poorly understood.

Our group previously showed that in *Marchantia polymorpha*, remodeling of the cell wall, which is essential for schizogenous air chamber formation, is regulated via the proteasome degradation pathway. This pathway coordinates the activities of downstream proteins associated with the cytoskeleton, as well as enzymes involved in both the degradation and synthesis of cell walls.

In this study, we focused on MpMOR1 and MpZWI, which were identified through interaction analyses as potential components of this regulatory pathway. We examined their roles in air chamber formation using mutant and reporter lines.

Detection of reproductive interference between closely related *Marchantia* species through artificial crossing experiments

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Although closely related species of bryophytes often grow sympatric, there is no detailed cell biological information on the mechanisms of reproductive isolation and interference between these species. *Marchantia polymorpha* subsp. *ruderalis* and *M. paleacea* subsp. *diptera* often grow sympatric in Japan, and when they grow intermingled, the sexual reproductive success of *M. paleacea* subsp. *diptera* appears to be reduced. In order to elucidate the basic mechanism of reproductive isolation and interference that exists between the species of bryophytes, we conducted artificial crossing experiments between the two species. It was clarified that the hybrid sporophytes were not formed between these species. However, the sperms are attracted to archegonia of another species and enter the interior of archegonia. The crossing experiments between *M. polymorpha* males and *M. paleacea* females even showed sperm penetration into the egg cell. However, this phenomenon did not occur in the crossing experiments between *M. paleacea* males and *M. polymorpha* females. These results suggest that asymmetric reproductive interference exists between the two species. The fact that *Marchantia polymorpha* subsp. *ruderalis* produces sperms almost throughout the year, unlike its closely related species, may play a role in hindering the reproductive success of closely related species.

Splashing into diversity: Morphometric variation, evolution and plasticity of a dispersal organ in *Marchantia*

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Marchantia polymorpha is well-known thalloid liverwort that has become a model plant. In the context of an interdisciplinary project investigating the factors driving the phenotypic plasticity of splash cups, – involving the fields of developmental biology, fluid mechanics, atmospheric physics, systematics and ecology, – we will present our initial findings on the morphometric variability of *Marchantia* splash-cups and gemma within the genus, their phenotypic plasticity in La Réunion Island and the hydrodynamics of dispersal and optimality of the splash-cup.

While the taxonomy of *Marchantia* is fairly well understood, little attention has been given to its vegetative characteristics. Around forty species are recognised worldwide, and our sampling recovered half of these. Our aim is to investigate the interspecific differences in the size and shape of the gemmae and splash-cups, in order to complement the intraspecific studies carried out in another part of the project. We have acquired a 2D landmark-based geometric morphometric measurements on gemmae and on splash-cups, and then we conducted a Procrustes analysis in order to eliminate the effects of scale, rotation and translation. We built a phylogenetic tree obtained by using five chloroplastic (trnLF, rbcL, psbA-trnH, rps4) and nuclear (ITS) markers. We will present our preliminary analysis of a phylomorphospace, the projection of a PCA of the shapes (gemmae and splash-cups) onto the tree.

We investigate the plasticity of the *Marchantia* splash-cup in La Réunion Island which presents a significant elevation gradient, and a broad diversity of microenvironments, especially in terms of rainfall. In May 2022 and 2023, 60 colonies from all over the island were identified and analyzed, with their environment traced (ecological context, canopy coverage rate, orientation). The first results show a significant correlation between diameter of splash-cups and the elevation of the colony, suggesting a specific adaptation of splash-cups

Finally, we focused on hydrodynamics of dispersal as a model of drop impacting on concave surface. We found two distinct hydrodynamic behaviors during impact on depending on the off-centering of the drop impacting the cone. Centered impact results in a circular corolla whereas an off-centered impact produces a simple lateral jet. Centered impact, a rare event, appears unfavorable for effective vegetative reproduction. The maximum horizontal reach observed in the off-centered case was close to one metre. A distance that would exceed the colony perimeter and would favor reproduction.

New additions to the bryophyte flora of Myanmar based on recent field surveys (2017–2025)

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Myanmar has long been considered a “floristic blank” among continental south east Asian countries, despite its biogeographically pivotal position at the crossroads of south Asia, east Asia, and Indochina. The country’s flora is influenced by neighboring regions: the Sino-Himalayan in the north, Yunnanese in the northeast, Assamese in the northwest, Thai-Indochinese in the southeast, and Malesian in the south. While this biogeographical setting suggests high floristic diversity, Myanmar’s bryophyte flora remains poorly documented. Since 2016, the National Museum of Nature and Science has conducted floristic inventories under an MoU with the Forest Research Institute, Myanmar. Between 2017 and 2025, seven field surveys were carried out, yielding approximately 2,000 bryophyte specimens from Chin, Kayin, Kayah, Shan, and Kachin States, as well as Yangon, Tanintharyi, and Mandalay Regions. Ongoing identification of these collections has revealed noteworthy bryophyte species new to the country, particularly in the families Calliergonaceae, Neckeraceae, Plagiotheciaceae, Pottiaceae, Pylaisiadelphaceae, and Notothyladaceae. This presentation reviews the historical progress of bryological research in Myanmar and highlights the newly recorded taxa, which contribute to updating the bryophyte flora of Myanmar and expanding our understanding of their distribution in Southeast Asia.

Epiphytic bryophytes as bioindicators of successional dynamics in selected tropical lowland rainforests, Sri Lanka

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The Kottawa (6° 5' 54.3"N and 80° 18' 31.1"E), Pituwala (6° 16' 5"N and 80° 12' 24"E) and Wilpita (6° 5' 6.1"N and 80° 31' 55.2"E) forest reserves in Sri Lanka are unique ecosystems that support high biodiversity. Bryophytes, including mosses, liverworts, and hornworts, are highly sensitive to microclimatic conditions. This study evaluated the role of bryophytes as bioindicators of successional changes within the selected forests. Three successional stages: early, intermediate, and late, were selected, with three plots (10 m x 10 m) established per stage. The presence and bark coverage of bryophytes were quantified using a transparent grid (20 cm x 20 cm) quadrat. Epiphytic bryophytes were collected and identified to generic/species levels using standard taxonomic keys. Results showed that early successional stages were dominated by *Plagiochila* sp., intermediate stages by *Taxithelium* sp. and the late successional stage by *Octoblepharum albidum* and *Calymperes* sp. Dominant species in the early stage were tolerant to extreme conditions, whereas in the late stage species thrived in stable and humid conditions. The presence and vitality of these bryophyte species serve as valuable indicators of ecological integrity in tropical rainforests.

Managing a bryophyte herbarium during the planetary emergency

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Natural History Museum, London, UK

There has never been a more urgent time to provide bryological resources to support biodiversity and conservation research. At the Natural History Museum, London (BM) we are reviewing our herbarium priorities through the lens of the planetary emergency, considering where our efforts can produce the most positive impact for bryophytes in the wild. The BM bryophyte herbarium represents over 250 years of biodiversity data from around the world and we will make these data accessible through large scale specimen digitisation. A newly completed herbarium inventory of taxonomic names and geographic regions enables, for the first time, a fuller understanding of the herbarium's scope. We have extended our focus to our unprocessed holdings that have not been prepared for the main herbarium. These collections are usually difficult to access, even though they often include a treasure trove of novel biodiversity data. We are currently curating unresearched material from Papua New Guinea, Sulawesi and Java collected by Alan Eddy in the 1960-70s, mainly comprising liverworts. We welcome collaborations that enhance the taxonomic data for these specimens and increase their utility for biodiversity research. Ultimately, we seek to connect our specimen data to conservation practitioners, through targeted herbarium work and global partnership.

Bryophyte biodiversity research and conservation initiatives at UBC: A focus on Haida Gwaii, Canada

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For more than 60 years, UBC bryologists have documented and studied the bryophytes of Haida Gwaii, a remote archipelago off the northern coast of British Columbia, which is home to the Haida Nation. Among Canadian provinces, bryophyte species richness is high in B.C., with approximately 75% of the known species represented. Of these, more than half of the mosses and three quarters of the liverworts have been recorded from Haida Gwaii. UBC's large and comprehensive collection of specimens from the archipelago underpins several current research and conservation initiatives including: (1) revisionary work on *Conocephalum* Hill, *Zygodon* Hook. & Taylor, "*Mastopoma*" Cardot., and *Aneura* Dumort.; (2) the assembly of a bryophyte DNA barcode library in partnership with the University of Guelph's Centre for Biodiversity Genomics; and (3) conservation ranking, listing, and recovery planning exercises. The UBC Herbarium recently partnered with the Haida Gwaii Museum to deposit representative specimens with the goal of increasing local access to a curated bryophyte collection. We are now exploring the possibility of engaging Haida partners in naming local species new-to-science. An exhibition of Des Callaghan's photographs in the Beaty Biodiversity Museum, including several photographed on Haida Gwaii in 2023, aims to increase bryophyte appreciation.

Unveiling biodiversity hotspots: A spatial analysis of moss (Bryophyta) richness in Sabah, Malaysia using herbarium records

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Herbaria are vital repositories of plant biodiversity, preserving specimens alongside essential taxonomic, geographic, and historical collection data. Sabah, Malaysia, is renowned for its exceptional moss diversity, reflected in extensive herbarium collections accumulated over decades. Despite this rich resource, large-scale spatial analyses of moss distribution in Sabah remain scarce, leaving significant gaps in our understanding of bryophyte biogeography in the region. To address this, we conducted the first comprehensive spatial analysis of moss species richness and endemism patterns in Sabah using herbarium records from the BORNEENSIS Herbarium (BORH), Universiti Malaysia Sabah. We compiled and analysed 5,987 georeferenced specimens, representing 514 taxa in 51 families. Geographic Information System (GIS) tools were employed to map spatial patterns of species richness. Our analysis revealed distinct areas of high moss species richness and identified key biodiversity hotspots across Sabah. These findings provide crucial insights for conservation planning and highlight areas with limited sampling that warrant future exploration. Furthermore, this study underscores the immense potential of integrating herbarium data with spatial analysis to enhance ecological and biogeographical research on bryophytes.

IUCN Red List assessment of bryophytes in the Bornean region: Are we on the right track?

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Borneo is globally renowned for its exceptional biodiversity, yet the conservation status of its bryophyte flora remains poorly documented. Amid escalating threats from habitat loss, land-use change, and climate variability, there is an urgent need to assess the region's bryophytes using standardised frameworks such as the IUCN Red List Categories and Criteria. This presentation reviews the current progress of bryophyte assessments in Borneo, emphasising data gaps, uneven taxonomic and geographic coverage, and the inherent challenges of applying IUCN criteria to cryptic, under-collected taxa. For the past decade, dedicated surveys and data compilation efforts have been undertaken to map the distribution of endemic bryophytes across the region, aiming to inform regional threat assessments. Despite advancements in species inventories and geospatial analysis, most of Bornean species remain unassessed. We examine key methodological approaches, share best practices, and propose a practical roadmap to accelerate assessment efforts, highlighting the importance of regional collaboration, targeted fieldwork, and the integration of herbarium records with geospatial tools. Are we on the right track? This presentation calls for renewed dialogue and collective action to elevate bryophyte conservation within the broader biodiversity and policy agenda in Southeast Asia.

The spatial phylogenetics of British bryophytes — a new perspective on biodiversity

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The Atlantic archipelago that includes Britain and Ireland is a global bryophyte diversity hotspot thanks to its internationally rare oceanic habitats, diverse topography and complex geology. Its bryophyte flora is possibly also the best known in the world, with a long-established tradition of field recording providing fine-scale distribution data that is geographically comprehensive and increasingly temporally informative.

Recent sequencing of multiple nuclear exons using the ‘GoFlag’ probes has produced a well-resolved phylogeny of British bryophyte species with 75% completeness. This, in conjunction with existing distribution data, enables a range of metrics from the developing field of spatial phylogenetics to be applied to the British flora to add an evolutionary dimension to biodiversity assessment, at the hectad scale.

Here we map Phylogenetic Diversity (PD) and Phylogenetic Endemism (PE) across Britain, as well as Relative Phylogenetic Diversity (RPD) and Relative Phylogenetic Endemism (RPE) — the latter two showing geographic concentrations of either long or short phylogenetic branches — using a spatial randomisation to assess statistical significance. We then employ PE and RPE to identify centres of neo- and paleo-endemism using CANAPE. The results provide an entirely novel view of spatial diversity for British bryophytes that can be used to help prioritise conservation resources.



Abstracts of poster presentations

Mosses of Long Pasia, a remote highland village located in the southwestern part of Sabah, Malaysian Borneo

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Long Pasia, a remote highland village situated in the south-western region of Sabah, Malaysian Borneo, is part of the ecologically significant Heart of Borneo landscape. This area, characterised by its montane and submontane forests, harbours a high diversity of plants, many of which remain poorly documented. This study presents the results of bryological surveys conducted in 2003 and 2012 by the senior author on Mount Muruk Mio and Rimau Hill in Long Pasia, with a focus on assessing species richness and composition of mosses. A total of 127 taxa in 66 genera and 30 families of mosses were collected, representing 16% of the mosses reported for Borneo. The families with the highest number of species were Leucobryaceae, Dicranaceae, and Sematophyllaceae. Among these species was a new record for Borneo and two for Sabah, including one Bornean endemic species. The findings underscore the importance of Long Pasia as a significant moss diversity hotspot, contributing valuable data to regional bryophyte inventories. The study highlights the need for continued exploration and conservation efforts in this under-surveyed region, particularly in the face of increasing environmental pressures from land-use change and climate variability.

Revision of *Sphagnum fimbriatum* complex in north Eurasia

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Sphagnum mosses represent an essential component of boreal, arctic and alpine wetland ecosystems; however, north Asia remains insufficiently sampled in recent studies dealing with *Sphagnum*. *Sphagnum fimbriatum* complex (sect. *Acutifolia*) includes five species, with *S. fimbriatum* and *S. girgensohnii*, considered to be widespread in north Eurasia, while *S. rubiginosum* has disjunct areal. Another two, *S. concinnum* and *S. tescorum*, occur mostly in Arctic and until now have been known in Eurasia only from few localities. We revised the complex across Russia using the integrative taxonomic approach combining molecular phylogenetics, traditional and geometric morphometrics and species distribution modeling to clarify status and affinities of these five species and their ambiguous morphotypes. We found that the complex includes two previously unsampled north Asian species closely related to *S. fimbriatum* s.str. and *S. concinnum* s.str., that differ phylogenetically, morphologically and ecologically. One of these new species is a probable paternal ancestor of *S. arcticum* and *S. olafii* that was predicted decades ago. *Sphagnum tescorum* appeared highly variable morphologically and widespread across north Asia, from the north Taimyr to northern Mongolia. Moreover, being suggested as allopolyploid species, *S. tescorum* shares plastid markers trnG and trnL-F with *S. rubiginosum* that might be considered as possible maternal ancestor for the former.

Diversity and distribution of Sematophylloideae (Sematophyllaceae s.l., Hypnales) of Taiwan

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This study investigates the species diversity and ecological distribution of Sematophylloideae (Sematophyllaceae s.l., Hypnales) of Taiwan, based on the examination of over 300 specimens from field collections and herbarium (TAIE). A total of 26 species and three varieties are recognized, including four species and one variety newly recorded in the region. Substrate preferences and elevational ranges were compiled to elucidate the ecological niches occupied by each taxon. The results offer an updated foundation for bryofloristics in Taiwan and provide essential data to support biodiversity monitoring, conservation planning, and future taxonomic and molecular studies.

Changes in bryophyte community composition and functional traits along a fog frequency gradient in montane cloud forest of Taiwan

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Montane cloud forest (MCF) is characterized by frequent fog occurrence, which leads to high relative humidity and low light availability, temperature, and evaporation. Bryophyte communities are abundant and diverse in MCF and are sensitive to environmental changes. Here we ask: Do the bryophyte species composition and functional traits change across microhabitats along fog frequency in northern Taiwan?

The horizontal transect was established from low to high fog frequency, and includes nine 20 x 20 m plots at elevations 1850–2150 m a.s.l. In each plot, three microhabitats (tree trunk, decayed wood and bare soil) were surveyed for bryophyte species composition using microplots 10 x 15 cm. Traits measured for each species include specific shoot length (SSL), water-holding capacity (WHC), tissue pH, and life-form. Environmental data, including microclimate (HOBO, TMS-4, iButtons), topography (aspect and slope), and substrate pH were recorded for microplots sampled in each microhabitat.

We hypothesize that fog frequency shapes the microenvironment condition within the microhabitat and influences the bryophyte species composition by filtering the bryophyte traits. The study evaluates the process of environmental filtering and the relationship between the environment and traits in bryophytes, and contributes to understanding bryophytes' functional trait ecology in the cloud forest.

Species composition and distribution of bryophytes among different tree fern species in Mt. Talomo, Davao City, the Philippines

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Bryophytes are known to be an important component of ecosystem biodiversity, and yet little is known about the composition of the species that grow on tree ferns. Hence, this study was carried out to determine the species of bryophytes colonizing different tree fern species in Mt. Talomo, Barangay Sibulan, Davao City through a purposive sampling technique. Results revealed 72 bryophyte species comprising 48 moss species from 31 genera and 22 families, while 24 species of liverworts belonging to nine genera and nine families were identified. Among the families, Neckeraceae had the highest number of species, with seven species, followed by Dicranaceae and Hypnodendraceae with four species each, respectively. Furthermore, 235 samples were obtained from six tree fern families belonging to three genera, and two families. Of these, three are endangered and two vulnerable species namely, *Alsophila atropurpurea*, *Sphaeropteris lepifera*, *Dicksonia mollis* and *S. elmeri*. Among the host tree fern species, *A. atropurpurea* had the highest number of bryophyte species, with 36 species colonizing. Moreover, among the bryophyte species, *Spiridens reinwardtii* was the most abundant with a wide array of host tree fern species with 28 samples (12%) followed by *Pyrrhobryum spiniforme* with 13 (5.5%), and *Schistochila* sp. 1 (5.1%). Different tree fern species provide a refuge for bryophytes to colonize. Conservation and protection of ecologically important species should be prioritized to conserve the remaining population of threatened species. Further study is recommended specifically on the growth form of bryophytes on tree ferns.

Spore characteristics of *Riccia* L. (Ricciaceae: Marchantiophyta) in the Western Ghats – light microscopic and scanning electron microscopic studies

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Riccia L., the most diverse thalloid liverwort genus of the family Ricciaceae has exceptional ability to withstand and adapt to extreme environmental changes throughout the seasons. Earliest documented record of *Riccia* in India appears in the posthumously published memoirs of Griffith. The Western Ghats are regarded as a bryological hotspot in India, owing to their distinctive topography, abundant rainfall and high humidity, all of which offer optimal conditions for bryophyte growth. This region harbours hundreds of bryophyte species, including many that are both endemic and rare. India is home to 50 reported species of *Riccia*, with 31 of them occurring in the Western Ghats. Previously, the classification of the genus relied primarily on vegetative traits, which have been shown to have high variability and questionable within species. Spore characteristics exhibit minimal variation, making them the most reliable traits for taxonomic studies. Use of light microscopy and scanning electron microscopy provide detailed insights into surface ornamentation and fine structural features critical for accurate species identification.

Designing a systematics workflow for big bryophyte genera: A pilot study on *Plagiochila* sect. *Plagiochila*

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With over 600 accepted species (8% of all described liverworts), *Plagiochila* rivals even the classic “big genera” of angiosperms in taxonomic complexity. Its scale means that conventional workflows struggle to keep pace with biodiversity discovery and assessment, so new, faster approaches are urgently needed. This doctoral project will focus on *Plagiochila* section *Plagiochila* (~30 species) as a manageable pilot group with the ultimate aim of producing a foundational monograph and establishing a methodological framework that can be scaled up to the rest of the genus and other large bryophyte lineages.

The study is grounded on three methodological cornerstones: (1) using a 'molecular-first' strategy to build the molecular phylogeny of the section via Hyb-Seq; (2) conducting an enhanced morphological analysis that combines traditional scoring, geometric morphometrics methods (GMM), and explainable artificial intelligence (XAI) to seek overlooked traits; (3) Compare species-level biochemical profiles to evaluate the usefulness of chemosystematics within the section, while simultaneously screening for metabolites with potential biomedical applications.

By applying the same toolkit, researchers across continents can share a roadmap for *Plagiochila* systematics, accelerating species discovery and turning scattered efforts into a cumulative, global synthesis.

Preliminary checklist of bryophytes in Mt. Maagnaw, Kitanglad Range, Bukidnon, southern Philippines

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This study presented a preliminary checklist of bryophytes in Mt. Maagnaw, Kitanglad Range, Bukidnon, southern Philippines. Specimens were collected through transect walks across different elevations and microhabitats to assess species diversity. The inventory revealed a total of 73 bryophyte species, comprising 50 mosses and 23 liverworts. Among the mosses, the families with the highest species richness were Meteoriaceae, Pterobryaceae, and Bartramiaceae. For liverworts, the most diverse family was Schistochilaceae. Most species were observed on tree trunks, soil, rocks, and decaying logs, indicating their preference for moist and shaded environments. Additionally, the presence of various moss and liverwort species suggests that the area provides suitable conditions for their growth and reproduction. These findings contribute to the growing knowledge of bryophyte diversity in Mindanao and provide baseline data for future conservation efforts in the Mt. Maagnaw, Kitanglad Range. The results of this study emphasize the need for conservation measures to protect the unique and rich bryophyte flora of Mt. Maagnaw.

Bryophytes along Sawaga River: Indicators and monitoring agents of pollution

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This study evaluates the potential of bryophytes as bioindicators for monitoring pollution along the Sawaga River in Bukidnon, Philippines. Sampling was conducted at three stations representing varying pollution levels: low (Station 1), moderate (Station 2), and high (Station 3). Bryophyte diversity and physiological responses were analyzed to assess environmental health. Results revealed a clear gradient in species composition and physiological stress corresponding to pollution levels. Station 1, characterized by low pollution, exhibited the highest diversity, with 15 species, including 13 pollution-sensitive taxa such as *Fissidens oblongifolius* Hook.f. & Wilson and *Bryum apiculatum* Schwägr. Moderate pollution at Station 2 reduced diversity to eight species, showing a balanced presence of both sensitive and pollution-tolerant species. At Station 3, the most polluted site, only five species were recorded, predominantly pollution-tolerant taxa such as *Hyophila involuta* (Hook.) A.Jaeger and *Vesicularia montagnei* (Bél.) Broth. Physiological stress indicators — including chlorophyll degradation, tissue damage, and wax deposition — increased with pollution intensity. Sensitive species thrived in relatively pristine conditions, while tolerant species dominated degraded habitats, supporting their reliability as ecological indicators. This study establishes a baseline for bryophyte-based pollution monitoring and underscores their value in assessing water quality and informing conservation strategies. It offers a cost-effective and ecologically sound approach to safeguarding biodiversity and managing riverine ecosystems amid growing anthropogenic.

Notes on the distribution and persistence of the endangered, Luzon-endemic liverwort *Drepanolejeunea bakeri* Herzog (Lejeuneaceae)

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Drepanolejeunea bakeri is an epiphyllous, Luzon-endemic liverwort reported to occur in moist rainforests of Mt. Polis, Mt. Makiling, and Mt. Bulusan in the Philippines. The IUCN SSC Bryophyte Specialist Group (2000) and the national list of threatened plants (2008; 2017) assessed this species as Endangered (B1+2cd). Vulnerable to changes in microclimatic conditions, the species has presumably declined due to drastic changes in habitat quality in the past 20 years –especially with the deforestation of Mt. Polis and numerous eruptions of Mt. Bulusan. Likewise, it was last reported in Mt. Makiling in 1976. Given these, the study aimed to provide updated information on the distribution and persistence of *Drepanolejeunea bakeri* through herbarium-based studies and field surveys conducted in 2022–2024. In Mt. Makiling, the species was recorded to occur in montane rainforests at 900–1090 m asl and colonise hosts such as ferns, aroids, pandans, and melastomes. Contrastingly, land conversion in Mt. Bulusan resulted in the extirpation of one of the two known populations of the species in the area. With these, additional field surveys in other parts of the species' known and potential range are recommended in order to come up with data necessary in updating its assessment information and in drafting action plans for its conservation.

On the bryophyte flora of Mount Pulag Protected Landscape in Luzon's Cordillera Central, the Philippines

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The bryophytes of Mount Pulag Protected Landscape (MPPL) — encompassing several of the highest peaks of Luzon Island, the Philippines — is here accounted as part of a broader bryofloristic study of the Cordillera Central. Pertinent literature from 1986–2025 was reviewed; and previous materials by earlier collectors deposited at CAHUP, as well as recent collections by the authors, were studied. A total of 285 taxa in 152 genera and 76 families are reported — of which, 170 taxa are mosses, 114 species are liverworts, and one species is a hornwort. The most species-rich families are Lejeuneaceae (22 spp.), Meteoriaceae (17 spp.), and Frullaniaceae (16 spp.). Considering recent trends in land use and land cover change, the occurrence of the Luzon-endemic *Merrilllobryum fabronioides* Broth. — albeit undetected in recent fieldworks — as well as several other species whose Philippine distribution is rather limited or is restricted to the Cordillera Central, highlight the significance of the MPPL as a Center of Plant Diversity, Key Biodiversity Area, and Biodiversity Conservation Priority Area in the Philippines. On-going efforts in processing backlog collections at CAHUP, as well as conducting fieldworks in underexplored areas, are expected to uncover new records and provide more information on the bryophytes of the MPPL.

Diversity and evolution of moss-feeding mites (Trombidiformes: Stigmaeidae: *Eustigmaeus*)

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Although bryophytes have been considered rarely consumed by arthropods, some arthropods feed on them. Some mite species in the genus *Eustigmaeus* (Trombidiformes: Stigmaeidae) only feed on mosses and complete their entire life cycle on mosses. However, the interactions between mites and mosses have remained poorly understood. To reveal the species diversity and host-plant use of the moss-feeding species, we conducted an extensive field study in Japan. As a result, we found ten moss-feeding species and recorded 26 host plant species. All host-plants belong to the class Bryopsida, comprising 18 genera from 11 families and five orders. We also clarified the host-plant breadth in four mite species: one represented polyphagy, while three species demonstrated varying degrees of host specificity. The feeding behavior of mites that causes the loss of cell contents may potentially drive the evolution of anti-herbivory traits (e.g., leaf surface structure, chemical composition) in moss gametophytes. Such interactions are likely to be globally widespread, considering that this genus comprises over 140 described species distributed across all ecozones except Antarctica. Advancing our understanding of the history of bryophyte-arthropod interactions will require interdisciplinary collaboration, and we hope this presentation fosters discussion on future directions for tackling this overlooked system.

Taxonomy of genus *Cladoradula* (Radulaceae, Marchantiophyta) in Taiwan

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The species of the genus *Cladoradula* in Taiwan are large, pendulous epiphytic liverworts. In this study, we examined specimens collected both by previous researchers and through our own fieldwork. The four taxa occurring in Taiwan can be distinguished based on several morphological characteristics: plant size, the shape of the lobes and lobules, the extent of leaf coverage, the length ratio between the lobe and lobule, and the degree to which the lobule covers the stem. All specimens were collected from persistently wet and muddy environments, suggesting that the relatively large body size of *Cladoradula* species increases their exposure to air and makes it more difficult for them to maintain stable microenvironmental conditions. As a result, they require a greater atmospheric moisture supply. Due to this ecological trait, the presence of *Cladoradula* species may also serve as an indicator of habitat stability.

Challenges and strategies in popularizing bryophyte science: Bridging scientific research and public awareness

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Bryophytes, although crucial in ecosystems, are often overlooked in public science communication, presenting unique challenges in popularisation efforts. Using the experience of creating and promoting the popular science book "Taiwan Bryophytes Under the Microscope", this study explores methods of translating complex and niche bryophyte research into content easily comprehensible by the general public. An analysis of the knowledge gap between researchers and the public reveals significant differences: scientists typically focus on issues such as taxonomy, microhabitat functions, and physiological mechanisms, whereas the public is more interested in bryophyte aesthetics, engaging narratives, and everyday relevance.

The study suggests that effective popularization strategies must balance scientific accuracy with engaging content. Visualization, storytelling, and connections to daily life are critical for bridging the gap between scientific communities and the public. Additionally, this research addresses methods for effectively integrating bryophyte conservation topics into public discourse, thereby enhancing public interest and actions toward bryophyte ecosystem conservation.

Overall, successful science communication about bryophytes requires balancing scientific rigor with appeal, as well as understanding public perception and needs, to foster broader acceptance and action toward biodiversity conservation.

Assessing taxonomic uncertainty in bryophytes from the Bunger Hills, Antarctica

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The study of Antarctic bryophytes has occurred across the continent since the early days of Antarctic exploration. Despite this, we know remarkably little about their diversity and distributions, especially in the poorly surveyed East Antarctica. Taxonomic uncertainty is a defining character for East Antarctic bryophytes, and there is scarce molecular data, high rates of phenotypic plasticity, possible cryptic speciation, and a lack of trained bryologists. Spatial uncertainty exists also, with collections biased towards the Antarctic Peninsula and research stations. While there are several published Antarctic Floras exist, they predate the expansion and application of modern genetic approaches. Conservation under the Antarctic Treaty System relies on species-level data. Current taxonomic and spatial uncertainties risk undermining effective biodiversity assessments and conservation planning in the Antarctic region.

This project will use specimens collected from the Bunger Hills in East Antarctica (2023, 2024) to: (1) resolve taxonomic uncertainties using morphological and molecular tools, (2) quantify fine-scale distributions, and (3) explore conservation planning scenarios. From this research, a spatially explicit and high-resolution taxonomic bryophyte dataset for the Bunger Hills will be produced, as well as a reference guide, keys, and authoritative profiles to advance resources for the bryophyte and Antarctic research communities.

A taxonomic revision of the genus *Anthoceros* L. (Anthocerotophyta Stotler & Crand.-Stotl.) in Japan

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The last revision of the genus *Anthoceros* in Japan based on morphology recognized five species: *A. agrestis* Paton, *A. angustus* Steph., *A. fusiformis* Austin, *A. macounii* M.Howe, and *A. subtilis* Steph. Over thirty years have passed, and further research based on molecular phylogenetic analysis and morphological reassessments is now required. We collected new specimens around Japan and performed phylogenetic analyses using plastid (*rbcL*, *trnK-matK*, *rps4*) and nuclear (ITS, *rbcS*, phytochrome) loci. The Japanese plants, previously treated as *A. fusiformis*, form two clades distinct from the North American *A. fusiformis*. The spore ornamentation of Japanese “*A. fusiformis*” was also different from that of North American plants. We propose to exclude *A. fusiformis* from the flora of Japan and to divide the plants having been misidentified into two taxa. One is a subspecies as comb. & stat. nov. in *A. caucasicus* Steph. including the type of *A. fusiformis* var. *taiwanensis* J.Haseg. Proximal faces of the spores of the subspecies have sharp-pointed cristate protuberances. The other taxon is a new species belonging to the subgenus *Indici*. Its spore was densely covered with conical, obtuse papillae. The presentation will also point out taxonomic issues surrounding *A. agrestis* and *A. subtilis* in Japan.

The diversity of mosses in An Toan Nature Reserve, Vietnam

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An Toan Nature Reserve is at the transition between the Central Highlands and South Central Coast of Vietnam, with elevations ranging from 230 m to 1,180 m. Unlike vascular plants, mosses in this reserve have been largely overlooked, and no prior research has been conducted. This study provides the first survey of moss diversity and compiles the first checklist for the area. All species recorded are new for An Toan, with some are the first reports for Vietnam. The moss floristic composition of the reserve shows close affinities with those of neighboring highland protected areas such as Kon Ka Kinh and Bidoup - Nui Ba National Parks.

A new fossil species of *Plagiochila* (Plagiochilaceae) from the Miocene Formation of Iki Island, Japan

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A new species of the genus *Plagiochila* is described based on a re-examination of fossils from the Monobe Formation (Late Miocene, 8.5 Ma) of the Iki Island, Nagasaki Prefecture, Japan. Dr. Hiroshi Inoue, an eminent taxonomist of the leafy liverwort family of Plagiochilaceae, introduced the fossil species *Plagiochila* for the first time in 1972 from the Monobe Formation with a brief description in Japanese but he abstained from identifying it at the species level or treating it as a species independent from previously known extant or fossil species. The author examined twenty-three specimens of the bryophyte fossils found in Iki Island and concluded that the species should be treated as a new species of *Plagiochila*, being the first fossil species of the genus *Plagiochila* and family Plagiochilaceae from southeast Asia. Although the lack of reproductive characters prevents a more detailed comparison of the new species with extant species, further careful examination of bryophyte fossils on Iki Island may reveal female plants with reproductive structures and provide valuable information on the evolution of the genus *Plagiochila* in Southeast Asia. The content of this research has been published in Hattoria (vol. 16, 2025).

Environment-diversity relationships of bryophyte communities in northeastern Taiwan forest

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This study investigates the relationships between bryophyte communities and environmental factors in Taiwan, focusing on species turnover and richness. Bryophyte surveys were conducted alongside vascular plant sampling in 20 × 20 m plots. Canonical correspondence analysis (CCA) and detrended correspondence analysis (DCA) revealed that liverworts and mosses respond differently to environmental gradients. Notably, the relative importance of environmental factors differed: fog frequency was a stronger predictor of liverwort turnover, whereas canopy openness played a more dominant role for mosses.

In terms of species richness, moss richness increased with canopy openness, while liverwort richness was positively associated with fog frequency. In contrast, vascular plant richness showed no significant relationship with the measured environmental variables.

These findings suggest that bryophyte species richness may respond more sensitively to environmental changes than vascular plants, likely due to their smaller size, limited dispersal, and dependence on microclimatic conditions. The distinct environmental preferences between liverworts and mosses further highlight the need to treat them as separate ecological indicators.

From bryophyte to microbe: How mosses shape microbial communities in deadwood

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Bryophytes influence the diversity of microbial communities inhabiting decomposing woods by modifying the surrounding microenvironment, thereby modulating wood decay dynamics. However, the interplay between bryophyte-induced environmental changes and microbial responses remains poorly understood. In this study, we investigated how bryophytes modify fungal and bacterial communities by altering the physicochemical properties of wood in *Fagus* forests in Japan. Community analyses revealed clear differences in microbial composition between bryophyte-covered and uncovered wood. The presence of bryophytes was associated with higher moisture content, increased concentrations of specific elements, and lower pH levels in decaying wood. These environmental shifts corresponded with increased relative abundances of specific microbial taxa, suggesting that bryophytes generate conditions favorable to specific microbial groups. Moreover, increased elemental concentrations may influence bacterial enzymatic activity, potentially leading to shifts in the biochemical pathways involved in wood decomposition. Our findings indicate that bryophytes not only modify the abiotic properties of decaying wood but also shape the composition and structure of associated microbial communities. These changes may ultimately impact the rate and nature of decomposition, thereby influencing forest ecosystem system functions.

Genus *Aneura* (Marchantiophyta) in Slovenia and new potential lineages for Europe

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The liverwort genus *Aneura* (Aneuraceae) has been the focus of many studies aimed at revealing the hidden cryptic diversity within the *A. pinguis* complex. The aim of our work was to use molecular methods to identify cryptic taxa and compile an up-to-date reference list of Slovenian bryophyte species with notes on their ecology. Using a standardised methodology outlined in several related studies, three plastid genetic regions (*matK*, *trnH-psbA*, *trnL-trnF*) and the complete nuclear ITS sequence dataset were analysed for 55 *Aneura* samples from different geographic regions. Phylogenetic position of the specimens studied was investigated using distance and maximum likelihood methods. The genus *Aneura* is genetically separated into roughly 20 clades corresponding to proposed cryptic species, nine of which were confirmed for Slovenia. These were the clades A, B, C, E, G, M (previously regarded as *A. maxima* in Europe) and *A. pinguis* s. str. Additionally, two new lineages for Europe were discovered and discussed. Some accessions grouped closely with a North American taxon *A. sharpii* and a southeast Asian clade, which was first discovered in Thailand, but does not have a formal name. Several previously recorded European distinct phyletic lineages were detected in clades A, B, C and E. The monophyletic status of taxon B is unclear, as sequences from *A. pellioides* and accessions from Thailand grouped within the confines of clade B. Furthermore, 20 morphological traits were selected for detailed study. The results indicate that the species differ somewhat in thallus width, thallus thickness, number of cells in the central part of the thallus, length of dorsal epidermal cells, the presence of a translucent margin and some other traits in the case of specific taxa. There were, however, many overlapping features among the clades examined. Ecological preferences in terms of suitable habitat characteristics are provided for each clade.

THE BRYOLOGICAL TIMES



The International Association of Bryologists was established in 1969 to promote international cooperation and communication among all persons interested in the biology of bryophytes. This is achieved through sponsorship and arrangement of meetings and symposia that relate to the various aspects of bryology, and by IAB-sponsored publications including *The Bryological Times* and *Bryophyte Diversity and Evolution*. The Association also supports the publication of reviews, lists, software, and compendia.

Website: bryology.org

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Images: *Phaeoceros carolinianus* (cover), *Diphyscium* sp. (page 5), *Marchantia paleacea* (page 38).
All photos taken by Ms Yu-Feng Yang, President of the Bryological Society of Taiwan.