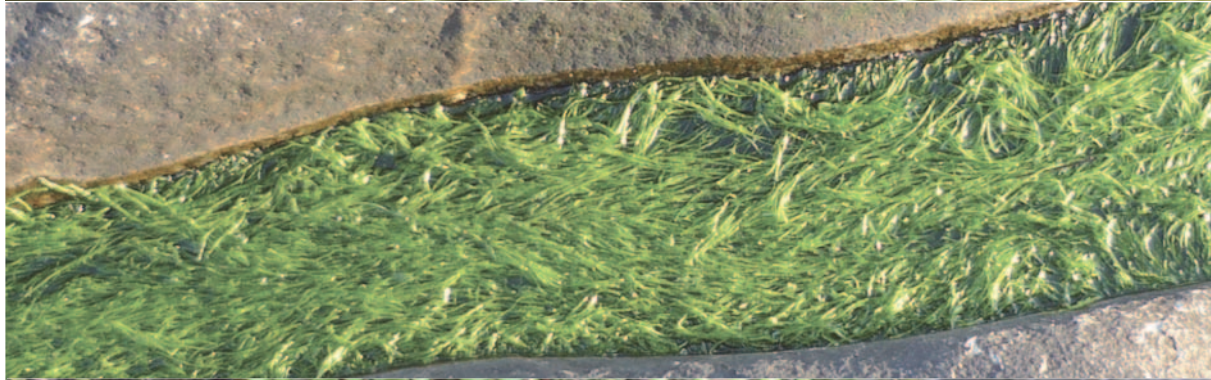


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XX SIMPÓSIO DE BOTÂNICA CRIPTOGÂMICA

PORTO, 22 A 25 DE JULHO DE 2015



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**XX SIMPÓSIO
DE BOTÂNICA CRIPTOGÂMICA**
PORTO, 22 A 25 DE JULHO DE 2015



22/07/2015

Wednesday- Quarta - Miercoles

3

08h30 **Registration** | Hotel Tuela Porto, Top floor

ROOM SUL

09h30 Inaugural session

10h00 Plenary session | **Biodiversity and Conservation**: Anne Magurran (UStA) "*Biological diversity in a changing world*"

11h00 **Coffee-break** | **ROOM DOURADA**

11h30 Invited thematic conference | **Biodiversity and Conservation**: Sílvia Carvalho (CIBIO-InBIO) "*Incorporating evolutionary processes into systematic conservation planning*"

12h00 BC1.01 | Blowing in the wind... Phenotypic variability or speciation event in the lichen genus

12h15 BC1.02 | Bryophyte beta diversity along an elevational gradient in Terceira Island, Azores

12h30 BC1.03 | Checklist de los briófitos de la Comunidad Autónoma del País Vasco (España): actualización y bases para una lista roja

12h45 BC1.04 | El género *Prorocentrum* (Dinophyceae, Prorocentrales) en aguas neríticas y costeras de Canarias: nuevas aportaciones

13h00 BC1.05 | Aspectos bioquímicos de la tolerancia a la deshidratación en *Pleurozium schreberi* durante la época seca en el páramo de Chingaza (Colombia)

13h15 BC1.06 | Macrofungal communities of two native oak woods (*Quercus faginea* subsp. *broteroi* and *Q. rotundifolia*) in Central Portugal, with a study of sampling methods

13h30 **Lunch** | Restaurant Hotel Tuela

ROOM SUL

15h00 BC2.01 | Diversidad y ecología de cianobacterias bentónicas en los ríos de Castilla-La Mancha

15h15 BC2.02 | Epiphytic lichen diversity in broadleaved forests in Cadí-Moixeró Natural Park: assessing habitat status.

15h30 BC2.03 | Filling knowledge gaps on the diversity of Iberian epiphytic bryophytes

15h45 BC2.04 | Keeping up with the Bryophytes: richness, diversity and threatened taxa patterns and conservation in headwater streams

16h00 BC2.05 | LEGE Culture Collection and its cyanobacterial diversity: strains data survey analysis highlights the increasing importance of this biological resource

16h15 BC2.06 | Limitaciones al establecimiento del líquen *Pectenium plumbea* a escala de paisaje inferidas a partir de modelización del hábitat y análisis de ocupación del hábitat potencial

16h30 BC2.07 | Líquenes en los cocones del karst del Parc del Garraf (Catalunya)

16h45 BC2.08 | Los líquenes epífitos del monte verde canario y su supervivencia en plantaciones

17h00 **Coffee-break** | **ROOM DOURADA**

ROOM DOURADA

17h30 Communications in poster | **Biodiversity and Conservation** (Session BC)

19h30 **Porto wine tasting** | Porto Botanical Garden



23/07/2015 Thursday - Quinta -Jueves	
ROOM SUL	
09h00	Plenary session Technology and Heritage: Patrícia Sanmartín (USC) " <i>Biology for cultural heritage preservation</i> "
10h00	Invited thematic conference Technology and heritage: Rui Pereira (Alga ¹) " <i>Portuguese Seaweeds - heritage and potential value</i> "
ROOM SUL ROOM NORTE	
10h30	TH1.O1 SEACOLORS: Natural pigments from selected microalgae with potential application in the textile industry
10h45	TH1.O2 Lichen-induced geochemical weathering of schist surfaces in Cõa Valley Archaeological Park (NE Portugal)
11h00	BC3.O1 Diversidad y ecología de los briófitos acuáticos y semiacuáticos de los ríos de Castilla-La Mancha
11h00	BC3.O2 Meloneis (Rhaphoneidaceae, Fragilariophyceae), nuevas y raras diatomeas asociadas a praderas de Cymodocea nodosa (Ucria) Ascherson
Coffee-break ROOM DOURADA	
ROOM SUL	
11h30	Invited thematic conference Bioindication and Environmental Management: João Honrado (CIBIO-InBIO) " <i>Indicators of what, for what, and for whom? Biodiversity, ecosystems and the governance of socio-ecological systems</i> "
12h00	BEM1.O1 Airborne fungal spores in Badajoz (SW Spain) and weather influence in their seasonal distributor
12h15	BEM1.O2 Airborne fungal spores in Payerne (Switzerland)
12h30	BEM1.O3 Airborne spores of Alternaria in three cities of Extremadura (SW Spain) and different factors influence in their seasonal distribution
12h45	BEM1.O4 An ecophysiological study across the Drake Passage on the saxicole tundra forming lichens of Usnea genus
13h00	BEM1.O5 Assessing the impact of alkaline dust pollution on the genetic variation of lichen Usnea subfloridana (lichenized Ascomycota, Parmeliaceae)
13h15	BEM1.O6 Briófitos asociados a minas de cobre en la Sierra Norte de la Comunidad de Madrid
13h30	TH2.O1 Lichen biota on stone monuments in the Iberian Peninsula
13h30	TH2.O2 Evaluación de tres abonos comerciales como fuentes de nitrógeno en la acumulación de ficobiliproteína y biomasa en Arthrospira maxima (Phormidiaceae).
13h30	BC4.O1 Una oportunidad para una Lista de Algas Bentónicas Marinas de España
13h30	BC4.O2 Viabilidad de la introducción de algas caráceas para naturalizar estanques en la ciudad de Barcelona
13h30	BC4.O3 Where the wild things are: is the higher taxa approach an effective method for selecting important areas for bryophyte conservation?
Lunch Restaurant Hotel Tuela	
ROOM SUL ROOM NORTE	
15h00	BC5.O1 Modelação da influência de alterações climáticas sobre micro-habitats e padrões de atividade de molusco terrestre (Geomalacus maculosus): contributos para a conservação de micro-comunidades biológicas dominadas por criptogâmicas
15h15	BC5.O2 Notas sobre la herbivoría en esporófitos de Buxbaumia viridis en el Pirineo
15h30	BC5.O3 Nueva aproximación para la descripción de las comunidades líquénicas y el comportamiento específico
15h45	BC5.O4 Phymatolithon calcareum in maerl beds from Atlantic Europe: insights from a species-specific microsatellite study reveal considerable clonality
16h00	BC5.O5 Produção de túberas (Terfezia spp.)– Novas espécies para Portugal
16h15	BC5.O6 Project MOVECLIM: Studying bryophyte macroecological patterns along elevation transects across archipelagos
16h30	BC5.O7 Saxicolous lichen diversity in a complex landscape in NE Iberian Peninsula
16h45	BC5.O8 The new World Checklist of Hornworts and Liverworts
17h00	SEB1.O1 Estudio monográfico de las especies epífitas y hemiepífitas de Blechnum (Blechnaceae, Polypodiopsida)
17h00	SEB1.O2 Coexistence and prevalence of symbiotic microalgae in Buellia zoharyi lichen: are substrata and/or biogeographic barriers involved?
17h00	SEB1.O3 Phylogenetic analysis of symbiotic Trebouxia microalgae within the genus Parmelia reveal new monophyletic lineages.
17h00	SEB1.O4 Molecular data indicate too extensive lumping in the moss genus Amphidium (Bryophyta)
17h00	SEB1.O5 Homalothecium meridionale (M. Fleissch. & Warnst.) Hedenäs a segregated species from H. sericeum (Hedw.) Schimp. (Brachytheciaceae, Bryopsida) in the Iberian Peninsula
17h00	SEB1.O6 Potential distribution and identity of introduced Amanita muscaria worldwide
17h00	SEB1.O7 Variación de rasgos morfológicos foliares en aspleniáceas ibéricas saxícolas en función de variables climatológicas
Coffee-break ROOM DOURADA	
ROOM DOURADA	
17h30	Communications in poster Bioindication and Environmental Management; Systematics, Evolution and Biogeography & Technology and Heritage (Sessions BEM, SEB & TH)
ROOM GT 332 (FLOOR 3)	
19h30	Extraordinary session " <i>O Museu de História Natural e da Ciência da Universidade do Porto</i> "
20h30	Extraordinary session Rui Figueira (IICT): " <i>Promote biodiversity data publishing and usage: the role of data papers</i> "



24/07/2015

Friday - Sexta - Viernes

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ROOM SUL	
09h00	Plenary session Systematics, Evolution and Biogeography : Christopher Ellis (RBGE) " <i>The cryptogamic epiphyte response to climate change: scaling from biogeography to habitat management</i> "
10h00	Invited thematic conference Systematics, Evolution and Biogeography : Mariana Ricca (UZ) " <i>Gene expression variation in Physcomitrella patens sporophytes</i> "
	ROOM SUL ROOM NORTE
10h30	SEB2.01 A preliminary evaluation of lineage differentiation in European Aneura
	BEM2.01 The herbivoral interaction between midge species, <i>Scatopsciara cunicularius</i> (Sciaridae: Diptera) and the thallose bryophyte, <i>Marchantia polymorpha</i>
10h45	SEB2.02 Advances into the evolutionary history and biogeography of Parmeliaceae (Ascomycota)
	BEM2.02 Distribución altitudinal de los líquenes terrícolas en los prados alpinos de Andorra
11h00	Coffee-break ROOM DOURADA
11h30	SEB3.01 A taxonomic study on cleistocarpous species of <i>Weissia</i> (Pottiaceae, Bryophyta) in Japan
	BEM3.01 The photoreceptor of ultraviolet-B radiation (UVR8) in <i>Marchantia polymorpha</i> .
11h45	SEB3.02 An ecogeographical approach to the genetic structure of <i>Parmelina carporrhizans</i> using specific microsatellites (SSR) markers
	BEM3.02 Brioflora terrícola en olivares no labrados de la provincia de Jaén (Andalucía, España)
12h00	SEB3.03 Assessing the taxonomical significance of bistratose leaf in <i>Orthotrichum anomalum</i> -like populations from western Iberian Peninsula
	BEM3.03 Detección y control de cianobacterias en fuentes ornamentales urbanas de la ciudad de Barcelona
12h15	SEB3.04 Evaluación del crecimiento vegetativo y del éxito reproductivo en <i>Grimmia decipiens</i> en un gradiente ambiental
	BEM3.04 Efectos de las microcistinas y los extractos de cianófitos en la fotosíntesis de algas fluviales. Implicaciones ecológicas y de gestión.
12h30	SEB3.05 Dancing with the distinction of <i>Orthotrichum</i> affine and <i>O. fastigiatum</i> , a morpho-molecular approach.
	BEM3.05 How to protect bryophytes from being drowned or lost? A framework for the efficient monitoring of priority bryophyte diversity
12h45	
	BEM3.06 Long-term effects of dangerous substances on diatoms (Bacillariophyta) and their communities as measured in the Ebro River Basin (NE Spain)
13h00	SEB3.07 El nuevo orden Collemopsidiales (Dothideomyceta) alberga una gran diversidad de especies marinas del género <i>Collemopsis</i>
	BEM3.07 Pulp mill industry emissions biomonitoring, and impacts on the photosynthetic performance of lichen transplants
13h15	SEB3.08 Estructura genética poblacional y flujo génico de <i>Mastodia tessellata</i> (Ascomycota, Fungi) en el eje bipolar Alaska-Antártida
	BEM3.08 Respuesta de líquenes y musgos como bioindicadores de altas concentraciones de CO2
13h30	Lunch Restaurant Hotel Tuela
	ROOM SUL
15h00	Extraordinary session Patrícia Tiago (Biodiversity4All): " <i>BioDiversity4All - a Portuguese citizen science project</i> "
15h30	General Assembly and Closing Ceremony
17h00	Coffee-break ROOM DOURADA
	ROOMS SUL & NORTE
17h30	<i>Meetings of Societies</i>



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Biological diversity in a changing world

7

Anne E. Magurran

Centre for Biological Diversity, School of Biology, University of St Andrews, Scotland, UK

Growing concern about biodiversity loss has sparked renewed interest in community structure. Ecological assemblages invariably include both common and rare taxa; species abundance distributions (SADs) describe these patterns. To predict how communities respond to anthropogenic change we need to understand the processes that shape species abundance distributions and influence local diversity. I will describe recent work evaluating spatial and particularly temporal trends in both alpha and beta diversity. It is becoming clear that these trends are scale dependent. In many cases we find that species richness is maintained through time, but, consistent with the prediction that turnover is accelerating relative to baseline levels, we often uncover marked changes in species composition. Beta diversity partitioning can be used to determine whether turnover in species identity is a consistently stronger driver of community reorganization than species richness. A growing number of studies suggest that biotic homogenisation may be a more serious, but as yet largely unappreciated, problem than local species loss. These analyses shed light on how ecological communities change through time, and in doing so help reveal how shifts in biodiversity will affect ecosystem function.



8 **Biology for cultural heritage preservation**

Patricia Sanmartín

Departamento de Edafología e Química Agrícola, Universidade de Santiago de Compostela

Biology for cultural heritage preservation covers both damage of cryptogams (algae, cyanobacteria, fungi, lichens, mosses) on stone heritage structures (biodegradation and biodegradation) and use of microbial species (mainly bacteria and some fungi) in biocleaning processes (bioremediation). Cryptogams and stone conservation are closely related since these organisms contribute substantially to the deterioration of materials, and color measurements are important in both fields. Therefore, in this plenary session, the state-of-the-art color measurement techniques as a method of conserving and preserving stony materials against cryptogams (mainly cyanobacteria) will be discussed. On the other hand, I will show the positive effects of some bacteria and fungi as cleaning agents, especially when the substances to be removed are complex and encrusted. In this framework, an ongoing methodology to remove graffiti from construction materials by using microorganisms, leaving the substrates undamaged, will be shown.



The cryptogamic epiphyte response to climate change: scaling from biogeography to habitat management 9

Christopher J. Ellis

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Concepts of risk management developed in the insurance industry include three components, hazard, exposure and vulnerability. Following this example: (i) climate change can be considered as a 'hazard' to biodiversity, (ii) larger-scale bioclimatic models quantify the 'exposure' of species to climate change, e.g. by measuring the sensitivity to climate change scenarios, as the loss of, or degree of spatial change in suitable climate space, but (iii) the overall risk to a species depends also on smaller-scale ecological 'vulnerability' factors, e.g. habitat fragmentation which may prevent an effective ecological/evolutionary response (migration/adaptation) commensurate with a species' exposure.

In this talk I draw on the risk analysis concept, to introduce climate change as a hazard. I then explore the use of bioclimatic models in order to understand the exposure (or sensitivity) of cryptogams to regional climate change, and address key challenges to the bioclimatic modelling framework. I aim to show that the use of bioclimatic models requires caution, but can be justified in three ways: (i) congruence in species' bioclimatic distributions for independently derived ranges (on different continents), supports climatically-controlled distributions, (ii) larger-scale distributions can be compatible with experimental growth rates, providing support from functional ecology, and (iii) historic shifts in epiphyte community structure are consistent with known patterns of past climate change, providing a supportive retrospective analysis.

Finally, I use European oceanic cryptogamic epiphytes as a case-study, to scale-down from patterns of larger-scale exposure, to ecological vulnerability at a landscape/habitat scale. This draws on the observation that oceanic epiphytes can be widely distributed in optimal 'oceanic' climates, but in sub-optimal 'continental' climates become restricted to ancient woodlands. The observation can be explained in two ways: (i) climatically-controlled growth rates may slow, lengthening generation times in sub-optimal climates, such that probabilities of colonisation become skewed towards microhabitats with increased continuity (e.g. in ancient woodlands), or (ii) ancient woodlands may have



- 10 a higher representation of microhabitat-types that offer a suitable microclimatic niche within a sub-optimal macroclimate (e.g. higher levels of humidity associated with old and leaning trees, or bryophyte-covered trunks). A newly developed stochastic-population model is introduced as a learning-tool, to explore the relative importance of each of these factors (climatically-controlled growth rates, or habitat specificity).
The key message is that by considering vulnerability, it becomes possible to identify practical solutions in local habitat management, which can be then used to offset the negative effects of larger-scale climate change.





Incorporating evolutionary processes into systematic conservation planning

11

Silvia B. Carvalho

CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos da Universidade do Porto, R. Padre Armando Quintas, 4485-661 Vairão Portugal

Given the present biodiversity crisis and the limited resources to preserve it, one of the major international goals is safeguarding biodiversity in conservation areas' networks. Spatial conservation planning has evolved remarkably in past decades, moving from strategies consisting in identifying spatial patterns of species richness, endemism and turnover, to sophisticated Systematic Conservation Planning (SCP) frameworks and algorithms to identify conservation networks that maximize overall representation and persistence of biodiversity while accounting for cost-efficiency. However, while the species and ecosystem levels of biodiversity are commonly incorporated in conservation planning, evolutionary processes and genetic diversity are rarely considered in practice. Here I will exemplify different ways for accounting to evolutionary processes in conservation planning. I will provide examples using surrogates for evolutionary processes (including species distributions, environmental gradients, and geographic features), and using genetic diversity directly at two different phylogenetic levels (inter and intra-specific). Finally, I will discuss current challenges and perspectives in terms better practices and tools for integrating genetic data and spatial conservation prioritization methods under global change scenarios.



12 Portuguese Seaweeds – heritage and potential value

Rui Pereira & Helena Abreu

ALGApplus, Lda. Travessa Alexandre da Conceição S/N. 3830-196 Ílhavo. Portugal

Seaweed industry as presently still a small scale in the country even though Portugal as a considerable tradition on the use of this natural resource. Its use began with the collection of the “sargaço” in the north of Portugal (a mix of beach casted seaweed essentially between Matosinhos and Moledo) and the “moliço” in Ria de Aveiro (a mix of seaweed and marine angiosperms). The collection of the sargaço is known at least since 1308. Much more recently and until the middle of the XX century, the collection seaweed for phycocolloid extraction was a very significant activity and Portugal was at that time one of the largest producers worldwide. All these activities are nowadays almost inexistent and the collection of agarophytes remains at a lower scale only in S. Martinho do Porto. It is consensual that the future exploitation of the Portuguese seaweed flora will not be based on the wild harvest, an activity that is in fact not-regulated (excluding the aforementioned).

The present need for quality, traceability and stability of supply can only be completely met through aquaculture production. The technologic advances in terms of production, namely on the cultivation on-land, in integrated multi-trophic aquaculture systems (IMTA), but also in the processing and biochemical characterization will allow us to explore the potential of the several hundred seaweed species existent in the Portuguese shore.

Industries such as the pharmaceutical, cosmetic and nutraceuticals are constantly seeking new sources of bioactive compounds and are attempt to the seaweed potential. Simultaneously, in the eastern countries, the growing awareness and concern with food habits and search for healthy foods favours the use of seaweed. In the food industry, seaweed are gradually becoming a more common ingredient. Between 2012 and 2013, more than 250 new products containing algae in the ingredient list were introduced in Europe.

However, the seaweed potential does not end in those applications. There are ongoing projects in the areas of animal food (from farmed animals to aquaculture, including pet food), bioplastics, textiles and bio-fuels. In all these sectors lays the future exploitation of this natural heritage – seaweed.



Indicators of what, for what, and for whom? Biodiversity, ecosystems and the governance of socio-ecological systems

João Pradinho Honrado

Ângela Lomba, António Monteiro, Cristiana Vieira, Joana Vicente, Ana Sofia Vaz

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Socio-ecological systems are complex, dynamic and adaptive entities consisting of coupled and interacting social and ecological systems. They can be defined at several spatial scales, from local to global, and their status and dynamics can be described on the basis of social, ecological and socio-ecological indicators. Those indicators should thus refer to the main components of the social system (social groups, stakeholders), of the ecological system (species, ecosystems), and of their interactions and regulating feedbacks (land uses, natural hazards, ecosystem services). Biodiversity is a key component of many socio-ecological systems, where it plays many different roles as a resource or an environmental asset. It is at the base of several important feedbacks from the ecological into the social system, but also of social decisions on resource and landscape management. Biodiversity is at the core of ecosystem functioning and thus of ecosystem services, which have been considered a primary link between social and ecological systems. Indicators and proxies of biodiversity, of ecosystem functioning and of the pressures driving their status and dynamics are therefore valuable tools in support of governance towards resilient landscapes. This talk will cover these and other topics related with the role of ecological indicators in the governance of socio-ecological systems, with an emphasis on the role of vegetation and landscape processes. The main ideas are illustrated with examples from recent projects focused on mainstreaming biodiversity and ecosystem services in spatial planning and sustainability governance.



14 Gene expression variation in *Physcomitrella patens* sporophytes

Marianna Ricca¹,

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² Department of Biology, Washington University in St. Louis, USA

³ Swiss Institute of Bioinformatics, Switzerland

⁴ Santa Fe Institute, New Mexico, USA

⁵ Institute for Systematic Botany, University of Zurich, Switzerland

The parental conflict hypothesis predicts that parent of origin gene expression is expected to evolve whenever there is a difference in resource allocation to the offspring between parents. Although the presence of endosperm is usually seen as a prerequisite for genomic imprinting, parental conflict is also predicted to occur in basal groups of land plants lacking endosperm, such as bryophytes. Bryophytes exhibit the hallmark of parental conflict and experimental observations suggest the existence of genomic imprinting. Furthermore, genomic and molecular data predict that mosses and flowering plants share multiple molecular mechanisms known to be involved in the realization of the parental conflict in flowering plants. In spite of that, molecular evidence of imprinting, its mechanisms and evolutionary implications in this basal group of land plants are unknown.

This project was developed to test the predictions of the parental conflict hypothesis in the model moss *Physcomitrella patens* by assessing parent of origin gene expression in the sporophytic tissues in reciprocal interstrain crosses. We looked at gene expression variation throughout sporophytic development and the impact of outcrossing in gene expression and gene expression regulation. We will provide a brief overview of our findings and their evolutionary implications.



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PORTO, 22 A 25 DE JULHO DE 2015

ORAL
PRESENTATIONS





16 Blowing in the wind... Phenotypic variability or speciation event in the lichen genus *Ramalina*

Pérez-Vargas, I.¹ & Pérez-Ortega, S.²

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Lichens with vagrant or unattached life forms occur in many areas of the world, from the low altitude, hot deserts and cold steppes to the high-altitude alpine areas and tundra (Pérez 1994,1997). These sites share similar arid or semiarid climatic condition, sparse vegetation and wind swept (Rosentreter 1993, Pérez-Ortega et al. 2012). Several lichen genera contain both attached and unattached (vagrant) forms. The most prominent of these genera in arid and semiarid regions of North America and Eurasia are *Aspicilia*, *Dermatocarpon*, *Rhizoplaca* and *Xanthoparmelia*. Distinct vagrant species are presently recognized in all of these genera although the validity of several of these taxa has been questioned (Rosentreter & McCune 1992).

Ramalina Nyl. is a large genus of cosmopolitan lichens with over 200 species currently recognised (Kirk et al. 2008). The species show a remarkable plasticity (Boucher & Nash 1990, Pintado et al. 1997) and a very complex chemistry (Krog & Swinscow 1973, Culberson et al. 1993). No vagrant species have been described in this genus. Nevertheless we have discovered some samples of free-growing *Ramalina* restricted to a small steppe in the Canary Islands. In outward form it is unlike all other *Ramalina*, having rolled lobes and without a holdfast. These vagrant forms co-occur with more typical, nonvagrant *Ramalina* species. We sought to determine whether this taxon represents a distinct species or whether it is an environmental modification of the more common, sympatric *Ramalina* species.



Bryophyte beta diversity along an elevational gradient in Terceira Island, Azores

Henriques DSG¹, Gabriel R¹, Borges PAV¹ & Ah-Peng, C²

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Oceanic island ecosystems are biologically simpler than their mainland equivalents and geographically well-defined, which makes them ideal systems to evaluate the processes that govern species community assembly. For this purpose, beta diversity is used to describe variation in species identities across sites. It is decomposed in species replacement and richness differences, which represent distinct ecological processes. Our aim is to evaluate beta diversity and its components at different scales along an elevational gradient in an oceanic island (Terceira).

After dividing the island's 1021 m elevational gradient into equal bands, bryophyte composition per band was obtained via the ATLANTIS database (www.atlantis.angra.uac.pt). Species replacement and richness differences were then calculated for three different spatial grains of the sampling unit: adjacent 51 m (small scale), 102 m (intermediate scale) and 204 m (large scale) band pairings.

We found that beta diversity responds to scale. At a smaller scale, beta diversity values are higher than at a larger one. At the intermediate scale species replacement is the largest component of beta diversity up until 510 m. From 510 m to the top of the island, richness difference is the main driver of beta diversity. Overall beta is smaller and composition similarity higher in the middle of the gradient, between 460-714 m.

Beta diversity variation with scale results from bryophyte assemblages appearing more homogeneous as sampling grain increases. The intermediate scale seems to be ideal for analysis at the island level, avoiding the coarseness of the larger scale and diluting the influence of microscale variables working at the smaller scale.

Beta diversity is low when compared with other groups, due to the environmental homogeneity and low zonation of the Azorean vegetation. The lowest values are found between 460-714 m, where the best native Laurisilva forest areas occur, hosting a rich bryoflora. By opposition, beta diversity is highest in the lowlands, between the first three 102 m band pairings. This is the most disturbed part of the island with very few forested areas, comprising mostly exotic species. Species replacement is the main process at work at these levels, indicating a gain and loss of species, probably due to high habitat disturbance levels.

Since scale seems to affect beta diversity values in Terceira, we recommend standardized studies of bryophyte community assembly at different scales. These can help understand ecological drivers acting on bryophyte communities and define conservation strategies more focused on bryophyte requirements at multiple scales.



18 Checklist de los briófitos de la Comunidad Autónoma del País Vasco (España): actualización y bases para una lista roja

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Se presenta el checklist de los briófitos conocidos para la Comunidad Autónoma del País Vasco (CAPV), actualizando el realizado en el año 2000 (Heras Pérez & Infante Sánchez 2000). El trabajo que se ha venido abordando desde el año 2000 ha llevado a una notable mejora del conocimiento de la diversidad briofítica del País Vasco. Además, el desarrollo del proyecto Flora Briofítica Ibérica ha contribuido muy notablemente, al examinar numeroso material de los herbarios ARAN (Sociedad de Ciencias Aranzadi), BIO (Facultad de Ciencias, Universidad del País Vasco) y VIT (Museo de Ciencias Naturales de Álava). La lista roja de los briófitos del País Vasco que se viene realizando en estos últimos años ha provocado la necesidad de poner al día la información que se dispone sobre la brioflora vasca.

La CAPV, formada por las provincias de Álava, Guipúzcoa y Vizcaya, abarca una superficie de 7.163,50 km². Además, este checklist incluye el enclave del Condado de Treviño (260,71 km²), perteneciente administrativamente a Burgos pero que geográficamente se corresponde con las comarcas naturales de Álava que lo engloban. En total, el territorio comprendido es de 7.424,21 km² (el 1,2% de la superficie total de la Península Ibérica).

Dos son los rasgos fisiográficos de la CAPV que más determinan su brioflora. El primero es la notable transición climática que se da desde la costa cantábrica al río Ebro, comprendiendo desde comarcas netamente atlánticas a las claramente mediterráneas, con una amplia franja en el centro de Álava de características subcantábricas. El segundo es la llamativa disminución altitudinal que se da en los Montes Vascos, entre los Pirineos y la Cordillera Cantábrica. Los primeros datos históricos que se conocen sobre la brioflora de la CAPV proceden de finales del siglo XVII, en torno a 1785 (Herbario Histórico Prestamero y recolecciones de Xabier de Arízaga), pero la contribución más decisiva se la debemos al matrimonio Allorge, ya en los años treinta del siglo XX.

En este momento, la brioflora de la CAPV está compuesta por 660 taxones (3 antocerotas, 158 hepáticas y 499 musgos). Se detallan la presencia los diferentes taxones en cada uno de los territorios considerados, los elementos más significativos y los más amenazados de la brioflora vasca.

Referencia:

Heras Pérez, P. & Infante Sánchez, M. 2000. Check-list de los briófitos de la Comunidad Autónoma del País Vasco. *Estudios del Museo de Ciencias Naturales de Álava* 15: 57-73.



El género *Prorocentrum* (Dinophyceae, Prorocentrales) en aguas neríticas y costeras de Canarias: nuevas aportaciones

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Prorocentrum (Dinophyceae, Prorocentrales) está representado en el archipiélago canario por 10 especies. Este género por fue descrito por Ehrenberg en 1834 designando a *P. micans* Ehrenberg como Holotypus, desde entonces se han descrito 77 especies de las cuales 9, la mayoría bentónicas, están consideradas tóxicas.

Prorocentrum se caracteriza por presentar una teca bivalvar con un aplastamiento bilateral notable. Cada valva está formada por una sola placa. En el extremo anterior o ventral ambas valvas presentan un conjunto de pequeñas placas, área periflagelar, donde se encuentran los dos poros por donde emergen los flagelos, uno de ellos helicoidal. Algunas especies presentan una espina apical y todas las especies poseen dos cloroplastos. Los caracteres usados para identificar y diferenciar las especies de *Prorocentrum* son el tamaño celular, la presencia de espina apical, los pirenoides, y en particular la arquitectura del área periflagelar, las bandas intercalares, la superficie valvar y su ornamentación.

El presente trabajo constituye una contribución al conocimiento del género *Prorocentrum* en aguas neríticas y costeras del archipiélago canario con aportación de 3 citas nuevas y una especie nueva. El estudio taxonómico se ha realizado a partir de muestras recogidas durante el año 2014 en diferentes campañas oceanográficas y de 5 praderas de *Cymodocea nodosa* (Ucria) Ascherson afectadas por crecimientos masivos de *Lyngbya majuscula* Harvey ex Gomont en las islas de Gran canaria y Fuerteventura.



20 Aspectos bioquímicos de la tolerancia a la deshidratación en *Pleurozium schreberi* durante la época seca en el páramo de Chingaza (Colombia)

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El presente estudio se realizó en el páramo de Chingaza (3.250 m.s.n.m.) ubicado en el centro de Colombia, durante la época seca. Se midió el contenido hídrico relativo en *Pleurozium schreberi* durante los ciclos de deshidratación/rehidratación naturales que se presentan durante el día, y se determinó los contenidos de proteínas solubles totales, azúcares solubles totales, azúcares reductores, fructuosa, sacarosa y prolina. También se determinó la actividad enzimática específica de Catalasa (CAT) y Peroxidasa (POD).

P. schreberi creciendo en los páramos andinos es un musgo tolerante a la deshidratación para lo cual presenta una serie de adaptaciones bioquímicas que le permite sobrevivir a períodos de déficit hídrico extremos, como son:

Alto contenido de azúcares solubles en especial de sacarosa y bajos niveles de azúcares reductores. Registó además un mayor aumento de sacarosa en los periodos de menor contenido hídrico relativo. La sacarosa puede ser el osmolito más importante durante la deshidratación de *P. schreberi* cumpliendo funciones de ajuste osmótico, vitrificación, osmoprotección y fuente de energía.

En *P. schreberi* la prolina no es un osmolito importante en el ajuste osmótico durante la deshidratación, sin embargo su aumento de concentración en el momento de la rehidratación puede estar asociado a promover la actividad peroxidasa.

P. schreberi presenta aumento en el contenido de proteínas totales cuando entra en estados de deshidratación, asociado posiblemente a la producción de enzimas del sistema antioxidante como catalasa o para mantener la estabilidad de los fotosistemas, lo cual se ve reflejado en la rápida recuperación de los procesos fotosintéticos cuando el musgo se rehidrata.

P. schreberi presenta como adaptaciones constitutivas para sobrevivir a estrés por deshidratación una alta actividad enzimática de catalasa, mientras que se presenta como adaptación inducida por la deshidratación una alta actividad enzimática de peroxidasa. El aumento de la actividad de CAT durante la deshidratación está asociado a procesos de protección, mientras que el aumento de POD durante la rehidratación está asociado a procesos de reparación y protección en especial de los fotosistemas.

Las mediciones anteriores se relacionaron con la actividad fotosintética y respiración, comprobando la función de protección de los azúcares y enzimas del sistema antioxidante.



Macrofungal communities of two native oak woods (*Quercus faginea* subsp. *broteroi* and *Q. rotundifolia*) in Central Portugal, with a study of sampling methods ²¹

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Macrofungi play crucial roles in forest ecosystems, yet their diversity still needs to be better understood. Despite the growing focus of research on fungal diversity in Mediterranean regions and the recent interest for these organisms in our country, the mycoflora of Portugal is far away from complete, and ecological studies that cover natural habitats need to be undertaken by the scientific community. The present study is a preliminary fulfillment of such need. We selected two native types of oak woods in the karstic Sicó massif (Central Portugal), to record the epigeal macrofungal diversity as well as to compare two sampling methods and to identify environmental variables that shape the species composition. This Natura 2000 protected site (PTCON0045) includes the most important continuous areas of marcescent Portuguese oak (*Quercus faginea* subsp. *broteroi*), and remarkable stretches of Holm oak (*Quercus rotundifolia*) on calcareous soils. Four fragments of each habitat were intensively collected over one main sampling season using plot-based and opportunistic methods, with standardized sampling efforts. Several environmental variables (vegetation, soil, topology, weather) were characterized. Results showed high diversity in both habitats, with a total of 250 and 230 taxa recorded, for the *Q. faginea* and *Q. rotundifolia* habitats respectively. Several taxa are first references for Portugal. The two methods used have provided substantial differences in species richness, while keeping a similar distribution by major trophic groups. The richness of the mycoflora along with the new records found in the *Q. faginea* woods emphasizes the knowledge gap in the mycodiversity of this habitat. Overall, and although based in only one fruiting season, these results clearly show the rich mycoflora of both protected habitats and highlight their ecological value and need for further research. We discuss the results aiming at a better integration of macrofungi diversity in the development of action plans for conservation.



22 Diversidad y ecología de cianobacterias bentónicas en los ríos de Castilla-La Mancha

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Durante un período de estudio que abarcó 12 años, se recolectaron macroalgas en cinco cuencas incluidas en el territorio regional de Castilla-La Mancha: Tajo, Júcar, Segura, Guadiana y Guadalquivir. Como parte de la comunidad de macroalgas, se recolectaron a mano talos macroscópicos de cianobacterias detectados a simple vista, adosados a diversos substratos o flotantes, cuya composición específica fue determinada posteriormente en el laboratorio. En total, se determinaron 25 especies de cianobacterias pertenecientes a 9 familias y 4 órdenes, siendo los órdenes Nostocales (48%) y Oscillatoriales (44%) los más diversos. Las especies más ampliamente distribuidas fueron *Phormidium favosum*, *Rivularia haematites* y *Nostoc verrucosum*. Los lugares más diversos en especies estuvieron localizados en tramos de ríos calcáreos, incluidos en los ecotipos fluviales nacionales denominados “Ejes mediterráneo-continental mineralizados”, “Ríos Manchegos” y “Ríos de montaña mediterránea calcárea”. En cuanto a las preferencias ecológicas, *N. verrucosum* mostró el rango más amplio de temperatura y pH; *P. retzii* y *Tolypothrix distorta* presentaron el mayor rango de valores de conductividad; *P. favosum* fue la especie más tolerante en cuanto a la concentración de fosfato y nitrato, mientras *Lyngbya martensiana* se recolectó en aguas contaminadas tolerando los valores más elevados de amonio. Los análisis multivariantes realizados indicaron que el pH, la conductividad, y la altitud, junto con la concentración de amonio y nitrato fueron las variables que mejor explicaron la variabilidad en la distribución y composición de la comunidad de cianobacterias. Así, los arroyos silíceos localizados en tramos de montaña, donde se midieron los valores más bajos de pH y conductividad, presentaron una comunidad diferente al resto de ríos, caracterizada por especies como *Coleodesmium wrangelii*, *Nostoc caeruleum* y *Phormidium fonticulum*.



Epiphytic lichen diversity in broadleaved forests in Cadí-Moixeró Natural Park: assessing habitat status.

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The Cadí-Moixeró Natural Park, located at the pre-Pyrenees range (NE Iberian Peninsula), hosts a broad variety of habitats from the Mediterranean to the alpine belt. Among them, coniferous forests are the most abundant habitats. On the other hand, broadleaved forests are present from the Mediterranean to the montane belt, despite their surface is not as extensive as coniferous woods. Biological diversity is a main focus on management of protected areas. However, some biological groups are less studied due to several reasons. Lichens are one of such not well known groups from the Cadí-Moixeró Natural Park. Recently, some surveys have focused on epiphytic lichen diversity in the park. The aim of this paper is to assess the habitat status of broadleaved forests using lichen diversity.

The study has been carried on 15 sites representing four kinds of forests: holm oak, oak, beech and mixed deciduous trees. Forests have been characterized in terms of climatic indices, agricultural activity and structure. Agricultural activity has been established based on the percentage of cultured land surrounding each site and field observations. The forest structure is defined from open to dens canopy based on aerial photographs. Lichen diversity has been evaluated in terms of species richness and several functional traits (thallus morphology, photobiont, reproductive strategy, tolerance to eutrophication, and tolerance to disturbance).

Species richness is higher in oak and mixed forests, and beech forests host the poorest lichen communities. Beech forests are linked to areas with a higher humidity, usually in areas with more precipitation, while holm oak and oak forests thrive on more drier and thermic areas. Forest structure determines significant changes on the tolerance to disturbance. Close forests content more species tolerating low levels of disturbance, while open forests hold a larger proportion of species tolerating high disturbances. Former ones also support more species reproducing by asexual processes. Oppositely, close forests are richer in species with sexual reproduction as well as in species with trentepohlioid photobionts.

Forests located in areas with intense agricultural activity bear more species tolerating high levels of eutrophication, which have foliose thallus. The remaining groups of tolerance to eutrophication do not vary significantly between the established categories.

The use of functional traits of lichen species shows up to be a good tool to assess the features and impacts in deciduous forests.



24 Filling knowledge gaps on the diversity of Iberian epiphytic bryophytes

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Knowledge on the diversity and distributions of the Iberian bryophytes has experienced a remarkable progress in the last 45-50 years. As a consequence, the taxonomy of the Iberian bryophytes is relatively well known. However, regarding the distribution and abundance of species across the territory large knowledge gaps exist to the point that the Iberian Peninsula can be considered under-surveyed. One of the most significant constraints to the accumulation of knowledge on the distribution and abundance of the species is the spatial bias in the sampling effort. Overall, survey effort concentrates in montane areas and/or singular sites while basal areas that are perceived as less attractive for specialists receive much less attention.

The main objective of this work is to contribute to significantly reduce the knowledge gaps on the distribution of Iberian epiphytic bryophytes obtaining a balanced and representative picture of the diversity patterns. The selected study area comprises more than 40000 km² comprising a large part of the Tagus and Duero basins within the Spanish territory. To select the sampling sites we applied a survey protocol based on a p-median algorithm aimed at obtaining a good representation of the environmental and geographic variability of the study area. In this work, we present the results of the survey that includes a catalogue of 89 bryophyte species including 9 liverworts and 80 mosses in the 107 studied localities. Besides, we report more than 70 provincial novelties, most of them located in the North Plateau, one of the least studied areas of the Iberian Peninsula. Additionally, some of the species that accumulate the highest amount of novelties across the territory are easy to identify and relatively common species. Altogether these results highlight the importance of performing systematic survey campaigns aimed at representing the geographic and environmental variability of the territory and provide evidence on the efficiency and usefulness of the protocol employed.



Keeping up with the Bryophytes: richness, diversity and threatened taxa patterns and conservation in headwater streams

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The relative importance of environmental factors affecting richness, diversity and threatened richness of bryophytes across scales in headwater streams remains unclear, despite this ecosystems sustaining one of the most unique and diverse bryophyte assemblages. In Portugal, aquatic habitats in mountain environments are among the most vulnerable to human pressures and many of the bryophytes correspond to nationally threatened species. In this context, we aimed to (1) explore the richness, threat and diversity patterns of bryophyte species assemblages at two different spatial scales and at three different levels of protection, (2) assess the environmental factors (related to hydrogeomorphology, land use/vegetation structure and human activity) that best explain these patterns, (3) explore the potential of bryophytes community structure as an indicator of fluvial hydrogeomorphologic disturbance, and (4) analyze data pertinent for fluvial monitoring and conservation.

The bryophyte survey was conducted on watercourses included mostly within areas with a protection status (Natura 2000 Sites network and National Protected Areas). Sampling was performed at two different spatial scales, with a total of 187 river segments and 835 microhabitats sampled. Species richness, threatened species richness and diversity at two spatial scales were compared between different geographical locations and between levels of protection, using the Kruskal–Wallis test. Partial least squares regressions were performed to investigate which parameters maintain the most rich, threatened and diverse bryophyte communities.

Richness in threatened species was significantly higher in Arga mountain range, a small Natura 2000 Site with a strong Atlantic influence, which emerges as an Important Plant Area for the conservation of bryophyte species and their unique fluvial microhabitats.

Bryophyte communities' richness, diversity and threatened taxa occurrence at the segment scale were positively influenced by increasing hydrogeomorphological quality, in particular by the riparian vegetation structure quality and naturalness, heterogeneity of fluvial morphodynamic habitats and substrate dimensions, water discharge and flow type. However, at the microhabitat scale, high current velocities were related to lower values of species richness, diversity and threatened richness, indicating that this variable constituted a physical constraint to bryophyte assemblages. In this way we proved that there is an intricate link between bryophytes and hydrogeomorphological integrity in headwater streams, making them suitable indicators with relevant applications ecological monitoring, management and conservation of fluvial ecosystems.



26 **LEGE Culture Collection and its cyanobacterial diversity: strains data survey analysis highlights the increasing importance of this biological resource**

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The Blue Biotechnology and Ecotoxicology group (CIIMAR, University of Porto) has undertaken a process of organizing its cyanobacterial isolates by creating a culture collection. This led to the recently membership of LEGE CC in the World Federation for Culture Collections (WFCC). The collection is also part of the Research Infrastructure EMBRC.PT. At present it comprises more than 350 different cyanobacterial strains, several of them unique among the (phylogenetic) diversity of the group. These isolates have been obtained since 1991, from samples collected in different environments and locations mainly in Portugal (including Madeira and Azores Islands), but also elsewhere (e.g. Australia, Brazil, Colombia, Morocco, Mexico). As in other collections worldwide, LEGE CC seeks to provide starter cultures for a diverse range of aims (R&D, science education & dissemination). In fact, this has been done with local, national and international entities, under different types of partnerships. Several studies, most of them from BBE group's own research, have shown the potential or the effective capacity of different LEGE strains to produce a myriad of chemical compounds, including toxins or newly discovered bioactive molecules. Soon, a number of strains (at least three) will have their genomes sequenced and annotated. Others studies revealed that some strains are phylogenetically distinct, and thus taxonomic challenging.

In this work, while presenting the Culture Collection, the main findings from a survey of published and unpublished data available on the total LEGE strains are given. Results from this meta-analysis are summarized and presented in a systematic manner, linking the phylogenetic placement of our strains in the "cyanobacterial Tree of Life" (based on 16S rRNA gene sequences), along with relevant information retrieved from the data compilation process (i.e. morphological features and identification, geographic and ecological origin, ecophysiological data, toxicity and bioactivity (bioassays, molecular, analytical) analyses performed; production/type of secondary metabolite, publications, year of publication, etc.). It is believed that connecting the phylogeny of each LEGE strain to the aforementioned data creates awareness and capture interest of the scientific community and of members of the general public, such as pharmaceutical and biotechnological enterprises. Finally, the online version (currently under construction) of the collection (www.ciimar.up.pt/legculturecollection) is presented.



Limitaciones al establecimiento del líquen *Pectenium plumbeum* a escala de paisaje inferidas a partir de modelización del hábitat y análisis de ocupación del hábitat potencial 27

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Pectenium plumbeum (Lightf.) P.M. Jørg. et al. es un cianolíquen epífito que aparece de forma puntual y discontinua desde los encinares del Atlas hasta los bosques del norte de Noruega. Su elevada sensibilidad a la influencia antrópica solo le permite desarrollarse bajo las condiciones que proporciona un bosque \pm maduro con cierto grado de conservación. En el centro de la Península Ibérica, donde ha sido catalogada como vulnerable, se distribuye en varias decenas de poblaciones, distantes entre sí y con un número de individuos que, en ocasiones, no supera la decena. Partiendo de la existencia de un número elevado de zonas próximas a las poblaciones, con un hábitat a priori favorable para su desarrollo, pero en las que el líquen está ausente o es muy escaso, nos preguntamos acerca de las posibles limitaciones a la dispersión o al establecimiento que pudiese tener esta especie y que condicionase la expansión de sus poblaciones y la colonización de nuevas áreas. En primer lugar se modelizaron la presencia y la abundancia de la especie en 400 parcelas de 50x50 m elegidas al azar en Montes de Toledo. Variables ambientales como la altitud y la precipitación, y de fragmentación del hábitat, como la cantidad de área forestal y de borde, resultaron ser muy importantes para el desarrollo de la especie. Los modelos fueron validados internamente de forma exitosa mediante diferentes aproximaciones (“Area under the ROC curve” para la presencia, y “bootstrapped cross validation” para la abundancia). Posteriormente fueron extrapolados en 1200 parcelas del Parque Nacional de Cabañeros, seleccionadas al azar, abarcando una mayor superficie (42000 Ha), para las que se obtuvo un valor predicho de abundancia y de probabilidad de presencia. Los modelos fueron comprobados en campo para poder testar si las predicciones se correspondían con la realidad. Asumiendo como valor límite de probabilidad de aparición 0.45, se maximiza el acierto de las predicciones de presencia/ausencia en un valor muy alto (87,3% de los casos). La correspondencia en las abundancias, es también alta (ρ de Spearman=0,67) y significativa. Esto evidencia el elevado poder predictivo de los modelos obtenidos, y que la especie ocupa en gran medida su hábitat potencial. Por tanto, a escala de paisaje, parece que quedan descartados los problemas dispersivos de la especie, y queda demostrado que la calidad del hábitat es la que está condicionando su presencia y abundancia.



28 Líquenes en los cocones del karst del Parc del Garraf (Catalunya)

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Los cocones son unos hoyos, en general poco profundos, que se generan por erosión de la roca calcárea. Constituyen uno de los múltiples tipos de erosión que caracterizan el exokarst del Garraf y son abundantes en las superficies horizontales de las rocas calcáreas.

Para los líquenes de este tipo de roca, los cocones constituyen un micro-nicho ecológico, caracterizado por la retención de agua de lluvia y la acumulación de un sedimento enriquecido con excrementos y restos de animales.

Presentamos los resultados del muestreo de 6 cocones del Parc del Garraf (Catalunya), en los que hemos diferenciado la parte exterior, la pared pendiente y la base.

Hemos identificado 20 especies que se engloban en 7 familias. La familia más representada es la de las verrucariáceas con los géneros *Bagliettoa* y *Verrucaria*, y la de las liquináceas con los géneros *Psorotichia*, *Thelochroa* y *Lempholemma*.

La distribución estadística de los diferentes puntos de muestro, a partir de una matriz de distancias de las especies, nos da dos grupos bien definidos y uno de transición.

El primer grupo ocuparía la parte superior de los cocones, constituido por 9 especies, representa la comunidad típica de las superficies horizontales de roca calcárea, de zonas áridas y sin cobertura arbórea. Este grupo se caracteriza por la presencia dominante de líquenes endolíticos y con alga clorofícea como fotobionte.

El segundo grupo, con 8 especies, lo encontramos en la base de los cocones y lo constituyen cianolíquenes, predominantemente micro-foliáceos y micro-fruticulosos. Este ambiente se caracteriza por la presencia de un sedimento, proveniente de la erosión de la roca más la acumulación de restos de materia orgánica, que periódicamente se inunda por agua de lluvia.

El grupo de transición, con 17 especies, lo encontramos entre la superficie y la base de los cocones, y su importancia varía en función de la anchura y pendiente del cocón.



Los líquenes epífitos del monteverde canario y su supervivencia en plantaciones forestales

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Las Islas Canarias forman parte de la Región Macaronésica, incluida en uno de los 25 Puntos Calientes de Biodiversidad del planeta o Hotspots (Myers et al., 2000). La biota líquénica de Canarias es extremadamente rica, con más de 1500 especies citadas en apenas 7447 km² (Hernández Padrón & Pérez-Vargas, 2010). Entre los diversos ecosistemas que encontramos en el archipiélago, uno de los más característicos es el Monteverde, bosque relictico y endémico de la Región Macaronésica, hábitat prioritario de interés comunitario (incluido en la Red Natura 2000) y con una superficie total de 7052,6 hectáreas en el archipiélago canario. Sin embargo, este bosque ha presentado grandes perturbaciones en las últimas décadas. Se estima que en la actualidad sólo existe un 11.8% de su área potencial (Del Arco et al. 2010). Entre las perturbaciones a las que ha sido sometido cabe destacar la tala del bosque en pro del desarrollo de plantaciones forestales monoespecíficas de *Pinus radiata*, *Eucalyptus globulus* y *Castanea sativa*, fundamentalmente.

El objetivo de nuestro proyecto es conocer si la composición líquénica epífita de estas plantaciones forestales instaladas en áreas potenciales del Monteverde es similar a la presente en el bosque nativo. Para ello se han realizado 5 parcelas de 100 m² en cada uno de los 4 ambientes estudiados a lo largo de la isla de Tenerife, siguiendo la metodología propuesta por Asta et al. (2002a,b), con una serie de modificaciones con la finalidad de adaptar dicha metodología al medio insular. El material recolectado fue identificado en el laboratorio a través de las técnicas habituales de Liquenología, y depositado en el Herbario de la Universidad de La Laguna (TFC-Lich).

Los resultados obtenidos tras el análisis estadístico de la composición de los distintos ambientes (NMDS y ANOSIM) muestran diferencias significativas entre los ambientes estudiados. Las plantaciones forestales son mucho menos diversas que el bosque nativo y además están caracterizadas principalmente por especies primocolonizadoras ligadas a ambientes antropizados y eutrofizados, de amplia valencia ecológica y distribución mundial.



30 Diversidad y ecología de los briófitos acuáticos y semiacuáticos de los ríos de Castilla-La Mancha

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En este estudio se presentan los resultados obtenidos en los muestreos realizados durante 11 años en los ríos de Castilla-La Mancha (período 2001-2011), como fruto de un programa de monitoreo de macrófitos fluviales realizado en el contexto de aplicación de la Directiva Marco del Agua. En 122 puntos de muestreo pertenecientes a las cuencas del Tajo, Guadiana, Júcar, Segura y Guadalquivir, se recolectaron los briófitos sumergidos (acuáticos) y los distribuidos inmediatamente por encima de la superficie de agua, los cuales viven principalmente emergidos pero toleran salpicaduras y períodos de inmersión (semiacuáticos). En total, se registraron 43 taxones, de los cuales 40 se determinaron a nivel de especie y 3 a nivel de género. Los briófitos estrictamente acuáticos más frecuentes fueron *Pellia endiviifolia* Dicks.) Dumort., *Rhynchostegium riparioides* (Hedw.) Cardot, *Hydrogonium orientale* (F. Weber) J. Kučera., *Fontinalis hypnoides* var. *duriaei* (Schimp.) Kindb., *Fissidens crassipes* Wilson ex Bruch & Schimp subsp. *crassipes* y *Leptodictyum riparium* (Hedw.) Warnst., mientras que los briófitos semiacuáticos más ampliamente distribuidos fueron *Didymodon tophaceus* (Brid.) Lisa, *Cratoneuron filicinum* (Hedw.) Spruce y *Palustriella commutata* (Hedw.) Ochyra. Siguiendo la tipología de ríos oficial a efectos de aplicación de la Directiva Marco del Agua, la mayor riqueza de especies fue registrada en “Ríos de montaña mediterránea calcárea” y “Ejes mediterráneo-continentalizados”, principalmente en ríos con valores altos de conductividad y pH, así como en un amplio rango de condiciones tróficas. Finalmente, se realizó un análisis de los factores ambientales que más influyeron en la riqueza y la composición de las comunidades de briófitos, y se discute su posible uso como indicadores de calidad del agua.



***Meloneis* (Rhaphoneidaceae, Fragilariophyceae), nuevas y raras diatomeas asociadas a praderas de *Cymodocea nodosa* (Ucria) Ascher-son**

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Los estudios sobre diatomeas bentónicas en ambientes de praderas de fanerógamas marinas sugieren la existencia de una taxo-cenosis rica y diversa prácticamente desconocida en la región Macaronésica. Los trabajos realizados en cinco praderas de fanerógamas marinas de *Cymodocea nodosa* (Ucria) Ascher-son afectadas por crecimientos masivos de *Lyngbya majuscula* Harvey ex Gomont (Cyanophyta) en las islas de Gran Canaria y Fuerteventura durante el verano y otoño de 2014, han revelado una gran diversidad de especies de microalgas y cianobacterias bentónicas y ticoplanctónicas asociada a estas.

Se han identificado un total de 180 taxa mediante microscopía óptica y electrónica de barrido cuyos phyla mayoritarios corresponden a Ochrophyta (diatomeas), Cyanophyta y Dinophyta. En este trabajo se presentan 3 especies nuevas de diatomeas del género *Meloneis* I. Louvrou, D.B. Danielidis & A.Economou-Amilli hasta ahora asociado a ambientes de aguas marinas hidrotermales.

La cantidad de nuevos registros identificados en este trabajo a partir de 45 muestras enfatiza la necesidad de continuar e intensificar el estudio de las diatomeas bentónicas de las praderas de fanerógamas marinas de Canarias.



32 Una oportunidad para una Lista de Algas Bentónicas Marinas de España

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En 2012 responsables del Ministerio de Agricultura, Alimentación y Medioambiente de España (MAGRAMA) a través de su División para la Protección del Mar, se pusieron en contacto con la Sociedad Española de Ficología (SEF), solicitando su colaboración en la elaboración de la denominada Lista Patrón de las Especies Marinas Presentes en España, elemento básico de la Ley 41/2010 de Protección del Medio Marino. En diciembre 2012 se entregaron tres listas iniciales (una por territorio) y en febrero de 2013 se unificó la información en una lista conjunta.

Fue en octubre de 2014 cuando se concretó por parte del MAGRAMA las características de dicha Lista Patrón, con la intención de que fuera publicada a finales de 2015. El compromiso de la SEF y de algunos de su miembros, fue el de participar de manera desinteresada en la elaboración de la parte de la Lista correspondiente a las algas bentónicas y fanerógamas marinas españolas. Esta participación representaba una buena oportunidad para realizar una lista actualizada y consensuada de las algas de nuestras costas.

Siguiendo las normas generales de presentación de la Lista Patrón, el catálogo de las algas se ha realizado considerando las costas Peninsulares y las Islas Canarias subdivididas en cinco sectores, siguiendo la nomenclatura de la Directiva Marco de Estrategia Marina de la UE, que considera cinco Demarcaciones Marinas: Noratlántica, Sudatlántica, Estrecho-Alborán, Levantino-Balear y Canaria. La Lista se ha estructurado siguiendo los criterios sistemáticos y taxonómicos de la base de datos ALGAEBASE, ampliamente aceptados en la actualidad. Se han catalogado las especies y taxones subespecíficos (subespecies, variedades y formas) citados para nuestras costas, indicando su presencia en cada una de las Demarcaciones Marinas, con una "P" si la especie está presente, "SD" si no se tienen datos que corroboren su localización pero con presencia probable, si ha sido citada en las proximidades de las costas de la demarcación. En el catálogo consideramos de interés añadir algunas particularidades de estos taxones, como es la indicación de la localidad tipo (si se encuentra en nuestras costas), si es endémico o presenta área restringida y, si debería tener algún grado de protección. Se indican, también, las referencias bibliográficas que soportan los datos incluidos en la Lista.



Viabilidad de la introducción de algas caráceas para naturalizar estanques en la ciudad de Barcelona

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Las fuentes ornamentales, además de constituir un elemento artístico y estético en las ciudades, pueden contribuir a incrementar la biodiversidad urbana y las ventajas que este hecho lleva consigo. En los últimos años, el criterio higienista y de salud ha hecho que la mayoría de ciudades aborde este tema como una amenaza para la ciudadanía, derivada de la problemática de la Legionella y del mosquito tigre. Este hecho ha provocado que muchas balsas y estanques que antaño alojaban una gran diversidad biológica, se empobreciesen debido a los tratamientos desinfectantes para tratar de eliminar estos organismos.

El principal objetivo de este trabajo ha sido abordar la introducción de algas caráceas para naturalizar láminas de agua, puesto que se ha observado que donde están presentes se consigue: 1) mejorar notablemente el grado de transparencia del agua, 2) disminuir la aparición de algas filamentosas y larvas de mosquitos y 3) obtener un ecosistema diverso, maduro y en equilibrio. Para ello se llevó a cabo un experimento anual de plantación de dos especies de algas caráceas (*Chara vulgaris* y *Chara globularis*) en sistemas acuáticos de la ciudad afectados por diferente grado de presión antrópica. Las porciones seleccionadas de cada especie se plantaron en vasos de plástico, para posibilitar así la mejor toma de medidas (altura) y observaciones quincenales (aparición de estructuras reproductivas i oósporas). Paralelamente, se dispuso de datos físico-químicos también quincenales (temperatura, pH, oxígeno disuelto, conductividad, nitratos y fosfatos).

Gracias a la gran capacidad de adaptación de las dos especies de estudio, éstas lograron crecer y reproducirse en todas las condiciones ambientales, por lo que sería factible su introducción en un amplio espectro de ambientes urbanos. Sin embargo, se observaron diferentes estrategias de desarrollo según la especie. Así, mientras *Ch. vulgaris* invirtió los recursos energéticos en reproducirse, *Ch. globularis* los invirtió en un rápido y elevado crecimiento vegetativo y se reprodujo más tarde. De esta manera, *Ch. vulgaris* actuó enriqueciendo el banco de semillas y *Ch. globularis*, por formar rápidamente una red enmarañada y ser apenas consumida por los herbívoros introducidos, actuó como especie facilitadora del enraizamiento de la primera.

Con esta información se podría diseñar la introducción de poblaciones mixtas, muy frecuentes en la naturaleza, para aumentar sus posibilidades de éxito y perdurabilidad.



34 Where the wild things are: is the higher taxa approach an effective method for selecting important areas for bryophyte conservation?

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Surrogates have been used as a support for conservation practices, since they are easier to assess and less time consuming than collecting species-level data. One of these surrogates is the “higher taxa approach”, i.e., the use of data with coarser taxonomic resolution than the species level, such as genus and family levels, as a surrogate for total species richness.

The aim of this work was to test if higher taxa (Genera) could be used in the selection of important areas for bryophyte conservation, using three different methodological approaches: Scoring, Important Plant Areas and Complementarity-based approach. We tested these approaches in a protected area, the Peneda-Gerês National Park, one of the best studied areas in Portugal for bryophytes and one of the first areas in the country with bryophyte collections. The knowledge of bryophyte distribution in this National Park has been increasing and distribution maps and detailed species lists were recently published, so we thought it would be a good area to test if the higher taxa approach is an effective method for selecting important areas for bryophyte conservation.

Our results showed that localities were ranked in a similar way using species or genera data, regardless of the methodology used. The complementarity-based approach in comparison with other methodologies protected a higher percentage of bryophyte species. In general, the three approaches identified the same areas as important areas for bryophyte conservation. Therefore, for the studied area and independently of the approach used, genera could be used in the selection of important areas for bryophyte conservation.



Modelação da influência de alterações climáticas sobre micro-habitats e padrões de atividade de molusco terrestre (*Geomalacus maculosus*): contributos para a conservação de micro-comunidades biológicas dominadas por criptogâmicas

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A conservação da biodiversidade requer ecossistemas estruturalmente complexos e funcionais ao nível dos macro-habitats e micro-habitats. Na realidade a fragmentação, degradação e perda de habitat são também as principais causas da degradação da biodiversidade nas micro-comunidades biológicas ao nível global. Este trabalho pretende demonstrar aplicação de duas metodologias complementares de modelação de micro-habitats dominados por criptogâmicas, visando contribuir para estimar de que forma estas comunidades poderão ser modificadas por alterações ambientais, utilizando como espécie indicadora do seu estado de conservação a presença, abundância e atividade do molusco terrestre *Geomalacus maculosus*. Esta espécie poderá funcionar como indicador ecológico de integridade destes sistemas, já que se encontra associada a condições ambientais muito específicas, nomeadamente de clima e de micro-habitats.

Para desenvolver os modelos, foram utilizados dados recolhidos entre Julho de 2011 e Junho de 2012 na localidade de Borbela, freguesia do concelho de Vila Real. Ao longo deste período foram realizadas saídas de campo associados a cada um dos objetivos do trabalho: contagem de indivíduos por unidade de área ao longo de 6 segmentos de um muro de granito e registo do comportamento de indivíduos em 2 segmentos do mesmo muro. Adicionalmente foram efetuados levantamentos das características do micro-habitat e condições climáticas.

Para avaliar o impacto de alterações climáticas nas comunidades criptogâmicas através da densidade da *G. maculosus*, foi utilizada uma abordagem holística baseada na metodologia estocástico-dinâmica (StDM), que permitiu simular as alterações e interações entre estes componentes e prever alterações de integridade destes sistemas. Foi ainda construído um modelo reducionista baseado em agentes (Agent Based Modeling – ABM), capaz de recriar a atividade de *Geomalacus maculosus* num ambiente virtual réplica dos micro-habitats observados, e assim analisar os padrões de utilização do espaço e características comportamentais da espécie em condições ambientais diferentes, permitindo explicar os padrões simulados no modelo holístico StDM.

Os resultados observados permitem perceber as alterações potenciais que poderão ocorrer nos micro-habitats e sua influência sobre a integridade de micro-comunidades. As metodologias empregues neste caso de estudo demonstram ainda o enorme potencial que poderão ter para serem aplicadas como ferramentas de gestão e conservação de micro-comunidades e das espécies ameaçadas associadas.



36 Notas sobre la herbivoría en esporófitos de *Buxbaumia viridis* en el Pirineo

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Tradicionalmente se ha considerado el consumo de briófitos por animales como un hecho raro y cuantitativamente poco importante, en especial porque se dudaba de su digestibilidad. Se presentan evidencias del consumo por parte de limacos de cápsulas inmaduras de *Buxbaumia viridis* (Moug. ex Lam. & DC) Brid. ex Moug. & Nestl. en el Pirineo.

Buxbaumia viridis es un briófito excepcional en el que el gametófito está reducido a la mínima expresión, mientras que sus esporófitos son relativamente grandes, presentes a lo largo de todo el año en sus diferentes estadios fenológicos. En el Pirineo, donde la especie está presente en bosques húmedos, particularmente en abetales o abetales-hayedos; es en primavera cuando la cápsula finalmente madura, perdiendo su color verde invernal.

Es precisamente en primavera cuando se ha detectado herbivoría sobre estas cápsulas jóvenes, siendo las lesiones observadas principalmente de dos tipos:

- Setas cortadas, donde falta la cápsula por completo, cuyo depredador no ha sido identificado.

- Cápsulas rasgadas y vaciadas, es el caso más común, en ocasiones sólo queda parte de la cutícula y a menudo sólo en la base de la cápsula. El depredador en estos casos son limacos juveniles (género *Arion*), lo que ha sido observado in situ en dos ocasiones. El animal rasga la cápsula con su rádula y va extrayendo del interior la masa esporal.

Entre los años 1999-2014, se han visitado 40 localidades con poblaciones de *Buxbaumia viridis*, situadas en Navarra y Huesca en la vertiente sur del Pirineo, y en Pyrénées-Atlantiques y Hautes-Pyrénées en la vertiente norte, con el objetivo de estimar el número de individuos. Las visitas se realizaron entre mediados de mayo hasta mediados de julio, en el momento de maduración de las cápsulas. Se han detectado consumos de cápsulas de *B. viridis* en 28 de estas localidades (70%) con lo que puede decirse que este consumo no es accidental. En cuanto a la dimensión del consumo, 10 localidades mostraban un consumo inferior al 20% del número total de esporófitos contabilizados, 14 un consumo medio entre el 21 y el 59%, y 4 de ellas superaban el 60% de esporófitos consumidos.



Nueva aproximación para la descripción de las comunidades líquénicas y el comportamiento específico

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La fitosociología clásica (Braun-Blanquet, 1979), más o menos adaptada por los liquenólogos, se ha usado para la descripción de las comunidades líquénicas con mayor o menor éxito. En los últimos años este campo de investigación no ha tenido más avances, en parte quizás por la dificultad para identificación de las especies y por la gran inversión de tiempo necesaria.

A partir del análisis de los diferentes tipos de contacto entre especies, dentro de una misma comunidad, nos proponemos interpretar la sociabilidad de las especies y evaluar la utilidad de esta información para caracterizar comunidades líquénicas. Para ello hemos estudiado dos comunidades colonizadoras, nitrófilas, de 25 años de antigüedad, que se han establecido sobre madera, una en orientación norte y otra sur (un total de 314 cm²). Los tipos de contacto los hemos definido a partir de la propuesta modificada de Armstrong & Welch (2007). Más allá de la estadística descriptiva hemos realizado sendos análisis de correspondencias (Benzecri J., 1973) sobre tablas de frecuencias de los diferentes tipos de contacto para cada especie. Esto nos permitirá hacer una representación en dimensión reducida y de forma simultánea de las especies y los tipos de contacto, con el objetivo de poder visualizar asociaciones entre ambos factores que nos permitan explicar el comportamiento de estas comunidades.

Resumen:

Recubrimiento (%): Norte -44,09/Sur- 10,09

Nº de especies: Norte-16/Sur-13

Nº de talos: Norte-1070/ Sur-786

Tipo de Contacto

Tregua (%): Norte-23,53/Sur-21,43

Aislado (%): Norte-16,17/Sur-16,1

Recolonizador (%): Norte-13,24/Sur-16,1

En el nacimiento de la comunidad, los talos buscan colonizar los espacios disponibles y crecer (contacto aislado), prefieren hacerse un lugar en el sustrato sin encontrar competencia directa con los otros talos que van constituyendo la comunidad. A medida que la distancia entre los talos vecinos se acorta, el tipo de contacto inicial cambia, hacia nuevos tipos de contacto entre talos vecinos cada vez más próximos (contacto tregua), la aparición de los distintos tipos de contacto que surjan determinara las tácticas de cada especie para lograr seguir formando parte de la comunidad y en la búsqueda de una convivencia armoniosa con sus vecinos (contacto recolonizador). La dinámica de maduración de la comunidad, está condicionado por factores intrínsecos, como la tasa de crecimiento específico, y por factores extrínsecos como la disponibilidad hídrica entre los más importantes dentro del microclima.



38 *Phymatolithon calcareum* in maerl beds from Atlantic Europe: insights from a species-specific microsatellite study reveal considerable clonality

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Maerl beds are widespread accumulations of slow-growing, unattached non-geniculate red algae that build habitats harbouring a high biodiversity of species. Within Atlantic Europe, the British Isles, Brittany and Galicia are regions with abundant maerl beds; however, several studies have warned about their reduction in extent and quality. Currently, appropriate management of maerl beds is lacking mainly because of incomplete knowledge about the diversity and connectivity of maerl-forming species. Here, we show the first species-specific microsatellite study on the genetic diversity and structure of a major maerl-forming species in Atlantic Europe: *Phymatolithon calcareum* (Pallas) W. H. Adey & D. L. McKibbin. Fourteen maerl beds from the British Isles to south Portugal were studied. Our sampling plan also included a more detailed regional-scale study in the rías of Galicia (North-West Spain). Our data show a high level of clonality in *P. calcareum*, but variable among beds even within the same region. Genetic diversity was low but populations were highly differentiated even at regional-scale. These results may have profound implications for the conservation and management of *P. calcareum* and the whole maerl community. Once disturbed/destroyed, the unaided recovery of genetic diversity in an impacted maerl bed seems unlikely due to the restricted connectivity between beds revealed by our data.

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Produção de túberas (*Terfezia* spp.)– Novas espécies para Portugal 39

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A produtividade das túberas (*Terfezia* spp.) está condicionada por diversos fatores, dos quais importa destacar: existência da planta hospedeira, existência de inóculo suficiente, o regime hídrico anual e a capacidade de recolha no terreno.

Atualmente, a maioria dos proprietários de áreas produtoras de túberas não exploram este recurso, ocorrendo a recolha desregrada por terceiros para consumo próprio ou venda clandestina para o sector restauração. Acresce que o produto carece de certificação alimentar.

O cultivo de túberas é uma atividade que não implica a mobilização do solo, dado que esta pode romper a ligação entre o sistema radicular e o fungo simbiote e reduzir a taxa de colonização devido à destruição do micélio extra-radicular. A médio e longo prazo, as condições de estrutura e fertilidade do solo vão melhorando até atingirem o patamar de estabilidade próprio do sistema, com efeitos benéficos na manutenção da biodiversidade. No presente trabalho desenvolveu-se a tecnologia associada à obtenção de plantas micorrizadas com *Terfezia* spp. e adicionalmente pretendeu-se confirmar quais as espécies de *Terfezia* que ocorrem espontaneamente em Portugal.



40 Project MOVECLIM: Studying bryophyte macroecological patterns along elevation transects across archipelagos

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It is reasonably asserted that global change will impact Earth differently, with more threatening effects on the most vulnerable areas, such as islands, humid zones, forests or mountains. Each one of these ecosystems is subject to a different group of stresses; however, they all need to be thoroughly investigated and model organisms, such as bryophytes, may contribute to the production of well-adjusted restoration and management plans, while their study increases the knowledge regarding the biology, physiology and ecology of species, either common or conservation concern.

Project MOVECLIM (Montane vegetation as listening posts for climate change) intends to investigate spatial changes in diversity for bryophytes and ferns along altitudinal transects in four oceanic (La Palma, La Réunion, Pico, Terceira) and one continental island (Madagascar). Elevational gradients represent unique landscape-scale experiments to describe biodiversity patterns and to study responses of biota to climate change. Epiphytic bryophytes were selected because they are a diverse group in tropical and subtropical ecosystems, although poorly studied due to their challenging taxonomy.

This presentation's research questions are: (1) How are the bryophyte' communities structured at different spatial scales in each island? (2) Are the diversity patterns across islands congruent or idiosyncratic? (3) What is the relative contribution of different factors in shaping the species richness distribution patterns (geometric constraints, climate, area, maximum elevation)?

A homogeneous hierarchical sampling strategy for each transect was accomplished setting up, at 200 m elevation intervals, two permanent plots (100 m²) and, when possible, climatic sensors. All plots were set up in native vegetation, mostly forests.

This methodology, used across a latitudinal gradient, for ecologically relevant, spore producing plants, has ecological implications to the understanding of insular community assemblages, scale effect and elevational shifts under a changing environment.

With this project we aim to contribute to the CBD (Convention on Biological Diversity) Aichi Biodiversity Targets, and to foster the understanding of community assemblages, scale effect and elevation shifts under a changing environment.



Saxicolous lichen diversity in a complex landscape in NE Iberian Peninsula

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The county of La Garrotxa (NE Iberian Peninsula) hosts a complex geological landscape due to the volcanic activity in the Holocen, about 17000-15000 years B.P. Those igneous rocks appeared in the middle of a region dominated by sedimentary rocks from different origins and characteristics (limestone, sandstone, schist). The availability of such a lithological diversity has led to colonization by a rich lichen biota.

A survey on 36 sites, including most of available lithological substrates, has provided a catalogue of 273 taxa. 50 taxa were terricolous species growing on the soil accumulated on top of stones or filling crevices and cracks. Among the saxicolous species, 12 can be considered as ubiquitous species, mainly growing on bark, but also colonizing stone surfaces. 211 species are considered strictly saxicolous.

Species composition differs dramatically between those communities growing on volcanic rocks from those colonizing sedimentary stones. Moreover, specific composition of lichen communities varies depending on the type of sedimentary stones.

Analyses on the abundance of functional traits and species richness between sites, considering the substrate, have reflected some differences on few traits. Communities are dominated by crustose thalli; however, endolithic thalli have an important role on limestone, but being almost absent on volcanic stones. The most abundant photobiont is a trebouxoid alga; otherwise, trentepohlioid algae and cyanobacteria are rare. Nevertheless, some species with fruticose thallus and cyanobacteria as a photobiont are well represented on limestones. The functional trait showing a clear pattern is the preference on pH of substrate. Acidophilous and neutrophilous species are almost restricted to igneous stones, while basophilous species are the dominant group on calcareous sandstone and limestone. Nonetheless, sandstone occasionally hosts neutrophilous and acidophilous species, colonizing siliceous pebbles dispersed in the calcareous cement. The abundance of species tolerating heavy disturbances ranges between the 20% and 40%, and is higher on sandstone than other rocks; otherwise, abundance decreases in Eocene limestone, representing less than 20%.



42 The new World Checklist of Hornworts and Liverworts

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A new checklist for all known and recognized hornworts and liverworts of the world has been compiled (Söderström et al. 2015). The aim has been to provide a standard list of existing taxa and to harmonize the nomenclature and taxonomy. It is a cooperation between over 40 bryologists worldwide over the last 6 years. Prior to the publication, several nomenclatural and taxonomic problems have been solved and published in 75 notes as open access in the journal *Phytotaxa*. This has led to several name changes based on recent studies (both morphological and molecular studies) and corrections of names not conforming to the requirements for the Botanical Code. Currently we recognize 7454 species in 398 genera, 92 families, 20 orders, 7 classes and 2 phyla. There are in addition over 500 notes on taxonomy and nomenclature of individual taxa. All protologues, both of accepted names and their basionyms, are checked and cited, resulting in a reference list of 3088 references. Some of the major nomenclatural changes will be enumerated and discussed here.



Airborne fungal spores in Badajoz (SW Spain) and weather influence in their seasonal distribution 43

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Introduction. Badajoz is located in the SW of Spain, close to Guadiana river. The main land uses some km around the location were irrigated crops, cereal crops and grassland pastures from green oaks dehesa. The aims of this work were to know the seasonal distribution of airborne fungal propagules for one year and analyses rain and temperature as the main influencing factors.

Material and Methods. Sampling was performed from April 2009 to March 2010 in Badajoz (SW of Spain). Air was aerobiological monitored with a Hirst spore trap 127 days distributed along the period studied. Petrolatum white was used as adhesive. Spore was identified and counted at 1000x magnification with one or two horizontal scans in the center of the slide. Data were provided as daily or hourly spores concentration per cubic meter. Weather data were provided by a meteorological station close to the spore trap.

Results. 86 spore types were identified including hyphae as propagules. Average spore concentration was 3634 spores/m³. Maximum values were reached on October 17th with 25603 spores/m³. 39 spore types reached average levels above 10 spores/m³. Twelve spore types or propagules represented more than 80% of total, in order with average concentration in spores/m³: *Cladosporium cladosporioides* (1565), *Cladosporium herbarum* (278), *Ustilago maydis* (170), *Ustilago cynodontis* (150), *Colletotrichum* (147), basidiospores no specified (126), *Aspergillus-Penicillium* (107), *Mycosphaerella* (92), hyphae (90), hyaline *Leptosphaeria* (78), *Amanita* (56) and *Alternaria* (49). Maximum concentration was reached in October due to *Cladosporium cladosporioides* mainly, nevertheless other fungal types reached maximum in June (*Cladosporium herbarum*), May (both *Ustilago* types) or August (hyphae). Total rain for the period studied was 781.4 mm, nearly twice as normal values, nevertheless nearly half of the rain appeared in winter.

Conclusions. Airborne fungal propagules at Badajoz were dominated by *Cladosporium cladosporioides* type that represented more than 40% of total reaching maximum values in autumn. In Spring *Ustilago* teliospores showed their maximum concentration and in summer a reduction in *Alternaria* and other basidiospores was appeared. Rain may play a relevant role for some spore types nevertheless temperature was a general more restrictive factor, both with low and very high values reducing spore concentration.



44 Airborne fungal spores in Payerne (Switzerland)

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Introduction. Fungal propagules in the air are present along the year with seasonal pattern depending on weather parameters. Their importance lies in relation to allergy and phytopathology. Aims of this work was to provide first estimation of airborne fungal concentrations in Payerne (Western Switzerland).

Material and Methods. Sampling was performed in 2013, between March 3rd and August 8th. A Hirst volumetric spore trap was used; it was located on the roof of the MeteoSwiss two-storey building in Payerne (Switzerland), a rural site. The adhesive used was silicon. Spore count was performed at x1000 magnification with one horizontal (longitudinal) transect in the center of the slide. Data were provided as daily or hourly spores concentrations per cubic meter.

Results. 66 spore types were identified. Average spore concentration on the whole period was 4146 spores/m³. Maximum values were reached on July 19th (26109 spores/m³) and on August 6th (24708 spores/m³). 26 spore types reached average levels above 10 spores/m³. Five spore types represented more than 80% of total, by order of average concentration [spores/m³]: *Cladosporium herbarum* (1941), *Cladosporium cladosporioides* (809), *Coprinus* (208), *Venturia* (183), *Leptosphaeria* (128) and *Ganoderma* (106). These spores reached their maximum concentrations in summer; nevertheless for *Venturia* and *Leptosphaeria* some very high values were reached only a few days. Other spore types, although with lower average values for the whole period, reached significant values in summer, such as *Alternaria* with frequent daily values around 50 spores/m³ and *Chaetomium* with a peak of 240 spores/m³ on July 13th. In spring Dyatrypaceae is noticeable with the highest values in march (103 spores/m³).

Conclusions. Airborne fungal propagules in Payerne showed a seasonal pattern, increasing from low values in late-winter to maximum ones in summer. Levels above 5000 spores/m³ were constant in summer from mid-June. Conidia from *Cladosporium* species were the most frequent and they determined the maximum peak of total concentration, followed by basidiospores from *Coprinus* and *Ganoderma*, and ascospores from *Venturia* and *Leptosphaeria*. *Alternaria* conidia were concentrated mainly in summer.



Airborne spores of *Alternaria* in three cities of Extremadura (SW Spain) and different factors influence in their seasonal distribution 45

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Introduction. The genus *Alternaria* is recognized as important pathogen in plants, and *Alternaria* allergens are one of the most important causes of respiratory allergic disease in Europe. Extremadura is a region located in the SW of Spain; it has an extensive territory with many different landscapes. The aims of this work were to know the seasonal distribution of airborne fungal spores of *Alternaria* for three years in three cities of Extremadura, and analyze the main influencing factors, like weather and land uses.

Material and Methods. Sampling was taken from March 2011 to December 2013 in Don Benito, Plasencia and Zafra. A Hirst spore trap was used of a continuous way. Spores were identified and counted at x400 microscopic optical magnification with two longitudinal scans in the centre of the microscopic slide. Data were provided as daily or hourly spores' concentration per cubic meter. The main land uses some km around the cities were irrigated crops, cereal crops and grassland pastures in Don Benito, oaks forests and olive crops in Plasencia, and oak forests, grassland pastures and olive crops in Zafra. Weather data were provided by a meteorological station close to the spore traps. Non parametric correlations (Spearman test) were used to compare with weather parameters. Wind direction influence and their relationships with land uses were analyzed using a GIS program.

Results. *Alternaria* concentrations were higher in Don Benito (35.7 spores/m³), followed by Zafra (17.5 spores/m³) and the lowest concentrations in Plasencia (11.4 spores/m³). Concentrations decreased year to year, probably due to the increase of rain and decrease of temperature. Maximum monthly average values were recorded in September and October (Don Benito and Plasencia) or during May and June (in the case of Zafra). With respect to analysis with daily weather parameters, statistically significant correlations appeared in 51 cases out of 63. In the hourly analysis, positive significant correlations were found with temperature, and negative with relative humidity and rain. Daily spores sums were the highest in Don Benito when wind blew from west (proceeding to irrigated crops and grassland pastures), then in Plasencia that did not showed a clear pattern and finally, and the lowest in Zafra, when wind blew from west (grassland pastures).

Conclusions. Don Benito, where there were much irrigated crops and grassland pastures surrounded the city, showed the maximum concentrations. Airborne conidia of *Alternaria* were higher when temperature recorded were high and rainfall was low. Bimodal seasonal distributions were found. It seems that the weather parameters and land uses were important factors for explain the *Alternaria* concentrations.



46 An ecophysiological study across the Drake Passage on the saxicole tundra forming lichens of *Usnea* genus

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Over the last 50 years stations on the Antarctic Peninsula have recorded a marked increase in near-surface air temperature. The rapid recent warming of the Antarctic Peninsula has resulted in changes in the terrestrial ecology. However, the biological records are shorter in length than the meteorological data, and observed changes are difficult to interpret. In order to be able to predict the effects of these changes one suggestion is to use small scale models on individual species, and direct comparisons between slightly warmer or cooler sites, which can be achieved through latitudinal displacements. Lichens appear to be particularly useful for monitoring climate change as they appear to respond to such gradients. However, the actual links between lichen performance and environmental factors are poorly understood and it is our aim to contribute to clarify them. In this study we focus on two islands located at opposite sides of Drake Passage: Navarino Island (Tierra del Fuego, north side) and Livingston Island (West Antarctic Peninsula, south side). Southern South America is the natural extension of the Antarctic latitudinal gradient, and both regions have very oceanic climate although colder on the south side of the Drake Passage. On either side there are similar terrestrial ecosystems dominated by *Usnea* lichens, known as high Andean tundra in Tierra del Fuego and as Antarctic tundra in West Antarctic Peninsula. Also, both regions remain relatively pristine and unaltered, which make them natural laboratories for plant research. Four *Usnea* species were studied; two occurring on both sides of the Drake Passage (*U. antarctica* and *U. aurantiaco-atra*), and the other two occurring only on the northern side (*U. trachycarpa* and *U. ushuaiensis*). Local distributions of these species were studied at each study site along the altitudinal gradient of about 300 m, and microclimate was recorded for the same area over nearly one year. The photosynthetic response of each species to temperature, light and thallus water content was subsequently determined under controlled conditions in the laboratory. Interestingly, all species had nearly identical responses of net photosynthesis to temperature and light, and only slight differences in relation to thallus water contents were found. In contrast, differences in distribution and environmental conditions were found between species and studied sites. Variation in overall performance in the absence of photosynthetic differences has been suggested to be a result of differing lengths of the activity period, and in light of that scenario we interpret our results.



Assessing the impact of alkaline dust pollution on the genetic variation of lichen *Usnea subfloridana* (lichenized Ascomycota, Parmeliaceae)

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Environmental pollution is a consequential threat to genetic diversity of species. However, very little is known whether and how air pollution, especially dust pollution, impacts the genetic diversity of lichens that are well-known indicators of environmental quality. Alkaline dust pollution may impact lichens directly, changing element concentration in lichen thalli, inducing chlorophyll degradation of photobionts or causing necrotic damages of thalli. Long-term alkaline dust pollution, which increases the pH value of tree bark, influences species richness and composition of epiphytic lichen communities. We aimed to study the effects of alkaline dust pollution from unpaved road on the genetic variation of *Usnea subfloridana* Stirt. populations using microsatellite markers. We sampled 310 *Usnea* thalli from Norway spruce (up to six meters from the ground) in *Pinus sylvestris*-dominated boreal forest stands in southern Estonia (58°8'N 27°2'E); four of these lichen populations were exposed to long-term dust pollution, and four populations were from unpolluted forest stands. We used nine unlinked mycobiont-specific polymorphic microsatellite loci to quantify the genetic variation of *U. subfloridana* populations. In total, we analysed 274 specimens and we found 72 alleles at nine microsatellite loci, which provided 168 different genotypes across eight lichen populations. All microsatellite loci were highly polymorphic. The generalized linear model (GLZ) showed that the presence of dust pollution and sample size revealed significant influence on allelic richness (A) and Shannon's information index (I) per population; those measures were higher in unpolluted forest sites than in polluted sites. The average age of spruces in forest sites did not reveal significant influence on any measures of genetic variation in our analyses. We suggest that the observed similarity of clonal diversity (M) indicates no differences in population dynamics; *U. subfloridana* populations from unpolluted and polluted forest sites belonged to the identical demographic stage, obviously contributing to the first generation after establishment. This is the first record demonstrating that long-term alkaline dust pollution had a negative impact on microsatellite variation. We suggest that combined complex of processes including the decline of suitable habitats and decrease of population size may reduce genetic variation of *U. subfloridana* in the vicinity of the source of dust pollution. We presume that loss of genetic variation in populations of common lichens may be used as a bioindicator to highlight the potentially threatening environmental disturbances. However, more research is needed to better understand the role of different variables and processes hidden behind the changes.



48 Briófitos asociados a minas de cobre en la Sierra Norte de la Comunidad de Madrid

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Los briófitos se consideran buenos indicadores de contaminación por metales pesados debido a su baja resistencia a la entrada de contaminantes. Los medios ricos en metales pesados pueden albergar especies y comunidades briofíticas tolerantes o metalófilas, que, a pesar del alto interés de sus adaptaciones especializadas, y de la posible presencia de táxones raros o amenazados, están generalmente mal conocidas. La minería es una de las actividades que inciden más en la contaminación del sustrato con metales pesados, además de producir profundas perturbaciones físicas.

En este estudio se pretende encontrar especies asociadas o tolerantes al cobre dentro de la Península Ibérica. Se ha centrado en cuatro minas de la Sierra Norte de la Comunidad de Madrid, donde existen abundantes explotaciones antiguas de cobre, de pequeña entidad, abandonadas desde principios del siglo XX. Debido a la falta de trabajos previos sobre el tema, se ha intentado realizar un catálogo base de los briófitos que se pueden encontrar en las explotaciones dedicadas al cobre, que sirva de precedente en este campo. En cada mina se reconocieron y muestrearon por separado dos áreas con aparentes diferencias en cuanto al grado de afección por cobre, en función de la presencia y cobertura de la vegetación vascular, la textura y color del sustrato, y la abundancia de briófitos. Los datos se confirmaron mediante análisis del contenido en metales pesados por TXRF.

En total se han encontrado 34 especies diferentes entre musgos y hepáticas. Cabe destacar la ausencia de especies claramente metalófilas como las del género *Scopelophila*, lo que puede deberse a la excesiva xericidad de la zona de estudio. Se detecta un empobrecimiento en las zonas afectadas por cobre (19 especies, frente a las 26 encontradas en las caracterizadas como menos contaminadas). En casi todos los sustratos aparecen musgos tolerantes a la perturbación: *Bryum dichotomum*, *Syntrichia ruralis* y *Didymodon acutus*. Se comprobó que los musgos pleurocárpicos aparecen únicamente en las zonas aparentemente menos contaminadas. En las zonas que habían sufrido una mayor alteración (pH 4,4) no se encontró ningún briófito.

El escaso número de especies y el pobre desarrollo de las muestras, en comparación con otros estudios de briófitos y polución, en especial en medios urbanos, también altamente perturbados, podría deberse a una mayor sensibilidad al cobre por parte de los briófitos.



The herbivorous interaction between midge species, *Scatopsciara cunicularius* (Sciaridae: Diptera) and the thallose bryophyte, *Marchantia polymorpha* 49

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This study was initiated when we observed that greenhouse cultures of the thallose liverwort *Marchantia polymorpha* were infested by larvae belonging to the midge family Sciaridae, causing considerable damage to the living thalli. The sciarid turned out to be *Scatopsciara cunicularius* – a species described as new to science from Germany over 70 years ago and never observed since. We noted that the sciarid fly population seemed to expand during early summer, when the temperatures increased in the greenhouses, suggesting that the life span, especially the larval stage is dependent on temperature. We therefore compared the performance of larvae reared at two constant ambient temperatures, 12.3 ± 0.6 °C and 22.6 ± 1.7 °C, respectively, in terms of feeding activity. We also studied the duration of the complete life cycle of *S. cunicularius*. The experiments were carried out inside Petri dishes, at a relative humidity between 101–116%, with a 14/10h day/night-cycle. The developmental period of the sciarids increased in the colder temperature. Larvae reared at colder temperature fed slower but over a longer period than those reared at warmer temperature, causing larger damaged area to the liverwort thallus. The mean periods of egg incubation, development and longevity at the higher temperature were: egg, 4.2; larva, 20.1; pupa, 3.9; and adult, 4.9 days, whereas those at colder temperature were: egg, 13.0; larva 95.0; pupa, 10.6; and adult 7.5 days, respectively. The results suggest that *S. cunicularius* is a promising future agent for biological control of *M. polymorpha* in greenhouse cultures.



50 Distribución altitudinal de los líquenes terrícolas en los prados alpinos de Andorra

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Andorra, microestado situado en el corazón de los Pirineos, es un lugar idóneo para realizar estudios de flora liquénica alpina teniendo en cuenta que el piso alpino ocupa el 37% del territorio (Mapa Digital dels Hàbitats d'Andorra, 2012). Por sus características y su vulnerabilidad a los cambios ambientales, los prados alpinos son ecosistemas adecuados para evaluar la influencia del calentamiento global sobre la distribución altitudinal de los líquenes terrícolas, los cuales a diferencia de los saxícolas dependen fuertemente del manto nival para su supervivencia en los meses de invierno (Bjerke, J.W., 2008). Los propósitos generales del presente trabajo son ampliar la flora liquénica andorrana, determinar los patrones de distribución altitudinal de las especies identificadas y seleccionar los taxones con potencial bioindicador del calentamiento global atendiendo a su área de distribución, su amplitud ecológica y su facilidad de identificación. Se tomaron muestras en 5 localidades por encima del nivel del bosque (entre 2400 m i 2900 m) mediante transectos altitudinales cada 100 m entre los años 1996 y 1999. Los resultados preliminares obtenidos nos han permitido i) incrementar el conocimiento de la flora liquénica de Andorra en más de 20 nuevas citas, ii) conocer las distribuciones altitudinales de cada uno de los taxones estudiados y iii) proponer una serie de especies potencialmente bioindicadoras del calentamiento global en prados alpinos acidófilos. Entre éstas destacan *Alectoria ochroleuca*, *Flavocetraria cucullata*, *F. nivalis*, *Lepraria crassissima*, *Ochrolechia frigida*, *Pycnothelia papillaria*, *Solorina crocea*, *Thamnolia vermicularis* y *Vulpicida tubulosus*. Dadas las variaciones de la temperatura media anual registradas en el Principado de Andorra en el periodo 1934-2008 (Esteban, P. et al., 2009) es posible que el patrón altitudinal obtenido haya variado en la actualidad como consecuencia del incremento de temperatura y, a su vez, de la reducción del período de innivación. En este sentido sería conveniente actualizar las prospecciones en las mismas localidades estudiadas.



The photoreceptor of ultraviolet-B radiation (UVR8) in *Marchantia polymorpha* 51

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Since the recent finding of the photoreceptor protein UVR8 in *Arabidopsis thaliana*, the knowledge of the responses of the photosynthetic organisms to UV-B radiation has considerably grown. This photoreceptor protein undergoes a conformational change after UV-B exposure, changing from a dimeric form to the functional monomers. This triggers a series of responses that help the organism to adapt to this stimulus. Some of these responses are for example the expression of certain genes implied in the biosynthesis of flavonoids and/or morphogenetic aspects.

From an evolutionary perspective, the study of UVR8 in bryophytes has great importance, due to the fact that these organisms were the first true plants that colonized terrestrial ambients with much more UV-B radiation than the primordial aquatic systems. In bryophytes, UVR8 has only been studied in the model moss *Physcomitrella patens*, which has two UVR8 genes and at least one of them is functional because it complements the *Arabidopsis uvr8* mutant.

Thus, our aim was to study the presence of UVR8 photoreceptor in *Marchantia polymorpha*. Given that liverworts were the first true plants colonizing land, *Marchantia* UVR8 may help understand the adaptation process that allowed plants to spread and dominate terrestrial environments and also how UVR8 protein has evolved in plants.

In this way, we firstly established cultures of *Marchantia polymorpha* in Petri dishes, using an accession which is currently been sequenced. Then, its RNA was isolated and corresponding cDNA synthesized. Using primers designed for the conserved regions of the UVR8 gene of other species, a fragment of *Marchantia* UVR8 was amplified and sequenced. Using this fragment and RACE-PCR technique, complete cDNA of UVR8 was obtained.



52 BRIOFLORA TERRÍCOLA EN OLIVARES NO LABRADOS DE LA PROVINCIA DE JAÉN (ANDALUCÍA, ESPAÑA)

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It has been studied the terricolous bryophyte flora from 26 untilled groves of Jaen province. It has been cataloged 40 species, 39 mosses and 1 liverwort, belonging to 6 families: Pottiaceae (30), Bryaceae (4), Funariaceae (2), Orthotrichaceae (2), Dicranaceae (1) and Lunulariaceae (1). It has been conducted a parallel study of the abundance and frequency of species, resulting in an average of 72% coverage and 12 species for each olive grove. The dominant species, present in more than 90% of the groves, are *Ptychostomum imbricatum* (Müll. Hal.) Holyoak & N. Pedersen, *Bryum argenteum* (Hedw.), *Didymodon vinealis* (Brid.) R.H. Zander, *Didymodon luridus* Hornsch. and *Aloina aloides* (Koch ex Schultz) Kindb., followed by *Barbula unguiculata* Hedw., *Crossidium crassinerve* (De Not.) Jur. and *Pseudocrossidium hornschurchianum* (Schultz) R.H. Zander, with a frequency greater than 50%. It is also noteworthy that these 8 species represent 85% of the total area occupied. It draws the conclusion that, if bryophytes were used as an alternative vegetation cover to vascular plants in these environments, it is possible to achieve high coverage of them handling a small number of species.

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Los autores agradecen a la Fundación Caja Rural de Jaén, a la ATPIOlivar y al IFAPA el apoyo recibido para la consecución del presente trabajo.



DetECCIÓN Y CONTROL DE CIANOBACTERIAS EN FUENTES ORNAMENTALES URBANAS DE LA CIUDAD DE BARCELONA

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Introducción:

En una actividad de divulgación científica se detectó una elevada abundancia de *Microcystis aeruginosa* (cianobacteria potencialmente tóxica) en una de las fuentes ornamentales de un jardín público en la ciudad de Barcelona. Desde BCASA (Medio Ambiente y Servicios Urbanos-Hábitat Urbano; Ayuntamiento de Barcelona) se lanzó una propuesta de obtener más datos respecto a la potencial toxicidad de las aguas de las distintas balsas y fuentes de este jardín urbano naturalizado debida a la presencia de cianobacterias.

Objetivos:

1.- Detectar las fuentes con mayor riesgo de toxicidad debida a cianobacterias u otros organismos fitoplanctónicos. 2.- Identificar las especies potencialmente productoras de cianotoxinas. 3.- Cuantificar sus abundancias. 4.- Adoptar medidas de control "no agresivas" para alcanzar concentraciones de cianotoxinas inferiores a los valores límite recomendados por la OMS.

Material y métodos:

Se realizó un muestreo selectivo de las masas de agua con mayor probabilidad de contener fitoplancton tóxico (poca tasa de renovación y/o elevada temperatura del agua) con el fin de detectar floraciones o potencialidad de floraciones.

Se llevó a cabo la identificación y recuento de las especies potencialmente tóxicas y análisis de microcistinas de cada localidad.

Resultados y conclusiones:

Se identificó *Microcystis aeruginosa* en todas las localidades muestreadas, aunque sólo en una de ellas se detectó la floración tóxica así como valores detectables de microcistinas.

Se identificó el origen de la floración y se propusieron medidas correctoras para el control de la floración y para evitar la dispersión de la especie tóxica por todo el conjunto de masas de agua del jardín urbano. Puesto que se trata de un jardín urbano naturalizado, donde coexisten otras especies (anfibios, peces, etc.) se buscaron soluciones no tóxicas, que afectaran solamente a la especie causante de la floración tóxica. Se realizaron actuaciones que modificaron las condiciones que dieron origen a la floración, es decir, se incrementó de la tasa de renovación del agua, se aumentó la turbulencia y se eliminó parte de la biomasa algal mediante una serie de vaciados parciales y periódicos de la fuente problema.

Al mismo tiempo se llevó a cabo un seguimiento de la floración mediante análisis de las densidades celulares y de microcistinas hasta que se consiguieron los efectos deseados: el control de la floración algal y la disminución de las microcistinas.

Finalmente se restauró de nuevo el circuito de aguas del jardín urbano sin haber tenido afectaciones a otras especies sensibles a tóxicos como anfibios o peces.



54 Efectos de las microcistinas y los extractos de cianófitos en la fotosíntesis de algas fluviales: Implicaciones ecológicas y de gestión.

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Las cianofíceas (Cyanobacteria) están ampliamente distribuidas por todo tipo de ambientes acuáticos y algunas especies sintetizan compuestos tóxicos cuyas funciones naturales se desconocen. Las cianotoxinas pueden afectar a los organismos acuáticos, desde los invertebrados a los vertebrados y representan un riesgo sanitario para las poblaciones humanas. Las microcistinas son las cianotoxinas más frecuentemente citadas, se conocen un número muy elevado de variantes y pueden estar presentes en una gran variedad de cuerpos de agua, aunque se desconocen los factores que inducen la producción de estos compuestos o los efectos que pueden producir en los diferentes organismos acuáticos.

En este trabajo se analizan los efectos de las microcistinas y los extractos de cianófitos en la fotosíntesis de algas fluviales pertenecientes a dos grupos taxonómicos que se consideran Buenos indicadores de calidad: rodófitos (Rhodophyta) y diatomeas (Bacillariophyta) para tratar de dilucidar el papel que pueden jugar las microcistinas y las cianofíceas en la competencia intraespecífica y en la fisionomía de las comunidades de productores primarios fluviales.

Los datos muestran que tanto los extractos como las microcistina_LR pura afectan a la actividad fotosintética de todos los organismos testados: las diatomeas (*Fistulifera pelliculosa*, *Gomphonema parvulum*, *Nitzshia frustulum* y *Stephanodiscus minutulus*) y la rodofícea (*Chroothece richteriana*) a concentraciones ambientalmente relevantes. Los efectos observados son positivos o negativos dependiendo de las especies y pueden incrementarse o desaparecer con el tiempo.

Las microcistinas y otros compuestos presentes en los extractos de cianobacterias pueden explicar la competencia interespecífica observada frecuentemente en la naturaleza, especialmente en arroyos calcáreos y después de fenómenos catastróficos como inundaciones o fuertes lluvias, que pueden destruir parcial o completamente los tapetes de cianofíceas y liberar los compuestos tóxicos que contienen, en una escala temporal estacional.



How to protect bryophytes from being drowned or lost? A framework for the efficient monitoring of priority bryophyte diversity 55

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Bryophytes are one of the most common groups of macrophytes in mountainous riverscapes and are recognized indicators of ecological integrity, anthropogenic impact and microhabitat heterogeneity. In Portugal, these distinctive communities count some rare and endemic species with conservation interest in their composition, and are associated with many priority aquatic and semi-aquatic European habitats.

However watercourses are subjected to several anthropogenic impacts such as dams, channelization and alteration of river beds for the construction roads and railways, among others. In this work we developed a framework to establish an efficient monitoring network of high conservation-interest bryological communities in riverscapes of Northern Portugal, taking into account the existing anthropogenic impacts.

A three step modelling approach was employed: (1) community-level modelling approach using biomod2 to produce a spatially-explicit model of community types (2) Zonation software to spatialize conservation priority for bryophyte communities with high conservation value; and (3) a monitoring network using “sampling” package based on unequal-probability, stratified random sampling and priority ranking. Four sampling strata were employed and obtained through the intersection of two criteria: (i) protection status of the areas (ii) presence of potential impacts from human infrastructures.

We obtained a spatialized potential distribution of major bryophyte community types in riverscapes and a spatial prioritization of the territory for the protection of high conservation-interest bryophytes at the regional level. This allowed the identification of key conservation areas. Additionally, a network to monitor conflicts between priority conservation areas and human impact was also developed.

Using bryophytes as model organisms we demonstrated the utility of modelling techniques to assist the development of efficient biodiversity monitoring networks at regional scales: This work reinforces the usefulness of bryophytes as indicator organisms for biodiversity monitoring in riverscapes and the need for monitoring schemes to account for cumulative impacts in biodiversity values inside and outside protected areas.



56 Long-term effects of dangerous substances on diatoms (Bacillariophyta) and their communities as measured in the Ebro River Basin (NE Spain)

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The Water Framework Directive (WFD) and consequent European Union legislation have focused on the importance of dangerous substances and pollutants to add to the measure of water quality. In order to study the long term effect that a selection of those substances have on diatom communities, the 11 years' worth of biological and physical-chemical data acquired at the Ebro River Basin by the Spanish authority in their bio-monitoring control network have been studied in adjacent sites located around and in effluent affected river sections. The main focus on the effects was placed onto changes in community structure, species diversity and diatom characteristics, such as size categories, life-forms and ecological guilds of the main diatoms found (surpassing 3% of the total community). A significant difference in diatom community structure has been observed most significantly in the sites located downstream to the effluent affected sites. These same differences have not been apparent in the comparison to upstream located communities. Temporal changes have been established, since a reduction of centric and planktonic species has been observed since 2008 and the motile guild increased not only in polluted sites but also varied through time. In regard to the life forms there was a tendency of non-attached and adnate diatoms to be found chiefly in effluent affected sites. Most changes in size were due both to temporal and spatial variability. Polluted sites tended to show increased cell size or to provoke a downstream size-increases.



Pulp mill industry emissions biomonitoring, and impacts on the photosynthetic performance of lichen transplants 57

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Lichen transplants of the species *Flavoparmelia caperata* were used to evaluate the accumulation of thirty-three elements putatively emitted from Kraft pulp mill industry, in a study conducted at Figueira da Foz (Portugal). Chlorophyll a fluorescence kinetics studies were performed in the transplanted lichens, in order to evaluate the hypothetical effect of elemental accumulation on photosynthetic performance. It was intended to evaluate the effects of distance — 500, 1000, 1500 and 2000 m — and period — 45, 90, 135 and 180 days — of exposure on both elemental accumulation and chlorophyll a fluorescence kinetics. Most elements — Al, B, Ba, Ca, Co, Cr, Cu, Fe, Hg, Li, Mg, Mn, Mo, Na, Ni, P, S, Sb, Sc, Sr, Ti and V — were found in significantly higher concentrations in the transplants exposed at 500 m of distance from the point source. Nearly half of the elements — B, Ba, Cr, Fe, Hg, Mg, Mn, Mo, Na, P, Pb, S, Sb, and V — were also found in significantly higher concentrations in the transplants exposed during 180 days. The chlorophyll a fluorescence kinetics parameters F_v/F_m and F_m were significantly decreased in the transplants exposed at 500 and 1000 m from the pulp mill and in those exposed during 135 and 180 days. Both Φ_{PSII} and Φ_{Exc} decreased significantly after 180 days of exposure. Significant negative correlations were identified between F_v/F_m and the concentrations in lichen transplants of B, Ba, Co, Fe, Hg, Mg, Mn, Mo, N, P, S, Sb, and Zn; F_m and Ba, Co, Hg, Mn, Mo, N, P, S, Sb, and Zn; Φ_{PSII} and N and P; and Φ_{Exc} and Mn, N, P, and S. These results indicate that lichens were subjected to stress and that photosynthetic performance was compromised in lichen transplants. This was related to the accumulation of several elements, which this study points to be emitted by a Kraft pulp mill industry.



58 Respuesta de líquenes y musgos como bioindicadores de altas concentraciones de CO₂

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En la planta de inyección en suelo de CO₂ situada en Cubillos del Sil (León) se ha estudiado recientemente la respuesta de *Parmelia sulcata* a concentraciones bajas de CO₂. Los resultados obtenidos no han sido satisfactorios, siendo incapaces de detectar alguna variación que pudiera servir para poder emplear este líquen como bioindicador de concentraciones bajas de CO₂. En base a estos resultados, el objetivo que nos planteamos en este trabajo es evaluar, bajo condiciones controladas de laboratorio, la respuesta que ofrece el líquen *P. sulcata* y el musgo *Pseudoscleropodium purum* ante altas concentraciones de CO₂.

Se han elegido estas dos especies, porque ambas han demostrado su gran valor como bioindicadores de contaminación atmosférica. Para estos experimentos se ha empleado una urna de metacrilato donde son colocados los organismos. La concentración de CO₂ en la urna se mantiene más o menos constante gracias a un sistema automático de inyección de CO₂ conectado a un analizador. En cada una de las especies se analizan diferentes parámetros fotosintéticos de la clorofila a para ver si alguno de ellos sufre variaciones con las concentraciones y/o diferentes periodos de tiempo ensayados.

Se han realizado varios experimentos, con concentraciones que han variado desde los 700 ppm hasta los 1500 ppm (respectivamente, doble y cuádruple de la concentración ambiental actual). Además se han probado diferentes periodos de tiempo en los que se mantiene a los organismos dentro de la urna a una determinada concentración de CO₂, variando desde 1 día hasta más de 3 semanas, realizando mediciones con frecuencia horaria en algunos casos o con 3 mediciones al día en otros.



Estudio monográfico de las especies epífitas y hemiepífitas de *Blechnum* (Blechnaceae, Polypodiopsida) 59

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La familia Blechnaceae constituye un importante grupo de helechos leptosporangiados, con más de 200 especies distribuidas en 9-10 géneros, repartidas en dos centros de diversidad, uno austro-pacífico y otro americano. La taxonomía dentro de la familia está aún por aclarar, especialmente la del género *Blechnum* (que concentra el 80% de las especies), en el que se reconocen hasta 8 grupos informales de especies, que han sido considerados y clasificados bajo diferentes categorías.

Este trabajo se centra en el grupo de *Blechnum fragile*, fundamentalmente neotropical, formado por 6-8 especies de plantas epífitas y hemiepífitas, de tamaño medio, con escamas del rizoma generalmente lineares y bicoloras, dimorfismo foliar y pinnas adnatas. El conjunto de estos rasgos permite caracterizar con cierta confianza a las especies del grupo. Sin embargo, algunos de estos caracteres macromorfológicos aparecen, aislados o combinados, en especies de otros grupos del género (especialmente del grupo *Blechnum divergens*), grupos que por ello presentan un cierto solapamiento taxonómico de compleja resolución. Este hecho incluye, también, el hábito hemiepifítico, tan aparentemente característico.

Por otro lado, subsiste cierta confusión taxonómica entre varias de las entidades del grupo de estudio (por ejemplo, *B. fragile*, *B. binervatum*, *B. ensiforme*, *B. acutum*), que han sido consideradas como especies independientes, como subespecies o como entidades coespecíficas. Por último, ciertas especies de reciente descripción (*B. fuscocosquamosum*, *B. nigrocostatum*) y de distribución aparentemente restringida, se distinguen con dificultad de otras ya conocidas.

En este trabajo se aborda un estudio monográfico del grupo, para tratar de resolver tres cuestiones: una, su monofilia; dos, la delimitación del complejo *B. fragile*; y tres, la ubicación filogenética de las especies de nueva descripción. Se aportan datos de naturaleza anatómica y micromorfológica, y se realiza un estudio molecular de marcadores cloroplásticos.

Los resultados obtenidos permiten concluir que el grupo de estudio es natural, morfológica y molecularmente separado de otros grupos, con los que había cierta confusión. El análisis molecular apoya, igualmente, la necesidad de separar las especies *B. fragile*, *B. binervatum*, *B. acutum* y *B. ensiforme*. También se señala la posición filogenética de *B. fuscocosquamosum*, muy próxima a *B. fragile*, quedando pendiente la posibilidad de ser subordinada a la misma, como una subespecie separada geográficamente en altura.



60 Coexistence and prevalence of symbiotic microalgae in *Buellia zoharyi* lichen: are substrata and/or biogeographic barriers involved?

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Biological soil crusts (BSC) frequently cover open spaces in xeric territories and are set up by highly specialized communities of lichens, mosses, bacteria and fungi. Lichens are common components of these communities, adapted to extreme environmental conditions.

Scientists are reviewing lichen characterization; these organisms are more complex than the marriage between a mycobiont and a phycobiont or cyanobiont, because non-phototrophic lichenic bacteria seem to also be implied in the symbiogenesis of thalli. Additional complexity was reported inside a single lichen thallus by the intrathalline coexistence of different algal species and/or genera. This process could be advantageous under extreme environmental conditions, and might be a more common phenomenon in ecologically adaptive lichens.

Buellia zoharyi Galun, a lichen species prevailing in the BSC, is said to be highly specific to gypsum soils, but it has also occasionally been found in other types of substrata.

We have selected six different populations, three on Miocene gypsum soils from the Iberian Peninsula (Almería, Madrid and Zaragoza) and three others from other substrata: two of them growing on volcanic soil in the Canary Islands (Lanzarote and Tenerife) and one other on calcareous soil in the Balearic Islands (Mallorca).

The *B. zoharyi* mycobiont was identified using ITS rADN as barcode. Phycobiont phylogenetic analyses were made using both chloroplast (LSU rDNA) and nuclear (nrDNA ITS) molecular markers. In addition, ultrastructural microscopic techniques were used to characterize each phycobiont found.

Our results suggest the presence of at least three different *Trebouxia* lineages. Furthermore, phycobiont coexistence events occur in all the populations analyzed, corroborated by the presence of at least two taxa of intrathalline symbiotic microalgae. The presence of a specific type of *Trebouxia* lineage as the prevailing phycobiont in each population, and the detection in Tenerife of a unique lineage which was not detected in the other locations, points out that the phycobiont distribution could be biased by the type of substrata or/and biogeographic barriers. In conclusion, these unexpected data seem to highlight these unique habitats as target areas for preservation.

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Phylogenetic analysis of symbiotic *Trebouxia* microalgae within the genus *Parmelia* reveal new monophyletic lineages. 61

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Parmelia is a genus of medium to large foliose lichens with a cosmopolite distribution. Even though phylogenetic relations within lichen-forming fungi *Parmelia* have been well established through various studies, little is known about their chlorobiont diversity. Previous studies seem to point to unicellular green algae *Trebouxia* as the preferred phycobiont within the genus. However, the previously stated lack of molecular and morphological data from these microalgae seems to be a shortcoming within the understanding of the biodiversity and ecological variability of the genus. In this study we aim to provide a new insight into the phylogenetic relationships and the ultrastructural characteristics between the different microalgae found in *Parmelia*.

Selected individuals from both the sorediate *Parmelia sulcata* Taylor and its close relative *P. barrenoae* Divakar, M.C. Molina & A. Crespo, and the isidiate lichens *Parmelia saxatilis*, *P. serrana* and *P. ernstiae* were collected across the Spanish forests. Whole lichen DNA extracts were analysed by molecular techniques. Nuclear nrITS and chloroplastic LSU rRNA markers were sequenced from the chlorobionts. These sequences were aligned with type material from different culture banks. Both genes were concatenated afterwards once their evolutionary models were proven to be the same with jModelTest. The widely used fungal barcode nrITS gene was chosen for the mycobionts. Morphological and ultrastructural studies were performed in whole symbiotic thalli as well as in several isolated and cultured microalgae.

Phylogenetic analysis reveal what appears to be at least two new *Trebouxia* lineages present among the analysed microalgae that do not provide a match with any gene sequence available at the GenBank database nor described in any other publication. One clade, not clearly related to any other *Trebouxia* complex, appears to be an exclusive symbiont of *Parmelia sulcata*. Our data also suggest another potential new clade of *Trebouxia* symbiotizing with *Parmelia serrana*, and a third one associated with *Parmelia barrenoae* thalli which seems to be related to the *Trebouxia impressa* complex.

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62 Molecular data indicate too extensive lumping in the moss genus *Amphidium* (Bryophyta)

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Amphidium belongs to the haplolepideous mosses (Dicranidae) and comprises primarily lithophytic species growing in dense turfs or cushions. The extant cosmopolitan distribution, which comprises the Northern Hemisphere as well as scattered occurrences in southern-temperate and tropical-alpine regions was interpreted as being of Pangean origin.

In a recent revision, only three out of 13 species considered to be validly published were accepted, *Amphidium lapponicum*, *A. mougeotii* and *A. tortuosum*. All three species occur in Macaronesia since the Macaronesian endemic *A. curvipes* was synonymized with *A. tortuosum*. The Macaronesian archipelagos (Madeira, Azores, Canary Islands) are a biodiversity hotspot of the Northern Hemisphere, and one of the most important floristic and phytogeographic regions in Europe. Molecular data revealed rather complex evolutionary histories and biogeographic relationships of endemic and non-endemic bryophyte species in the Macaronesian region. However, most studies focused on diplolepideous mosses and liverworts, whereas inferences from haplolepideous mosses such as *Amphidium* in Macaronesia are still scarce. Here we infer species circumscriptions and relationships in *Amphidium* based on phylogenetic analysis of molecular data (nuclear ribosomal ITS and partial plastid rps4-trnF regions) and morphological-anatomical characters, with a focus on Macaronesia. The sampling comprised herbarium material and recent collections from fieldwork of *A. californicum*, *A. curvipes*, *A. cyathicarpum*, *A. lapponicum*, *A. mougeotii* and *A. tortuosum*, as well as two morphologically deviant, putative *A. lapponicum* collections from Central Asia (Mongolia and Russia). We aim to test whether (i) the recognition of the three species *Amphidium lapponicum*, *A. mougeotii* and *A. tortuosum* is supported by molecular phylogenetic reconstructions, (ii) *A. cyathicarpum* and *A. curvipes* should be considered synonymous with *A. tortuosum* or treated as separate species, in the case of *A. curvipes* thus whether it represents a Macaronesian endemic taxon or not, and (iii) the deviant collections from Central Asia represent a separate species. The molecular, morphological and ecological characterization of the *Amphidium* taxa occurring in Macaronesia will contribute to improve identification tools, supporting also the recognition of this region in terms of its importance for biodiversity conservation.



Homalothecium meridionale (M. Fleissch. & Warnst.) Hedenäs a segregated species from *H. sericeum* (Hedw.) Schimp. (Brachytheciaceae, Bryopsida) in the Iberian Peninsula

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In this study the genus *Homalothecium* (Brachytheciaceae) has been examined in detail, in particular the *H. sericeum* s.l., as a contribution to the Flora of the Iberian Peninsula.

Recent discoveries of *Homalothecium meridionale* (M. Fleissch. & Warnst.) Hedenäs in Europe prompted a new look at the genus in the Iberian Peninsula. The seta ornamentation and some peristome characteristics are critical new traits introduced by Hedenäs et al. (2014) to distinguish this species. In general, *H. meridionale* is also distinguished by leaf length to width ratio and margin denticulation in the alar region of branch leaves. Morphological features are also inferred with molecular analyses.

Locality information after a revision of herbarium collections (LISU, PO, MUB, BCB, VAL, LEB, SANT and MACB) is the basis for a new distribution map for the Iberian Peninsula. Ecological conditions registered in specimens' label and field observations allowed us to present the more important ecological requirements of *H. meridionale*, very common on +- trees, growing mainly in the Mediterranean enclaves of the Iberian Peninsula, not only in the lowlands but also in mountain ranges with some oceanic influence and is relatively indifferent to the nature of the substrate. It is more common in Mediterranean climate areas in the central and southern part of the Iberian Peninsula, However, in Portugal it is more frequent in lowland areas than in Spain, perhaps due to precipitation constraints in some southern areas.

In conclusion the distribution of this species is now much wider than known before (based on Hedenäs et al., 2014).

References:

Hedenäs, L., A. Désamoré, B. Laenen, B. Papp, D. Quandt, J. M. González-Mancebo, J. Patiño, A. Vanderpoorten & M. Stech. 2014. Three species for the price of one within the moss *Homalothecium sericeum* s.l. *Taxon* 63(2): 249–257.



64 Potential distribution and identity of introduced *Amanita muscaria* worldwide

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Amanita muscaria sensu lato is an eye-catching and easily noticed fungus, the red-and-white spotted mushroom of fairy tales. However, it comprises multiple clades that are considered different species according to the phylogenetic species concept. Members of this northern hemisphere species complex have been introduced to many locations in the southern hemisphere, and south of its native range in the northern hemisphere. The species seems confined to plantations in Tanzania, Zimbabwe and South Africa but in Colombia it appears to be associating with native *Quercus humboldtii*, and in Australia and New Zealand the species is considered invasive and associates with native *Fuscospora cliffortioides* (formerly *Nothofagus solandri* var. *cliffortioides*). Which phylogenetic species are introductions, and whether more than one phylogenetic species of the *A. muscaria* complex has been introduced to new ranges, is unclear. Nor do we know if multiple species co-occur in introduced ranges.

In this study we hypothesized that the cryptic species of *A. muscaria* possess distinct environmental niches, and that environmental niche models of the different clades would predict which species are introduced to different parts of the world. We also used ITS sequencing of *A. muscaria* from across its introduced ranges to ascertain the identity of the occurring species. Species distribution modeling predicts that both clade I (North America) and clade II (Eurasia, Alaska) can grow in parts of the introduced ranges, in places including Chile, southern Brazil, Uruguay, New Zealand and southern Australia. But sequence data from many populations demonstrates that across its introduced ranges *A. muscaria* is mainly (perhaps solely) represented by clade II, the originally described *A. muscaria* from Eurasia. Results are discussed in relation to the current knowledge of the ecology of each cryptic species, as well as in relation to historical information about co-introductions with exotic hosts.



Variación de rasgos morfológicos foliares en Aspleniáceas ibéricas saxícolas en función de variables climatológicas

65

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Los rasgos foliares son caracteres adaptativos sobresalientes, dada su relación directa con procesos biológicos cruciales como transpiración y fotosíntesis. Desde hace tiempo se han estudiado aspectos ecomorfológicos de variables como el área foliar (AF) y los pesos fresco (PF) y seco (PS). A partir de estas, se han calculado otras variables para extraer un mayor conocimiento funcional de los rasgos básicos foliares, caso del área foliar específica (SLA).

Existe una gran cantidad de estudios de esta naturaleza en espermatófitos, pero el conocimiento cae drásticamente en el caso de los helechos de climas templados. En Europa, muchos helechos presentan carácter forestal, si bien hay grupos particularmente adaptados a las grietas de piedras (saxícolas), entre los que destaca el género *Asplenium* (Aspleniaceae), con unos 20 taxones ibéricos. Una parte de la explicación de cómo estos helechos pueden desarrollarse en medios comparativamente más hostiles pasa por la comprensión de las estrategias funcionales relacionadas con el aparato foliar.

En este trabajo proponemos realizar un estudio de las principales variables foliares en especies saxícolas de helechos ibéricos y estudiar las correlaciones que pueda haber con variables climatológicas.

Se han seleccionado 5 especies de *Asplenium* de las que, hasta la fecha, se han muestreado 50 individuos de 8 localidades geográficas, a diferentes altitudes. De cada individuo se han seleccionado 3-5 hojas adultas, sin daños y sin esporas. De cada hoja se ha medido el área, el peso fresco y el peso seco. A partir de diferentes bases de datos, se ha recabado información bioclimática básica de cada localidad.

La variación encontrada en los rasgos foliares considerados parece independiente de la temperatura media anual y la precipitación anual. Las temperaturas medias de las máximas y el periodo de aridez parecen imponer una reducción del peso foliar y un aumento del SLA en general. Las mayores correlaciones se han detectado, sin embargo, en relación con el frío: la reducción de las temperaturas medias mínimas y el aumento del periodo de heladas probables, causan una reducción importante y continuada del área foliar y de los pesos seco y fresco. Una temperatura media de las mínimas por encima de 4.5°C permite que la planta experimente un significativo desarrollo de las hojas, tanto en área como el peso.

Se aporta una hipótesis funcional general a las respuestas encontradas y se comentan los resultados en comparación con estudios previos en otros grupos de plantas.



66 A preliminary evaluation of lineage differentiation in European *Aneura*

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Three species of the genus *Aneura* are recorded in Europe: *A. pinguis*, *A. maxima* and *A. pseudopinguis*.

Aneura pinguis occurs in all continents and is widespread in Europe. It is known to occupy a wide range of habitats, from different types of mire communities to wet sand dunes and humid soil banks growing on and associated with a wide variety of bryophytes. Morphologically the thallus varies from narrow and thick with multistratose margins to larger wider forms, generally with locally unistratose margins. Size and number of oil bodies have been shown to be variable.

Tropical *Aneura maxima* and *Aneura pseudopinguis* have been reported from Europe since the nineties. Morphologically some extreme forms of *A. pinguis* seem to fall into the morphology of *A. maxima*, further complicating the taxonomy of European *Aneura*. In Britain, DNA barcoding has revealed 7 distinct lineages of *Aneura* in which specimens referred to *A. maxima* are included (Blockeel et al. 2014).

Here we make a first evaluation of the lineages present in European material referred to *A. pinguis*, *Cryptothallus mirabilis* (= *A. mirabilis*), *A. maxima* and *A. pseudopinguis*, using 3 coding cpDNA regions (*rbcL*, *rpoC1* and *matK*) and 1 non-coding cpDNA region (*psbA-trnH* intergenic spacer). Samples used mostly come from Scandinavia and neighbouring areas, but samples from other areas including Portugal and 1 sample from Spain were also analysed. From the ca. 90 samples studied so far, we can recognize 8 different lineages. Morphological, ecological and geographical validation of these lineages is still ongoing.

References:

Blockeel, T L, Bosanquet, S D S, Hill, M O and Preston, C D 2014. Atlas of British & Irish Bryophytes Vol 1. Pisces Publications, Newbury.



Advances into the evolutionary history and biogeography of Parmeliaceae (Ascomycota) 67

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Parmeliaceae systematics and phylogeny is being studied by SYSTEMOL working team by successive approaches. Here we are updating last results. We aim to elucidate the evolutionary history of the family using molecular data. Results estimates the date of the origin of the family back to the Cretaceous (112.50Ma), around the same time than the origin and radiation of angiosperms. In comparison to other families of lichenized fungi, Parmeliaceae have diversified recently. Within the family, the first divergence occurred in mid Cretaceous when the crustose lineage *Protoparmelia* s.str. diverged from the rest of the groups. Other major clades in the family, such as alectorioid, anzioid, cetrarioid, hypogymnioid and usneoid appear to have diversified more recently. While most of the divergence occurred during the Paleogene, the radiation of the lineages appears to have occurred at different times between Oligocene-Miocene. The genera *Nesolechia* and *Phacopsis* are shown to have lost lichenization independently. These lichenicolous clades in the family originated at the Oligocene-Miocene boundary.



68 A taxonomic study on cleistocarpous species of *Weissia* (Pottiaceae, Bryophyta) in Japan

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The genus *Weissia* (Pottiaceae) includes both stegocarpous and cleistocarpous species. Although the cleistocarpous species are sometimes treated as segregated genus *Astomum*, recent molecular phylogenetic studies do not support this (Werner et al. 2005). In Japan, five cleistocarpous species of *Weissia* had been reported as *Astomum*: *A. acuminatum* Dixon & Thér., *A. crispum* (Hedw.) Hampe, *A. exsertum* Broth., *A. japonicum* G.Roth and *A. kiiense* S. Okamura. In his monograph of Japanese Pottiaceae, Saito (1975) only recognized *Weissia* as a genus and cleistocarpous species were placed in subgenus *Astomum*. He recognized two species in Japan: *W. crispum* (Hedw.) Mitt. (= *W. longifolia* Mitt.) and *W. exsertum* (Broth.) P.C.Chen, with *A. acuminatum* and *A. kiiense* synonymized in *W. crispum*. However, the taxonomic assessment of *A. japonicum* remains in doubt since type material was not studied. In the present study, a phylogenetic analysis is presented based on sequences of chloroplast *rbcL* and *rps4* genes to clarify phylogenetic relationships within the Japanese species. We also re-examined Japanese specimens, including types, and a morphometric study was applied to assess variation within Japanese populations. Our molecular phylogenetic analysis revealed that cleistocarpous species of *Weissia* in Japan are divided into four groups that are also supported morphologically and are well defined by a combination of characters: seta length, capsule shape and size, the condition of the annulus, and prechaetial leaf shape and size. Although annular cells have been not confirmed in cleistocarpous species in Japan, all specimens determined as *W. exsertum* and some determined as *W. crispum* have, just below the beak, cells that are smaller than other exothecial cells, and this character is useful for the taxonomy of Japanese species. We also confirmed that type material of *A. japonicum* also shows an annulus and the other morphological characters that place it well within one of the four groups revealed in our molecular and morphometric analysis. Therefore the species should be treated as *Weissia*.



An ecogeographical approach to the genetic structure of *Parmelina carporrhizans* using specific microsatellites (SSR) markers 69

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Parmelina carporrhizans, long considered synonymous with *P. quercina* (Hale, 1976), is a well-separated species (Arguello et al, 2007) but this misinterpretation has obscured the knowledge of their variability and distribution. We have developed molecular markers that serve as fine tools to measure genetic diversity and structure of this species with the aim to address specific conservation studies or biomonitoring. We present the first analyses of the genetic diversity and structure of populations of *P. carporrhizans* based on these highly variable markers.

Materials and methods

Taxon sampling: We studied 230 samples of *P. carporrhizans* from 12 localities in the Iberian Peninsula, Canary Islands, Morocco and Sicily.

Genetic markers: Eight microsatellite loci and two Mat genes were amplified with specific primers (Alors et al 2014) and sized at the Unidad de Genómica (Parque Científico de Madrid-Universidad Complutense, Madrid) with an automated laser fluorescence DNA sequencer (Applied Biosystem 3730 DNA analyzer; Applied Biosystems, Foster City, California). Fragment sizes expressed in base pairs (bp) were calculated using the program Geneious 7.0.6 (<http://www.geneious.com>, Kearse et al., 2012) by comparison to an internal molecular marker standard.

Climatic analyses: Nineteen bioclimatic variables of the sampling sites were extracted from the 30 arc seconds resolution (~1 km) layers in the WorldClim repository (<http://www.worldclim.org/>) with Diva-GIS 7.5, and principal component analyses were performed to compare the localities.

Population diversity and genetic structure analyses: Genetic diversity, spatial correlation and genetic structure were analyzed with Structure v2.3.4, Alleles in Space 1.0 and GenAlex 6.5 using the matrix of fragment sizes of the microsatellites and the assignment to mat type (Mat1-1 or Mat1-2).

Results and discussion

Microsatellite markers detected high variability within and between localities indicating the usefulness of these markers for population studies. The genetic structure analysis showed two genetic pools, one including the samples from Tenerife and Gran Canaria and other encompassing samples from the rest of the localities and the climatic variables also discriminated Macaronesian from Mediterranean localities. Mantel randomised test of genetic and geographic distances indicated isolation by distance.

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70 Assessing the taxonomical significance of bistratose leaf in *Orthotrichum anomalum*-like populations from western Iberian Peninsula

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Orthotrichum anomalum Hedw. is a widespread moss, especially frequent in saxicolous environments. Although it is primarily distributed in the Northern Hemisphere, *O. anomalum* is one of the few species with bipolar distribution in this genus. In Europe it is a common moss, and in the Iberian Peninsula only becomes scarce towards the West because of the predominance of siliceous rocks and the increasing oceanic influence, two factors tolerated but usually avoided by this moss.

Even being usually easy to distinguish, *O. anomalum* is very variable for several visible traits: cushions colour, plant size, leaf papillosity, seta length and capsule size, prominence of capsule ribs, peristomial ornamentation, etc. However, no specimens with bistratose leaves have been previously described for this species. During the revision of the genus *Orthotrichum* Hedw. for Flora Briofítica Ibérica, we found several populations from the western-central area of the Iberian Peninsula (provinces of Salamanca in Spain and Beira Alta in Portugal), whose leaves show the lamina predominantly and irregularly constituted by 2-3(4) strata of cells. These populations could correspond to a different taxon (Lara & Garilleti 2014) since, besides exhibiting that exceptional morphological variation, they thrive in an area with suboptimal environmental conditions for *O. anomalum*. Moreover, in the western half of the Iberian Peninsula concur several other species that have been described and recognized as different taxa based on the development of bistratose leaf-laminae, such as *Zygodon catarinoi* C. Garcia, F. Lara, Sérgio & Sim-Sim or *Racomitrium hespericum* Sergio, J. Muñoz & Ochyra.

The aim of the present study is to test molecularly if these *O. anomalum*-like populations with multistratose leaves lay within the variation of the species or if they correspond to a different taxon. For this purpose, we evaluate the phylogenetic placement of the western Iberian Peninsula bistratose populations within a phylogenetic reconstruction of the subgenus *Orthotrichum* based on two DNA regions (atpB-rbcL, trnL-trnF).

Reference:

Lara, F. & R. Garilleti. 2014. *Orthotrichum* Hedw. In: J. Guerra, M. J. Cano & M. Brugués (eds.) *Flora Briofítica Ibérica*, vol. V, pp: 50-135. UMU / SEB. Murcia.



Evaluación del crecimiento vegetativo y del éxito reproductivo en *Grimmia decipiens* en un gradiente ambiental 71

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Las dinámicas poblacionales son poco conocidas en briófitos, y aún menos en comunidades saxícolas, donde frecuentemente se asume que el crecimiento y recambio de especies es relativamente lento. *Grimmia decipiens* es un buen modelo para estos estudios, dado que es uno de los musgos más comunes en rocas de la Sierra de Guadarrama, y crece en un rango altitudinal amplio dando almohadillas grandes en ambientes semisombreados. Aunque su distribución es relativamente bien conocida, no se tienen datos acerca de los factores que la determinan ni de su óptimo ecológico.

El objetivo de este trabajo consiste en poner a punto un método de estudio de las poblaciones de *G. decipiens* y la observación de diferencias de crecimiento vegetativo y reproductivo a lo largo de un gradiente altitudinal en la Sierra de Guadarrama (Madrid). Hicimos un seguimiento en seis localidades entre 850-1630 m en un período de siete meses. En cada localidad se marcaron cinco almohadillas y tomamos datos de diversos parámetros de crecimiento vegetativo y fenología (densidad y crecimiento de brotes, cantidad de esporófitos de años anteriores, cantidad y estado de desarrollo de esporófitos nuevos, y tamaño de la almohadilla). Empleamos marcadores de posición para asegurar la homogeneidad de los datos, y tomamos datos acerca de la disponibilidad de hábitat en cada localidad, así como de sus condiciones ambientales.

Hemos observado variaciones de crecimiento tanto entre las localidades elegidas como en períodos cortos, incluso en un mes. Los resultados más evidentes se refieren a la producción de esporófitos, donde detectamos cambios entre los meses y entre localidades. Observamos dinámicas rápidas de las almohadillas en función del estrés mecánico (por nieve, animales, etc.), que resultan en su destrucción total o parcial; y a través de fenómenos de competencia interespecífica (líquenes y musgos).

En cuanto al crecimiento vegetativo, cabe destacar diferencias entre las localidades en el tamaño de las plantas de la almohadilla, que es máximo en la localidad con menor altitud. Discutimos el óptimo de crecimiento en el rango de altitud para los distintos parámetros. Por último, indicamos algunas mejoras al protocolo para aumentar la eficacia de toma de medidas y minimizar la interferencia de las mediciones con el crecimiento del musgo.



72 Dancing with the distinction of *Orthotrichum affine* and *O. fastigiatum*, a morpho-molecular approach.

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Orthotrichum fastigiatum was described by Bruch as a very similar species to *O. affine* Brid., from which it is difficult to separate. The differentiating morphological characters that the author highlighted are the shape of the leaves apex, the lacunose exostome, and the constitution of the endostome segments. The taxonomical status of this taxon was soon questioned, since Hübener (1833) considered it as a variety of *O. affine*, slightly differentiated by the peristome structure. Nyholm (1956) rescued it at the specific level, and provided new morphological characters to distinguish it, especially the wide ribs and striate exostome (contrarily to narrow ribs and papillose exostome in *O. affine*). Forty years later, Lewinsky (1998) formally synonymized it with *O. affine*, and thus has it been considered from then on. However, Frahm (2011) observed a diffuse and highly variable morphological differentiation that could justify some infraspecific consideration for this taxon, although he did not propose any formal taxonomic change. Furthermore, Medina et al. (2009) observed two different patterns in spores ornamentation within samples attributed to *O. affine*, without identifying any geographical pattern. Moreover, these authors found the two types of spores within the same sample. Finally, while studying the genus *Orthotrichum* for the Iberian Bryological Flora, Lara and Garilleti (2014) found differences in several morphological characters that strongly suggested the existence of two separate taxa. These are the different development of the exothecial bands, the structure and ornamentation of the exostome and the ornamentation of the spores.

In this context we have developed a morphometric and molecular study, including samples originally attributed to *O. affine* that span along its geographic range. An initial morphological study allowed the differentiation of two morphotypes on the basis of the detected qualitative characters. Samples of these two morphotypes were analyzed with multivariate statistical techniques, using 21 quantitative morphological characters that have been proved to be taxonomically useful within the genus. In addition, the genetic variation underlying the two morphotypes has been analyzed on two nuclear and two chloroplast loci. Both the morphological and molecular results point to the differentiation of two taxa at the species level, and therefore the reinstatement of *O. fastigiatum* is proposed.



El nuevo orden *Collemopsidiales* (Dothideomyceta) alberga una gran diversidad de especies marinas del género *Collemopsidium* 73

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La familia Xanthopyreniaceae comprende cinco géneros que albergan tanto hongos liquenícolas como formadores de líquenes. Estos líquenes, que forman simbiosis con especies de cianobacterias, muestran características morfológicas y anatómicas que los sitúan en el límite del concepto de líquen. Mediante el análisis filogenético con seis marcadores moleculares (nuLSU, nuSSU, mtSSU, RPB1, RPB2 y TEF- α) hemos logrado situar a esta familia dentro de la superclase Dothideomyceta, aunque no ha sido posible averiguar su ubicación exacta. Describimos el nuevo orden Collemopsidiales para acomodar esta familia y ofrecemos los primeros datos sobre las relaciones filogenéticas dentro de ella. Mediante el uso de cinco fósiles como puntos de calibración, estimamos el origen del orden Collemopsidiales en c. 230 M ya. Por último, usando dos marcadores moleculares y algoritmos de delimitación de especies, analizamos la diversidad específica dentro de las especies marinas del género *Collemopsidium*. Nuestros resultados apuntan a que existe una gran diversidad de especies que no ha sido descrita hasta la fecha, con resultados preliminares que señalan c. 26 taxa. La capacidad de perforación del substrato en este grupo parece haber evolucionado en paralelo en varios linajes a lo largo de su evolución.



74 Estructura genética poblacional y flujo génico de *Mastodia tessellata* (Ascomycota, Fungi) en el eje bipolar Alaska-Antártida

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La biota antártica presenta numerosas especies de hongos formadores de líquenes con distribución bipolar (c. 40% de la diversidad total). Este patrón biogeográfico es relativamente común en especies de estos organismos, mientras que en otros grupos terrestres suele quedar relegado a nivel de género y familia. Sin embargo, todavía no se ha propuesto un mecanismo que explique el origen de las poblaciones de hongos liquenizados bipolares con presencia en el continente Antártico. Hasta el momento, la dispersión a larga distancia figura como el mecanismo más plausible para explicar dicha distribución disyunta, pero siendo este el caso, se desconoce si las especies bipolares llegaron o se originaron en el continente antártico.

Mastodia tessellata (Ascomycota) forma líquenes que tienen que hacer frente a condiciones ambientales extremas, tanto por sus distribución geográfica, como por su nicho ecológico. El hongo establece una simbiosis con el alga laminar *Prasiola borealis* mediante la cual ambos organismos son capaces de prosperar en un ambiente dominado por intensos periodos de hidratación-deseccación como ocurre en el cinturón supralitoral. Se distribuye por Alaska y Siberia, en el hemisferio norte, y Tierra de Fuego, Antártida, Tasmania y Nueva Zelanda, en el hemisferio sur. En el ámbito de la filogeografía, *M. tessellata* constituye un organismo modélico para testar la hipótesis del origen antártico de un organismo con este patrón biogeográfico y discernir el papel que han tenido los procesos históricos en su moldeado.

Más de 200 individuos fueron muestreados en 15 poblaciones a lo largo de un eje sur-norte abarcando desde la Península Antártica hasta Alaska, incluyendo Tierra de Fuego. Los datos moleculares obtenidos con la amplificación de tres marcadores nucleares (ITS, EFA y MCM7) fueron analizados para: a) inferir clústeres genéticos en base a modelos de mixture y admixture; b) explorar las relaciones genealógicas entre haplotipos; c) elaborar reconstrucciones filogenéticas datadas de cada marcador por separado, y combinadas; d) proponer y contrastar varios modelos de migración bajo el marco teórico de la coalescencia, y e) explicar la evolución de los tamaños poblacionales a través del tiempo. Los primeros resultados apuntan hacia una fuerte estructura poblacional que muestra la existencia de tres linajes que representan Alaska, Tierra de Fuego y Antártida, con la presencia de haplotipos compartidos entre las dos últimas regiones. El origen de *M. tessellata* data de finales del Mioceno, o del Pleistoceno, según diferentes aproximaciones.



SEACOLORS: Natural pigments from selected microalgae with potential application in the textile industry

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SEACOLORS main aim is the demonstration and validation of obtaining natural dyes from a sustainable and renewable source, algae, and their application in textile industry to replace synthetic dyes, which are pollutant and harmful for the environment. Under this approach, less contaminated wastewaters will be obtained due to the higher biodegradability of natural dyes, thus reducing water purification processes.

To identify and select potential microalgae and cyanobacteria that can be used as raw material for the dye industry, a number of strains obtained from natural samples, isolated, characterized and included within the BEA collection, have been assayed at a laboratory scale to determine growth characteristics (growth rates, duplication times, biomass and/or pigment yields) and pigments/dyes composition that might be useful for industrial dyeing processes. Growth performances and target pigment/dye concentrations have been quantified from the biomass obtained under laboratory standard conditions.

Microalgae and cyanobacteria strains have been selected by considering both: (1) possibilities of being cultivated at pilot scale, performing consistent biomass yields in a sustainable way; and (2) pigments/dyes profile and accumulation characteristics (possible nutrient/light effects). Pigments/dyes profile and concentration are being checked, according to standard methodology per group of pigments (phycobiliproteins – red and blue, and carotenoids – orange and yellow), at the same time as each strain's growth under controlled conditions (light, photoperiod, temperature, CO₂ pulses and selected growth media). Extracts are being checked for pigment/dye concentration and purity criteria. Biomass, liquid crude extracts and freeze-dried pigments are being prepared to check dyeing performance.

Main screening results from selected strains will be presented considering target pigments/dyes. Until now, best performances were obtained with: *Synechococcus* sp. (CCBA 0132) and *Erythrotrichia* sp. (BEA 0620) for red pigment/dye phycoerythrin; *Arthrospira platensis* (BEA 0007) and *Leptolyngbia* sp. (BEA 0946) for blue pigment/dye phycocyanin; and, *Halochlorella rubescens* (BEA 0069) and *Sarcynochrysis marina* (BEA 0313) for orange/yellow pigments/dyes carotenoids



76 Lichen-induced geochemical weathering of schist surfaces in Côa Valley Archaeological Park (NE Portugal)

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The Côa Valley Archaeological Park (Vila Nova de Foz Côa, northeast Portugal), is a UNESCO world heritage site holding one of the world's most important collections of Prehistoric open-air rock-art. Lichens are the most abundant colonizers of the engraved rock surfaces in the park but their impact on rock surface weathering, and rock-art deterioration, is still a matter of debate. The present study addresses the geochemical weathering of schist by *Aspicilia contorta* subsp. *hoffmanniana* S. Ekman & Fröberg ex R. Sant., *Caloplaca subsoluta* (Nyl.) Zahlbr., *Lecanora pseudistera* Nyl. and *Peltula euploca* (Ach.) Poelt ex Ozenda & Clauzade, four dominant colonizers of exposed schist surfaces in the region. Based on element analyses by X-ray fluorescence (XRF), this study shows the mobility of major elements associated with rock surface colonization by three out of the four studied lichens. Mobilization of elements was detected in the rock-lichen interface of colonized surfaces and these changes reflected an increase in the content of some elements including P, Mg, Si and Ca and decrease of others including Al and K, that can be related to processes of element leaching, adsorption or mineral neof ormation at the lichen-rock interface. *Caloplaca subsoluta* is associated with the highest number of changes in the amount of assessed elements, among the studied species. Samples colonized by *Lecanora pseudistera* had no detected influence on element content, contrasting with the strong activity in surfaces colonized by *Caloplaca subsoluta*. Considering the observed heterogeneity in element mobility across species, lichen-induced weathering is case-dependent and it seems necessary to assess the effect of each species individually when evaluating the impact of lichen colonization.

Preliminary results of the effect of microclimate on lichen-induced geochemical weathering reveal that geochemical alteration occurs mainly on dry surfaces and is much reduced or potentially absent on moister surfaces.

These results have important implications for open-air rock-art conservation in the Côa Valley Archaeological Park as engraved surfaces are mainly concentrated on south-east facing slopes. There is probably some variation in the relative abundance of neof ormed and alteration minerals in different portions of the samples but according to present evidence, the lichens currently dominant on the vertical schist surfaces in the Côa Valley are unlikely to be responsible for the differential rock surface weathering, and consequent distribution pattern of engraved surfaces.



Lichen biota on stone monuments in the Iberian Peninsula ⁷⁷

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The main objective of this study consists in providing current data (1994 -2014) on the knowledge status of lichen biota that grows on stone monuments that belong to the historic heritage in the Iberian Peninsula. A search for bibliographic references of scientific articles on this topic was made (Scopus, Google, PubMed, etc.) and 11 studies on monuments biodeterioration were selected. A data analysis (statistical and clustering) of their lichen biota information was done to know the richness of lichen species, the families they belong to, their different life forms, their photobiont, and what the representative (eutrophic, xerophytic, photophytic, acidophilous, etc.) functional groups are. The analysis showed 319 lichen species located in the Iberian Peninsula, of which 105 were found in Portugal that belong to 90 genera and 60 families. The most representative family was Teloschistaceae and the genera *Caloplaca* sens. lat. with 36 species. The crustaceous life form was the most abundant with 75-95% of all the species on monuments. The green photobiont *Trebouxia* was the most frequent (90%). In addition the results indicate that northwestern granitic monuments of the Iberian Peninsula have more hygrophytic, mesophotophytic, mesotrophic and acidophilous lichen species. However on central and southeastern calcareous monuments, xerophytic, photophytic, eutrophic and, basophilous lichen biotas predominate. As data were obtained from the literature, the results are preliminary and must be handled carefully.



78 Evaluación de tres abonos comerciales como fuentes de nitrógeno en la acumulación de ficobiliproteína y biomasa en *Arthrospira maxima* (Phormidiaceae).

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Arthrospira maxima (Spirulina) es una cianobacteria fotosintética que contiene entre un 55% y 70% de proteína, lo cual la hace un organismo de interés para la industria alimentaria. Sin embargo, en países del tercer mundo como Colombia la seguridad alimentaria es un tema de interés prioritario, puesto que en algunos de sus municipios 1 de cada 3 niños se encuentran en estado de desnutrición, siendo la producción de biomasa de *Arthrospira maxima* una solución a dicho problema. El objetivo del presente trabajo fue evaluar tres abonos comerciales (Nitrox, Fertitec y Yara) como fuente de nitrógeno en la acumulación de biomasa y ficobiliproteínas, adicionalmente como característica de cada abono debe ser de fácil acceso y bajo costo para la comunidad campesina y familias de escasos recursos. De acuerdo a lo anterior se realizaron cultivos de *Arthrospira maxima* durante 15 días sometidos a medios nutritivos con diferentes concentraciones de cada abono, de igual manera se suprimieron los nutrientes complementarios. Se tomaron mediciones de: conteo celular, cuantificación de peso seco y contenido de clorofilas y ficobiliproteínas. De los tres abonos evaluados solo Abono Yara dio resultados exitosos en el crecimiento y producción de biomasa, obteniendo 0,95 gramos / litro de biomasa seca. El análisis estadístico reveló que este abono en las diferentes concentraciones usadas, con o sin los nutrientes suplementarios no presenta diferencias significativas con un 95% de confianza, mostrando un p-valor de 0.062



XX SIMPÓSIO
DE BOTÂNICA CRIPTOGÂMICA



PORTO, 22 A 25 DE JULHO DE 2015

POSTER
PRESENTATIONS





80 BC.P1. Hylocomiaceae en Flora Briofítica Ibérica

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En esta comunicación aportamos los resultados del estudio que hemos realizado de la familia Hylocomiaceae para el proyecto Flora Briofítica Ibérica.

En el área geográfica que cubre la Flora Briofítica Ibérica se pueden encontrar 8 especies de la familia, repartidos en 5 géneros:

Hylocomium splendens (Hedw.) Schimp.

Hylocomiastrum pyrenaicum (Spruce) M.Fleisch. ex Broth.

Hylocomiastrum umbratum (Hedw.) M.Fleisch. ex Broth.

Loeskeobryum brevirostre (Brid.) M.Fleisch.

Pleurozium schreberi (Willd. ex Brid.) Mitt.

Rhytidiadelphus loreus (Hedw.) Warnst.

Rhytidiadelphus squarrosus (Hedw.) Warnst.

Rhytidiadelphus triquetrus (Hedw.) Warnst.

Se trata de especies con caracteres morfológicos poco variables y por tanto bien definidas, que viven sobre todo en bosques eurosiberianos o de coníferas, por lo que su área de distribución se ciñe al norte de la Península Ibérica.

Algunas especies son muy comunes (*H. splendens*, *R. triquetrus*) por lo que hay muchas citas bibliográficas refrendadas por abundantes material depositado en los herbarios ibéricos. Otras en cambio son muy raras (*H. pyrenaicum*, *H. umbratum*), se conocen de pocas localidades, hay poco material de herbario y en ocasiones se trata de muestras recolectadas hace ya muchos años; su rareza hace que sus caracteres diferenciales sean poco conocidos y que se les considere "Vulnerables" (Brugués & González-Mancebo, 2012).

Aportamos claves de identificación, descripción de los caracteres diferenciales más importantes e iconografía original de todas las especies de la familia, indicando en algún caso las últimas recolecciones conocidas.

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BC.P2. Presencia y abundancia de *Peridinium cinctum* y *Peridinium willei* (Peridinales, Dinophyceae) en el Lago de Sanabria (NW España)

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Peridinium cinctum (O. F. Müller) Ehrenberg 1832 y *Peridinium willei* Huitfeldt-Kaas 1900 son dos de las especies de dinoflagelados tecados más citadas en los estudios de fitoplancton continental, incluidos los de lagos y embalses españoles. En el Lago de Sanabria (NW España) *P. cinctum* ha sido citada en varios trabajos, pero no hay referencias de la presencia de *P. willei* en este lago. Sin embargo *P. willei* sí ha aparecido en otros sistemas lacustres de la zona. El objetivo de este trabajo es efectuar un análisis minucioso de la identidad de los individuos de *Peridinium* de tamaño grande en el Lago de Sanabria para comprobar si se da o no en él coexistencia de *P. cinctum* y *P. willei*, y describir la dinámica de estas especies a lo largo del año. El estudio se basa en muestras de fitoplancton de red y cuantitativas recogidas mensualmente entre mayo de 1998 y abril de 2000. Los resultados de las muestras de red muestran que *P. cinctum* y *P. willei* estuvieron presentes simultáneamente prácticamente durante todo el periodo de estudio, aunque las abundancias absolutas (en individuos/l) calculadas con muestras integradas de la zona eufótica, fueron en ambas especies bajas, e incluso no se detectaron individuos en muchas de estas muestras. Las mayores densidades de las dos especies se observaron en la época de estratificación (julio-agosto de 1998) o al inicio de la misma (mayo-junio de 1999), coincidiendo con las menores concentraciones de nutrientes en el agua (fósforo reactivo soluble y nitratos). Los máximos anuales de *P. cinctum* fueron de magnitud muy similar en ambos años, pero *P. willei* fue mucho más abundante en 1999, superando además a *P. cinctum*, lo que podría ser explicado por la mayor tolerancia de *P. willei* a las bajas temperaturas. En mayo y junio de 1999 se analizaron muestras tomadas a varias profundidades para observar la distribución vertical de ambas especies. En los dos meses *P. willei* se concentró en capas más próximas a la superficie que *P. cinctum*, lo que está de acuerdo con observaciones de otros autores que apuntan a una mayor capacidad de crecimiento de *P. willei* con altos niveles de radiación.



BC.P3. El género *Pseudevernia* en la Península Ibérica

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El género *Pseudevernia* se incluye en el denominado clado *Hypogymnoide* junto con los géneros *Arctoparmelia*, *Brodoa* e *Hypogymnia* (Crespo et al. 2010, Thell et al. 2012). En la Península Ibérica está integrado por una única especie: *Pseudevernia furfuracea* (L.) Zopf. Es un líquen foliáceo, muy despegado del substrato dando un aspecto fruticuloso, con simetría dorsiventral y uno o varios puntos de sujeción. Sus lacinas son aplanadas, divididas dicotómicamente y con los bordes recurvados, dando a la cara inferior un aspecto acanalado, sin rizinas y de color negro, aclarándose hacia los ápices. La cara superior es gris-verdosa, generalmente presenta isidios cilíndricos, en ocasiones ramificados o coraloides e incluso aplanados y espatulados en los bordes y ápices. Raramente presenta apotecios, en la cara superior, pedunculados y de pequeño tamaño, cóncavos, lecanorinos y disco marrón-rojizo. Tiene ascos claviformes con ocho esporas, simples y elipsoides. Crece en substratos ácidos, corticícola, generalmente sobre coníferas o cortezas ácidas de árboles caducifolios, muy raramente es saxícola. (Seaward & Purvis 2009).

No existe ningún trabajo monográfico anterior en la Península Ibérica con la excepción del realizado por López-Redondo & Manrique-Reol (1989) sobre la variabilidad química de la especie. Pero hay numerosas citas en trabajos florísticos diversos.

Se ha realizado una búsqueda bibliográfica, se han revisado los especímenes procedentes de los herbarios MACB, MAF-Lichen y MA-Lichen y se muestra su distribución en la península.

Se han encontrado las dos variedades descritas: *furfuracea* y *ceratea* (Ach.) D. Hawksw. morfológicamente iguales y sólo distinguibles por la reacción C de la medula (C- var. *furfuracea*/C+ rojo var. *ceratea*) debido a la presencia de ácido olivetórico en ésta última (Seaward & Purvis 2009). Los datos moleculares no diferencian estos especímenes (Ferenkova et al. 2010). Hay ejemplares sorediados reconocidos como un taxón distinto,---(Bitter) Zopf (Hale 1968) pero no han sido reconocidos como una entidad taxonómica distinta (Hafellner & Obermayer 2004, Ferenkova et al. 2010) ya que en realidad parece ser la respuesta a la infección de un hongo liquenícola.

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BC.P4. New records of Cladoniaceae from Croatia

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In the framework of the Project related with the Cladoniaceae family in the Mediterranean area of Eurasia new records of the family from Croatia are presented. The country is included in the Holarctic Kingdom and is shared between the Illyrian province of the Circumboreal Region (Polunin & Walters 1989), where the beech forests are dominant above 1000 m, with different vegetation series related to the substrate, and the Adriatic province of the Mediterranean Region with xerothermic evergreen vegetation dominated by *Pinus halepensis* and *Quercus ilex* close to the sea level, and substituted by deciduous and thermophilous oaks when the sea influence decreases (Trinajsti 1995). The dominant substrate is calcareous (limestones, karst and dolomites).

Nearly 500 specimens were collected this spring in the north and center of the country (provinces of Istria, Karlobac, Lika-Senj, Primorje-Gorski Kotar, Šibenik-Knin, Zadra and Zagreb) most of them belong to the Velebit mountains located between the inner Dinaric Alps and the Adriatic Sea. The species were determined by their morphology and chemical characters. The secondary compounds were TLC analyzed according to standard procedures. After an examination of works on lichens of Croatia (Christensen 1988, 1987; Christensen & Hansen 1994, Labak et al. 2011, Ozimec 2011, Ozimec et al. 2009, 2010; Burgaz & Pino-Bodas 2012) some of our collections represent extensions of the range of the species.

Of the 40 species reported 8 are new records to Croatia: *Cladonia conista*, *C. cyathomorpha*, *C. incrassata*, *C. novochlorophaea*, *C. parasitica*, *C. pulvinella*, *C. peziziformis* and *C. af. libifera*. Two chemotypes were founded in *C. rangiformis* (ATR, RAN; ATR, RAN, FUM) and in *C. subrangiformis* (ATR, FUM; ATR, FUM, BOU). Some records with only one reference: *C. caespiticia*, *C. firma*, *C. digitata*, *C. deformis*, *C. phyllophora*, *C. rei* and *Pycnothelia papillaria* are confirmed.

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BC.P5. Revisión morfológica y filogenética de *Cladonia rangiformis* (Cladonia-ceae, Ascomycota)

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Cladonia rangiformis tiene su centro de distribución en la región Mediterránea (Litterski & Ahti 2004), siendo la especie más abundante en la Península Ibérica (Burgaz & Ahti 2009). Presenta una gran variación fenotípica (Laudon 1971; Ahti 1978; Brown & Smirnoff 1978; Burgaz & Ahti 1992; Litterski & Ahti 2004), puede presentar podecios con escúmulas o carentes de ellas, con manchas blancas medulares o sin ellas, podecios muy ramificados o no, con diferentes grado de robustez y provistos de soredios o sin ellos. Se han descrito dos quimiótipos, el más común contiene atranorina y ácido rangiformico y el quimiótipo II con atranorina, ácido rangiformico y ácido fumarprotocetrárico. Esta variación condujo a que se describieran distintos taxones, *C. aberrans*, *C. pungens*, *C. rangiformis* var. *gracillima* y *C. rangiformis* var. *sorediophora*. Actualmente la mayor parte de los autores consideran a estos taxones como sinónimos pero hasta la fecha no se ha realizado un estudio taxonómico exhaustivo. Los objetivos de este estudio fueron: 1) estudiar si existe alguna correlación entre la variación fenotípica y genética de *C. rangiformis* y 2) determinar si los taxones descritos dentro de *C. rangiformis* merecen algún estatus taxonómico.

Se han estudiado 70 especímenes procedentes de la Península Ibérica, La Macaronesia, Alemania, Bosnia i Herzegovina, Croacia, Finlandia, Grecia, Irán, Republica Checa, Suecia y Turquía. Un exhaustivo estudio morfológico ha sido llevado a cabo, tomando medidas de: el número de ramificaciones por podecio, tipo de ramificaciones, ángulos de las ramificaciones, longitud de los entrenudos, grosor de la pared del podecio, así como de cada una de sus capas y la cobertura de la capa algal. Los metabolitos secundarios fueron analizados mediante TLC (White & James 1985). Además se han obtenido secuencias de tres loci (ITS rDNA, IGS rDNA y rpb2) que fueron analizadas mediante Máxima Parsimonia, Máximo Likelihood e inferencia Bayesiana.

Nuestros análisis muestran que *Cladonia rangiformis* no es genéticamente homogénea, sin embargo los linajes filogenéticos encontrados no corresponden con los taxones previamente descritos.

BC.P6. Assessment of biodiversity patterns in the bryoflora of the Serra de Sintra (Portugal) and evaluation of the impact of environmental changes on community structure of saxicolous bryophytes

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The Serra de Sintra represents a remarkable site in Portugal from the point of view of bryophyte biodiversity. Its geographical position and climatic conditions, characterized by a mixture of atlantic and Mediterranean traits, allow for uncommon species richness and the occurrence of taxa found nowhere else in continental Portugal and shared only with Macaronesian islands, such as the liverworts *Marchesinia mackaii* and *Drepanolejeunea hamatifolia*. Given the interest hold by this region, a thorough study of the main features of the bryoflora of the Serra de Sintra, overall and in relation to specific factors, habitats and substrates, was undertaken.

As a first step a check-list of taxa occurring in this region and a description of the features of its bryoflora were realized. Overall, 279 taxa were recorded in the Serra de Sintra, out of which 5 belonging to Anthocerotophyta, 87 to Marchantiophyta and 187 to Bryophyta. The dominance of the oceanic species on the other chorological types has clearly emerged from this study. The most striking feature of the bryoflora of this region is represented by its uncommonly high density of taxa, around 9,3 per square kilometer. The Serra de Sintra represents a relevant site in Portugal also from the conservational point of view, hosting around 30 taxa which are regarded as threatened at national level (Sergio et al. 2013).

Since one of the main morphological features of this eruptive massif is represented by the very high density of boulders and rocks, the second stage of this study consisted in assessing the ecological features and distributional patterns of bryophyte communities developing on such an abundantly available and highly characterizing substrate.

The survey included boulders and rocks measuring at least 1,30 x 1,30 x 1,30m, which were checked on four sides (N,S,E, O) and on the top with a 1x1m square. The main objectives of the study consist in assessing the influence of climatic and environmental factors, as well as of human impact, on distributional patterns of saxicolous bryophytes. The study being still in its first stage, interesting results are expected from its development.

During fieldwork for this second stage of the study a species new for Portugal, *Isopterygiopsis mulleriana*, was discovered in the Serra de Sintra, which confirms the importance of this region as a bryophyte refugium not only for Macaronesian species spreading towards mainland Europe but also for species from continental Europe expanding towards its edge.



BC.P7. Identifying spatio-temporal and anthropogenic factors to understand the expansion of *Campylopus introflexus* (Hedw.) Brid. in Portugal

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Campylopus introflexus (Hedw.) Brid. is one of the 100 worst alien species in Europe and is a classic example of a recently introduced bryophyte in Europe (Stech & Dohrmann, 2004). Recorded for the first time in Portugal only in 1996 (Sérgio, 1997), it was subsequently detected in numerous new areas and its spread is currently alarming. In 2003 approximately 40 new locations (Sérgio et al., 2003) were revealed in regions with a clear Atlantic influence but to date this species is known from more than 170 localities in the country and, in many of these areas, it covers extensive spaces.

Diverse studies have highlighted the methodological deficiencies for understanding *Campylopus introflexus*'s expansion, particularly due to the complex interactions between ecological factors and reproduction strategy, perhaps including genetic disorders. In this work, we used changes in land-use and human impact to identify and evaluate the possible causes of spread that aid the species' effectiveness in reaching new areas.

In order to investigate the relationship between increasing *C. introflexus* and anthropogenic pressure, we modeled the evolution of area of occupancy in relation to environmental variables, including some related to climatic conditions. We validated MaxEnt distribution prediction models using new presence and true absence data, which showed agreement in the evolution of *C. introflexus*'s area of occupancy.

Taking into account these results, we suggest, if possible, minimizing the species' impact on native biodiversity by selecting sites to monitor and mitigate the spread of this invasive species, and can be used in the future to identify new critical areas.

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BC.P9. Bryophytes rising from the ashes: preservation of gametophyte remains in archaeological sites from Sabor valley

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Bryophyte charred remains are infrequently recovered from archaeological excavations and their preservation as carbonized elements is generally doubtful, since most tissues do not contain lignin. However, some bryophytes tissues might contain silica or be protected by a cuticle, both of which may enhance their preservation potential and charring in such contexts (Reitz & Shackley, 2012).

During the archaeological excavations in the Sabor valley (Northeast Portugal) regular archaeobotanical sampling methods took place in several sites from different chronologies. During the analyses of the floated samples from two of the surveyed sites, carbonized gametophyte remains of bryophytes were recovered among archaeological charcoal, seeds and fruits. In Terraço das Laranjeiras (site TL), bryophyte remains were recovered from Bronze Age pits (2nd millennium BC). Although these pits were, interpreted at first as structures for storing cereals, the analysis of archaeobotanical remains suggested that their contents, at the phase of their abandonment, consisted mostly of debris from daily activities, namely from early stages of crops' processing. The bryophytes from Crestelos (Site C) were retrieved in six different contexts: two post holes (C1), the floor of one hut (C2) and two ovens (C3). These contexts were mostly from the Iron Age (second half of the 1st millennium BC) and the Roman Period (1st-3rd centuries AD).

The presence of these remains in archaeological samples proves that gametophytic organs and tissues can be carbonized. Since many of this bryological fossils are reduced to its gametophyte axis or fragmented leaves, they are likely being tagged as "undetermined" plant remains or identified only to the Family or Genus level. To our knowledge, this is the first time that the possibility of preservation and identification of carbonized gametophytes of bryophytes is noticed and registered in archaeological contexts. These remains also play a role in understanding and characterizing archaeological contexts and archaeobotanical assemblages.

Reitz E & Shackley M (2012). *Environmental Archaeology (Manuals in Archaeological Method, Theory and Technique)*. 560 Pp.



84 BC.P10. Exploring the driest of the wettest: Moroccan watercourses' bryophytes functional signature along pressure and hydrologic gradients

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Bryophytes can be found almost in every ecosystem and they are one of the major groups of land plants despite their small size. Normally they are theoretically associated only to areas with high density of rain, due to their extreme dependence upon water for their survival and reproduction, but they can also be located in very arid areas, where they also thrive thanks to specific morphologic and physiologic adaptations and reproduction strategies. The semi-arid climate of the Mediterranean area, dry and hot in summer and mild in winter, imply that the bryophytes play a secondary role in the vegetation coverage and diversity of this area. The substrates where bryophytes are mostly found in Mediterranean's areas are usually water-related habitats or microhabitats (such as rocks, slopes or uncovered soils) in more humid or heavily shaded conditions.

Aquatic bryophytes populations of watercourses in semi-arid climates have a very important ecological function, since they might be the solely providers of protection and food to the water wildlife since they are the major primary producers, especially in the watercourses with temporary flow. Moreover, they represent an added value for habitat and water quality conditions assessment since many are perennial plants colonizing the riverbed and margins even during low-flow conditions or drought events.

In 2012, a sampling campaign was performed 287 sites in Morocco, and in 18 sites, watercourses with bryophytes were found and surveyed. The characterization of the environmental parameters of this 18 sites was made with multiple spatialized information using ArcMap software, aiming to extract macro-, meso-, or microhabitat parameters, contextualizing the sampling points within the Moroccan landscape and the human pressure on the surveyed watercourses. The bryologic specimens were analyzed in the laboratory to determine their specific diversity (species richness) and functional profile (life forms and strategies) at each sampling point and the expected and unexpected correlations analyzed.

The correlation analysis of the functional diversity of each sampling point with the environmental context in terms of dryness and human pressure gradients aimed to comprehend the patterns of bryophyte biological functional spectra with the present climatic and conservation contexts. Moreover, we discuss the implications that the future climate change scenarios might have on the conservation of bryological elements in these fluvial scenarios of Mediterranean arid areas.

BC.P11. Especificidad líquen-forófito en el monterverde canario

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Entre los diversos ecosistemas del archipiélago canario encontramos el monterverde, bosque relictico y endémico de la Región Macaronésica, hábitat prioritario de interés comunitario (incluido en la Red Natura 2000) y con una superficie total de 10.181 hectáreas en el archipiélago canario (del Arco et al., 2010).

El objetivo de nuestro proyecto es conocer si los líquenes epífitos del monterverde presentan alguna afinidad respecto al forófito sobre el que se desarrollan. Para ello se han establecido 6 parcelas de 100 m² a lo largo de la isla de Tenerife, siguiendo fundamentalmente la metodología propuesta por Asta et al. (2002a-b), con una serie de modificaciones para adaptarla a las características del territorio insular. Se han analizado los líquenes epífitos presentes en *Erica arborea*, *Ilex canariensis*, *Laurus novocanariensis* y *Morella faya*. El material recolectado fue identificado en el laboratorio a través de las técnicas habituales de Liqueología, y depositado en el Herbario de la Universidad de La Laguna (TFC-Lich).

Los resultados preliminares obtenidos por NMDS y ANOSIM muestran diferencias significativas en la composición líquénica presente en los árboles estudiados, lo que nos hace pensar en una posible especificidad de los líquenes hacia sus forófitos. Dicha especificidad podría deberse tanto a las características físicas de las cortezas estudiadas, como químicas o, probablemente, a una combinación de ambas.



BC.P12. Are crustose attached coralline algae associated to maerl beds more diverse than the unattached maerl-forming ones?

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Traditionally, studies on non-geniculate coralline algae in Atlantic Europe have focused in maerl-forming species. Maerl beds are deposits of unattached, slow-growing, non-geniculate red algae that play a critical ecological role by building and consolidating habitats that harbour high biodiversity. Despite the ample attention paid to maerl forming-species, no study so far has focused on the associated crustose corallines. Here, we used DNA barcodes and morphological data (Scanning Electron Microscope) to test: (i) if crustose attached coralline algae associated to maerl beds are more diverse than the unattached maerl-forming species; and (ii) if any/some species occur under both growth forms. The study was carried out with samples collected from subtidal maerl beds in two MPAs (Marine Protected Areas): Parque Nacional Marítimo-Terrestre das Illas Atlánticas de Galicia (Spain) and Parc Naturel Marin d'Iroise (Brittany, France). Our data show that the diversity of crustose attached species is higher than that of the unattached ones. According to DNA barcodes, the crustose attached algae belong to four genera: *Phymatolithon*, *Lithothamnion*, *Lithophyllum* and *Mesophyllum*. Moreover, no species was found growth under both forms.

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BC.P13. Nuclear DNA content in the maerl-forming species *Phymatolithon calcareum* (Rhodophyta)

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Maerl beds are widespread accumulations of slow-growing, unattached non-geniculate red algae that build habitats harbouring a high biodiversity of species. Within Atlantic Europe, one of the major maerl-forming species is *Phymatolithon calcareum* (Pallas) W. H. Adey & D. L. McKibbin (Corallinales, Rhodophyta). This species is listed in the Annex V of the European Union Habitats Directive as one of the two maerl-forming species with community interest. Recent molecular studies focused on the diversity and taxonomy of the maerl-forming species (Carro et al. 2014; Pardo et al. 2014a,b; Peña et al. 2014) confirm that *P. calcareum* is one of the most abundant maerl-forming species, and suggest that thallus fragmentation must be the main mechanism of propagation given the low occurrence of fertile plants, all of them assumed to be sporophytes (diploid). In other algal groups, diploid and haploid phases have been distinguished attending to their nuclear DNA content assessed with microspectrophotometry (Kapraun, 2005). Here, we applied this technique to *P. calcareum* to discriminate diploid/haploid phases. Preliminary results reveal a low nuclear DNA content that resembles other red algae. We hope that this study will improve our understanding of the life-history of maerl-forming species.

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BC.P14. The genus *Hypnum* Hedw. (Hypnaceae, Musci) in the Iberian Peninsula, Balearic Islands and Macaronesia

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A taxonomic revision of the genus *Hypnum* Hedw. (Hypnaceae, Musci) in the Iberian Peninsula, Balearic Islands and Macaronesia has been carried out on the base of herbaria and field material. Some 2740 specimens, including the most of type material, were studied. The majority of studied specimens were borrowed from ARAN, B, BCB, BCN, BM, BP, C, E, FH, FI, FCO, GDA, GFW, GLAM, HBG, HIRO, JE, LEB, M, MACB, MAK, MGC, MO, NEU, NICH, NY, O, OXF, PC, PR, S, SAAR, SALA, TFMC, TRH, U, UPS, VAL, VIT, W, Z and ZT. The genus *Hypnum* is currently represented for 17 taxa (Ruiz & Brugués 2011) [*H. andoi* A.J.E. Sm., *H. callichroum* Brid., *H. cupressiforme* Hedw. var. *cupressiforme* Hedw., *H. cupressiforme* var. *filiforme* Brid., *H. cupressiforme* var. *lacunosum* Brid., *H. cupressiforme* var. *resupinatum* (Taylor) Schimp., *H. cupressiforme* var. *subjulaceum* Molendo, *H. hamulosum* Schimp., *H. imponens* Hedw., *H. jutlandicum* Holmen & E. Warncke, *H. pallescens* (Hedw.) P. Beauv., *H. procerrimum* Molendo, *H. recurvatum* (Lind. & Arnell) Kindb., *H. revolutum* (Mitt.) Lindb. var. *revolutum*, *H. revolutum* (Mitt.) Lindb. var. *dolomiticum* (Milde) Mönk., *H. uncinulatum* Jur. and *H. vaucheri* Lesq.]. The designation of new lectotypes as well as proposition of new synonyms are included. The conservation of the name *H. uncinulatum* against *H. pseudocupressiforme* are proposed (Ríos et al. 2014). *Hypnum cupressiforme* var. *julaceum* Molendo are added to the study area (Ríos & Medina 2014). Morphological descriptions, photographs, drawings and identification keys for the species of *Hypnum* from the area are provided. The distinctions and distribution of all species are discussed.

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BC.P15. Efecto de la edad del árbol en los patrones de diversidad de líquenes epífitos en plantaciones de pinos y eucaliptos

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En este estudio comparamos la diversidad y cobertura de líquenes epífitos en plantaciones de pinos, *Pinus pinaster*, y eucaliptos, *Eucalyptus globulus*, en 5 rangos de edad diferente. El objetivo principal fue conocer cómo avanza la sucesión en pinares y eucaliptales, analizando el ritmo de acumulación de especies y cobertura del tronco en cada caso.

El trabajo fue realizado en tres localidades del NW de España, en los ayuntamientos de Ponte Caldelas, Pontearreas y Porriño (Galicia). En cada localidad fueron seleccionados 5 rangos de edad para cada una de las plantaciones de pinos y eucaliptos: 0-5, 6-10, 11-15, 16-20 y 21-25 años. En cada plantación seleccionada se eligieron 5 árboles, en cada árbol se muestrearon las orientaciones N y S. Para cada orientación se muestrearon dos alturas en el tronco, una a aproximadamente 130 cm del suelo y otra en la base. El muestreo se realizó utilizando una red de 20 x 20 cm subdividida en 400 celdas de 1 cm². Se identificaron los líquenes que aparecieron en la red para obtener los datos de diversidad. La cobertura se calculó contando las celdas ocupadas por cada taxón, utilizando números decimales cuando el ejemplar no cubría la totalidad de la celda.

El catálogo liquénico ascendió a 31 taxones, de los cuales la mayoría fueron del biotipo crustáceo (58%), seguido del foliáceo (32%) y del fruticuloso (10%). El área cubierta por líquenes creció constantemente con la edad, tanto en eucaliptos como en pinos, siendo alrededor de 4 veces mayor en pinos. La riqueza de especies aumentó progresivamente con la edad hasta los 20 años, sin incrementos en edades posteriores en el caso del pino y una disminución en la riqueza en el caso del eucalipto. La biodiversidad en pinos fue, aproximadamente, 2 veces mayor que en eucaliptos. Sin embargo, si sólo tenemos en cuenta la parte inferior de los troncos, la biodiversidad fue similar en las dos plantaciones. Esto puede ser debido a que la corteza de los eucaliptos se renueva periódicamente en el tronco y se mantiene en la base, permitiendo el crecimiento y estabilidad de los líquenes en esta zona, a diferencia de lo que ocurre en las partes superiores.

Conclusiones.- Existe una mayor diversidad y abundancias liquénica en pinares que en eucaliptales en todas las edades. El número de especies liquénicas aumenta con la edad en los dos tipos de plantaciones, siendo el ritmo de incorporación de especies mayor en el caso de los pinos.



BC.P16. *Chenia ruigtevleia* Hedd. & R.H. Zander (Pottiaceae) new to Europe

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In the course of the study of the bryological flora of a coastal mountain range in the eastern Iberian Peninsula (Sierra Calderona), specimens of a moss belonging to the genus *Chenia* R.H. Zander (Pottiaceae), previously unknown to the Mediterranean (Ros et al. 2013) were found. The specimens differed most saliently from *Chenia leptophylla* (Müll. Hal.) R.H. Zander, the only known species of the genus in the northern hemisphere, by the presence of papillae on the cells of the lamina and on the nerve compared to the smooth laminal cells of *Ch. leptophylla* except for the cells at the distal margin. Accordingly, the specimens were identified as *Ch. ruigtevleia* Hedd. & R.H. Zander, the only of the four species in the genus with papillose laminal cells. The specimens from the new locality are described and illustrated in comparison to *Ch. leptophylla*. To date, this recently described species was thought to be a South African endemic known only from two populations (Hedderson & Zander, 2008). The specimens were found growing on the soil of a small shaded ravine together with other annual or weedy bryophytes such as species of *Acaulon*, *Bryum*, *Didymodon*, *Lunularia*, *Microbryum*, etc. The plants were sterile and showed the same asexual multiplication mechanisms and ecological requirements as *Ch. leptophylla*, suggesting similar spread mechanisms for the two species. Thus, it is likely that *Ch. ruigtevleia* is much more widespread than the actual disjunct distribution indicates.

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BC.P17. New species for the Flora of the Calderona Mountain Range (Valencia, Spain) 87

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Since 2007 when we presented a first list to the flora of the Sierra Calderona (Puche, 2007), there have been numerous collections which have increased by more than 60 taxa the flora of the territory. The most important records include:

Species of conservation concern:

Grimmia capillata De Not. considered vulnerable (VU) by Ros et al. (2012). We add two new locations in Serra and Marines.

Petalophyllum ralfsii (Wilson) Nees & Gottsche, it is a new species for peninsular Spain. It is considered Vulnerable (VU) by Brugués & González-Mancebo (2012) and included in Annex II of Habitats Directive 92/43 / EEC.

Cephaloziella integerrima (Lindb.) Warnst, is a new species for the Valencia Community and the second report for the Iberian Peninsula (Brugués, 2013), considered Critically Endangered (CR) by Brugués & González-Mancebo (2012).

Chenia ruigtevleia Hedd. & R.H. Zander (for comments on this species see a separate communication), should be included in this section too.

Species new to the Valencian area (Community/Province): *Grimmia lisae* De Not, *Acaulon dertosense* Casas, Sérgio, Cros & Brugués, *Leptobarbula berica* (De Not.) Schimp, *Astomum levieri* Limpr., *Tortula israelis* Bizot & Bilewsky, *Riccia subifurca* Warnst. ex Croz., *R. beyrichiana* Hampe ex Lehm., *Fossombronina maritima* Paton, *Cephaloziella stellulifera* (Spruce) Schiffn.

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88 BC.P18. Rediscovery of *Orthotrichum mollissimum* Müll.Hal., a neglected Ethiopian-Arabian moss

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The famous 19th century bryologist Karl Müller described an outstanding African moss species, gametophytically closely resembling *Orthotrichum diaphanum* but provided with *Gymnostomous capsulae* (Müller 1878). The description of *O. mollissimum* was based on a collection from a Red Sea coastal foggy mountain (Erkautit or Arkaweit Mt.), an area nowadays belonging to Sudan. Since then, no further records of this species have been reported. For her continental revision of the genus, Lewinsky (1978) could not locate any original material of the species, and suggested including it under *O. diaphanum*. Although no formal synonymization was done, *O. mollissimum* has not been considered a distinct species anymore (O'Shea 2006).

As a result of recent collections in mountainous areas of Eastern Africa we have found several samples that undoubtedly correspond to *O. mollissimum* in a locality from northern Ethiopia. Furthermore, revision of some samples named as *O. diaphanum* from southwestern Arabia mountains (Kürschner 1984) has yielded two additional localities for *O. mollissimum*.

We herein present an updated description of the species, with a complete set of pictures that highlight all traits that allow its easy identification and safe distinction from similar taxa. The conclusion of our study is that *O. mollissimum* is a distinct epiphytic, Palearctic moss. Moreover, current data suggest that it could be restricted to Afrotropical environments in the surroundings of the Red Sea.

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BC.P19. Entomopathogenic fungi from vineyards of Douro Wine Region of Portugal

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Entomopathogens, the organisms that can kill insects, are widely distributed in nature and have been used as biopesticides worldwide. However, currently very little is known regarding their geographic distribution. In this work, we focussed on the biodiversity of entomopathogenic fungi (EPF) in Douro Wine Region (DWR) of Portugal and in this line chose six different vineyards. These vineyards differ from each other in aspects such as annual rainfall, biodiversity, ground cover vegetation and usage of herbicides. Soil samples were collected from 150 different places within these farms as well as from the uncultivated soil nearby. These soil samples were baited with six late instar *Tenebrio molitor* (Coleoptera: Tenebrionidae) and *Galleria mellonella* (Lepidoptera: Pyralidae) larvae, each, and kept inside the humid chamber at 25 °C. Kochs' postulates were confirmed through subsequent infections on larva and pure cultures of isolates were maintained using different growth media. Fungal infection spectrum against above mentioned Coleoptera and Lepidoptera insect pests were also analysed. DNA sequencing of the internal transcribed spacer (ITS) region of the ribosomal DNA was employed for species' identification. We found many isolates of EPF, especially, from the two most renowned entomopathogenic fungal genera *Beauveria* and *Metarhizium*. Moreover, numerous isolates from *Bionectria*, *Paecilomyces* and *Fusarium*, and fewer isolates from *Lecanicillium*, *Mortierella* and *Trichoderma* were also observed. Overall, these results are useful in understanding the diversity of EPF in the vineyards of DWR.



BC.P21. CryptoBlitz: Exploring the bryophytes, lichens and mushrooms of Serralves Park through a Bioblitz event with a citizen science framework and kits

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The current biodiversity crisis is regarded by the scientific community as truly worrying. However, the involvement of the remaining society in this concern has failed over time, although absolutely essential to reverse (or at least reduce) the situation. One reason for this failure is the existing disconnection between people and nature, fuelled by over 80% of the human population in Portugal living in urban or peri-urban areas. It is imperative to provide connection opportunities with nature, preferably in close proximity, both geographically (within or near large urban centers) and in terms of communication (using accessible language).

The Research Centre in Biodiversity and Genetic Resources (CIBIO) develops top research in various aspects of biodiversity, from genes to ecosystems, transversely in taxonomic terms. One of its main objectives is science communication and promoting awareness and appreciation of biodiversity in society. In 2012 it established a collaboration protocol with the Serralves Foundation and the Portuguese Foundation for Science and Technology (FCT) for a scientific dissemination project promoting interaction between the audience and nature in a very easy and swift manner at the Serralves Foundation, whose park is one of the most important green spaces in the city of Porto. Under this protocol, two BioBlitz events in the Serralves' Park were organized with the help of CIBIO's expert researchers from different taxonomic groups. A BioBlitz is an intense survey of species made by researchers with public participation, open to families, students, teachers and other community members, thus participating in the inventory task of various biological groups, namely bryophytes, lichens and macrofungi (mushrooms). For the 2015's edition, pedagogic resources enabling bryophytes and lichens inventory in autonomy were developed. These citizen science kits had two objectives: i) familiarize the public with these groups, which often get unnoticed and are particularly difficult to work with the general public, awakening the desire to (re)discover the world of cryptograms; and ii) contribute to the inventory of species. This involvement, in addition to fostering interest in science, allowed an emotional connection with these groups, crucial for their conservation.

During the 2014's event, the species list for bryophytes, lichens and mushrooms were increased in 14, 15 and 7 new species recorded, respectively. In 2015, species number was the same for mushrooms but the number of bryophytes and lichens was increased in 33 and 15 species, respectively. These groups contributed the most to the list of new species present in Serralves' Park.



90 BC.P22. Putting the bryophytes out there: publishing the bryophyte collection data of Porto Herbarium (PO) with GBIF

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The Porto Herbarium (PO) of the Natural History Museum of Porto University contains about 22000 herbarium specimens of bryophytes (including mosses, hepatics and hornworts), collected since 1837 by 61 different collectors, which have been actively databased and reviewed in the last years. The majority of specimens were collected in Portugal, but PO Herbarium also includes a specific collection (General Herbarium) with specimens from many European countries and the former African Portuguese colonies (Mozambique, Angola, São Tomé e Príncipe).

The Natural History Museum of Porto University, as one of the most recent national data providers, published recently its first botanical collection through GBIF. The “Bryophyte collection of Porto Herbarium (PO)” contains a total of 7621 occurrences in GBIF of which more than 99% are georeferenced. Data is available at IPT service of the Portuguese Node and through the international GBIF portal.

This dataset now available on GBIF has three independent collections. One of this published collections, is the historical collection of António Machado, who published the first Portuguese Bryophyte Flora (1925-1933) and is a European reference collection with type specimens. This collection holds 1591 records collected all over Portugal, but mainly in the northwestern part, corresponding to 174 different genus and 401 taxa, collected mostly by António Machado.

The two other collections included in this dataset correspond to more recent collections done in specific habitats (watercourses and exposed rock outcrops) during floristic and ecological surveys between 2002 and 2007. The watercourses dataset corresponds to a field survey carried out by the collector Cristiana Vieira in Portuguese Northwest mountain regions, located in the transition zone between Atlantic and Mediterranean territories. This dataset is substantially composed of saxicolous aquatic and semi-aquatic taxa, with 3033 records with a predominance of mosses (119 taxa of mosses, 38 taxa of liverworts and 1 taxon of hornworts). The exposed rock outcrops dataset corresponds to a field survey carried out by the collector Helena Hespanhol in North and Central Portugal region. In this dataset are represented 2997 records corresponding to 2 phylum (Bryophyta and Marchantiophyta), 74 genera and 128 taxa (species, subspecies and varieties) found on rock surfaces, fissures and cavities.

Bryophyte collection of Porto Herbarium (PO) GBIF node: <http://www.gbif.org/dataset/677f03d8-8229-4274-9e6f-9f1078369c0b>

BC.P23. New records of tropical aphylloroid fungi in Portugal

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New records of the aphylloroid fungi (Basidiomycota) *Climacodon pulcherrimus* (Berk. & M.A. Curtis) Nikol. and *Hjortstamia crassa* (Lév.) Boidin & Gilles are reported to Portugal, and the presence in the country of *Stereum illudens* Berk. is confirmed.

The pantropical species *Hjortstamia crassa* was described from Vietnam by Lévillé (sub *Thelephora crassa*) and has a world wide distribution, being reported from North, Central and South America, Asia, Africa and Australia. In Europe, during many years, was only known from Poland, and recently was found in Spain, Italy and Portugal. Its distribution is enlarged to more 3 localities, growing on angiosperm wood (*Eucalyptus*, *Juglans regia*, *Philadelphus* and *Ulex*)

Climacodon pulcherrimus was described by Berkeley & Curtis (sub *Hydnum pulcherrimum*) based on a collection from South Carolina (USA), and is a species that, besides North America, is largely distributed through Asia, registered in South America and very rare in Europe, reported from France and Russia, with recent records in Spain. It is also known in Australia [Council of Heads of Australasian Herbaria (CHAH): Australia's Virtual Herbarium, 2015-03-11. Accessed via <http://www.gbif.org/occurrence/993051340> on 2015-04-24] and was collected in the region south of Portugal by Grosse-Braugkmann in 1997 (Staatliche Naturwissenschaftliche Sammlungen bayerns: The Fungal Collection of Helga Grosse-Brauckmann at the Botanische Staatssammlung München. Accessed via <http://www.gbif.org/occurrence/475045851> on 2015-04-24]. It has now been found in a region near Lisbon, growing on *Quercus suber*.

Stereum illudens was described from Australia by Berkeley, being frequent in this country and reported also from Tasmania and New Zealand, and more recently from China. In Europe it is restricted to Spain and was seen in Portugal in the province of Estremadura (<http://mushroomobserver.org/82803> on 2015-04-24). Now it has been found in the province of Ribatejo, always growing on *Eucalyptus*.

They are all alien species in the Portuguese territory, and its presence should certainly result from accidental introductions. It is common knowledge that many exotic species arrived in Europe due to human activity. Imported plants and wood-chips, in the case of saprobes, most likely are the main pathways.



BC.P24. Reevaluación de catálogos briofíticos antiguos: evolución del estado del conocimiento sistemático y de factores ambientales

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La revisión de catálogos florísticos antiguos nos ofrece grandes oportunidades en la investigación ecológica, por ejemplo, en cuanto al seguimiento de la dinámica de los ecosistemas. Sin embargo, en el campo de la briología hay que tener en cuenta los grandes avances en el conocimiento sistemático y taxonómico en las dos últimas décadas, que han supuesto la descripción de numerosas especies o cambios en su circunscripción, nuevas claves, monografías, etc.

En este estudio nos hemos centrado en los briófitos epífitos sobre *Fagus sylvatica* L. en el Hoyo del Avellano, un enclave aislado en el Hayedo de la Pedrosa (Puerto de La Quesera, Sistema Central, Segovia), uno de los hayedos más meridionales de la península Ibérica, de carácter relictico. Se cuenta con diversos estudios previos de las comunidades epífitas sobre hayas en la península Ibérica, y con un catálogo briofítico, realizado por E. Fuertes y su equipo en 1995, que cubre todo el Puerto de La Quesera. Realizamos un muestreo semi-sistemático de los briófitos en base, tronco y ramas de 18 hayas aisladas, en la periferia y el interior de la masa del bosque y un análisis estadístico de correspondencia de las muestras, revisamos los ejemplares recolectados sobre haya en 1995, y evaluamos la extensión de la mancha del hayedo desde 1975 hasta la actualidad. Identificamos 2 especies de hepáticas y 16 de musgos, entre las que destaca *Orthotrichum shawii* W., catalogada como vulnerable en el Atlas y Libro Rojo de Briófitos de España, así como primera cita para la provincia de Segovia. La distribución de las comunidades sobre hayas corresponde a lo descrito, aunque destacamos la abundancia de hayas jóvenes con comunidades briofíticas pioneras, que concuerdan con la expansión del hayedo observada en la comparación entre 1975 y 2014. De las 29 especies que se identificaron en 1995, coinciden 15 de ellas y aparecen tres diferentes (*Dicranum scoparium*, *Orthotrichum pumilum*, y *O. shawii*). Sin embargo, algunas de las especies previamente descritas podrían no estar sobre haya, según el nivel de precisión de la etiqueta del ejemplar. Algunas otras han sido reidentificadas debido a errores o a actualizaciones taxonómicas. En nuestra revisión hemos apreciado numerosos problemas en la localización de los pliegos. Con las limitaciones impuestas en investigación actualmente, ponemos de manifiesto la necesidad de trabajos florísticos sistemáticos que permitan reevaluaciones posteriores, y destacamos la importancia de la conservación y procesado de las colecciones botánicas en los herbarios.

BC.P25. Is the endangered *Isoetes durieui* Bory (*Isoetaceae*, *Pteridophyta*) really rare in the southwest of the Iberian peninsula?

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Isoetes durieui Bory is a terrestrial and primitive vascular plant that belongs to the Pteridophyta Division. Its general distribution comprises the west of the Mediterranean region. It is considered as a rare species that grows on siliceous soils, always in temporary ponds or humid areas such as riversides. In the Iberian Peninsula it is more frequent in the western part. Nevertheless, disjunct areas can be found in Catalonia and even in the Balearic Islands. In Andalusia region (south of Spain) it is endangered and catalogued as vulnerable (Ley 8/2003, de 28 de octubre, de la flora y fauna silvestres) and included in the red list (Lista Roja de la Flora Vascular de Andalucía (2005)).

The study area is located in the southwest of the Iberian Peninsula, corresponding to the province of Huelva (Andalusia, Spain), area which is composed of acid soils in the main. The mean annual rainfall is quite high (around 800-900 mm). These two factors are very important for the establishment of different species within the genus *Isoetes*. Records from bibliography and web sites (such as www.anthos.es, last accessed February 2015) and vouchers from herbariums have been compiled, resulting seven 10 x 10 km different cells in the study area. On the other hand, twelve new populations have been found in a field work during 2014. Consequently, the current distribution of *I. durieui* has been updated with seven additional new cells. The new voucher samples will be deposited in the herbarium of the Faculty of Sciences of the University of Cordoba (COFC).

Isoetes durieui has been frequently found sharing habitat with *I. hystrix* Bory, being latter more abundant than the target species of this work. In some cases, pure populations of *I. durieui* composed by numerous specimens have been detected. Due to the lack of colourfulness and size, genus *Isoetes* usually goes unnoticed. With some experience on the identification of the natural habitat we are able to find out new populations. Results state that the occurrence of *I. durieui* has been doubled (10 x 10 km cells) in the province of Huelva. This fact leads to wonder whether *I. durieui* is really rare in the southwest of the Iberian peninsula.



92 BC.P26. Epiphytic lichen traits relate to distinct dimensions of forest habitat quality

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and ability to support biodiversity and ecosystem services is crucial for the conservation of European native woodlands, which are expected to expand in the future. Identification of lichen functional groups responding to habitat quality remains poorly explored despite the well-known influence of habitat quality on lichen diversity and the need to better understand ecosystem functioning. We proposed to evaluate the ability of lichen functional traits and respective functional groups to respond to oak woodland habitat quality in a Portuguese Natura 2000 site.

Lichen diversity was sampled in 25 woodland patches located along a gradient of agricultural use, ranging from 5% to more than 25% of arable land, in Peneda-Gerês National Park. Easily identifiable lichen traits for which a functional relationship to habitat quality could be hypothesized (type of photobiont, growth-form and reproduction strategy) were related with 5 classes of in-field indicators of oak woodland abandonment.

Lichen community composition was significantly explained by habitat quality. The relationship between the analysed traits and the community's response to habitat quality was associated with two underlying dimensions: 1) positively correlated with the intensity of grazing, height of regenerating oaks, and abundance of young trees, and negatively correlated with the diversity of woodland specialist plants, possibly reflecting decreased plant litter availability; 2) positively correlated with the intensity of tree cutting and negatively correlated with the cover of all vegetation strata, possibly reflecting increased arid conditions. Type of photobiont and reproduction strategy was more strongly related with the first gradient: fertile and sorediate cyanolichens were more important in less grazed woodlands, with lower oak regeneration and higher diversity of woodland specialist plants; whereas the importance of isidiate chlorolichens increased with grazing, higher oak regeneration and lower diversity of woodland specialist plants. Growth-form was strongly related to both gradients, with higher abundance of broad lobed species associated with lower habitat quality. An expected decline in the abundance of *Lobarion* species as a result of habitat quality loss is supported by our results. Within *Lobarion*, Pannariaceae appeared as more related with long time abandoned woodlands where trees are older; whereas Lobariaceae seem to be favoured by increased woodland openness associated with more recently abandoned woodlands.

Habitat quality determines a contrasting response of lichen functional groups to oak woodland abandonment indicators, emphasizing the importance of lichen functional diversity for developing effective habitat quality monitoring systems in European native woodlands.

Assessing habitat quality, namely habitat resilience



BC.P27. Lichens and lichenicolous fungi from north-west Peneda-Gerês National Park (north-west Portugal)

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A catalogue of 300 lichens and lichenicolous fungi from Peneda and Castro Laboreiro areas in north-west Peneda-Gerês National Park (north-west Portugal) is presented as a result of the VI field excursion of the Spanish Lichen Society (SEL - Sociedad Española de Liquenología). *Anisomeridium ranunculosporum* (Coppins & P. James) Coppins, *Arthonia sampaianae* (Diederich & Etayo) Ertz & Diederich, *Catil-laria lobariicola* (Alstrup) Coppins & Aptroot, *Polycoccum umbilicariae* (Linds.) D. Hawksw. and *Sphaerellothecium stereocaulorum* Zhurb. & Triebel are recorded for the first time in the Iberian Peninsula. The list also includes 4 lichens that are new to continental Portugal, namely: *Arthrosporum populorum* A. Massal., *Bryoria implexa* (Hoffm.) Brodo & D. Hawksw., *Cliostomum flavidulum* Hafellner & Kalb and *Ephebe hispidula* (Ach.) Horw.; as well as and 9 lichenicolous fungi that are also new to Portugal, including: *Abrothallus parmeliarum* (Sommerf.) Nyl., *Dactylospora parasitica* (Flörke) Arnold, *Everniicola flexispora* D. Hawksw., *Lichenocodium erodens* M. S. Christ. & D. Hawksw., *Marchandiomyces corallines* (Roberge) Diederich & D. Hawksw., *Phaeosporobolus usneae* D. Hawksw. & Hafellner, *Sclerococcum sphaerale* (Ach.) Fr., *Syzygospora bachmannii* Diederich & M. S. Christ. and *Unguiculariopsis lettaui* (Grumman) Coppins.

BC.P28. Molecular diversity of *Dictyota cyanoloma* Tronholm et al. populations from the Mediterranean coast of the Iberian Peninsula. 93

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Nine populations of *Dictyota cyanoloma* were sampled along the entire Mediterranean coast of the Iberian Peninsula, a region where this species has been considered as introduced. To assess the variability of the populations, the mitochondrial regions *cox1*, *nad6-nad11* and *trnG-rpl16*, and the chloroplastid *rbcL-rbcS* intergenic spacer were amplified and sequenced for four to seven individuals per population. Compared to other studies on seaweeds, the genetic diversity observed in *D. cyanoloma* from the Mediterranean coast of the Iberian Peninsula was relatively low. The distributional pattern of the haplotypes showed that six of the nine studied populations of *D. cyanoloma* presented only one haplotype per population and only three populations (Algeciras, Estepona and Motril) showed two haplotypes. *Dictyota cyanoloma* presents significantly more genetic differentiation among populations than within populations and the genetic structure of *D. cyanoloma* in this region is loosely related to geography. The results of genetic diversity analyses show some typical patterns of alien species (e.g. the relative low genetic diversity and the lack of geographic structure). Interestingly, the three populations that show greater number of haplotypes are the southern ones, located near to the Strait of Gibraltar, place of mixing waters with Atlantic Ocean and also an area of heavy maritime traffic. Comparison of genetic composition of introduced populations with native ones could provide further information about the colonization process of *D. cyanoloma* to the Mediterranean Sea.

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94 BC.P29. Nuevas especies de Hifomicetes de la Península Ibérica e Islas Canarias

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Durante el desarrollo del Proyecto Nacional con el título "Identificación, filogenia y conservación de hifomicetes cultivables de la Península Ibérica y sus islas" (CG2011-27185) se organizaron diversas campañas de recolección de muestras de restos vegetales de diversos espacios naturales. En concreto, del material procedente de la península (Asturias, Cantabria y Navarra) e islas Canarias (Tenerife, la Gomera y la Palma), se aislaron diversos hongos asexuales con caracteres morfológicos que discrepaban del resto de especies de los distintos géneros a los cuales pertenecían. Por lo que, para determinar si se trataban de nuevos taxones para la ciencia, se llevó a cabo un exhaustivo estudio fenotípico y molecular de los mismos con la finalidad de circunscribirlos tanto a nivel genérico como específico, y conocer su situación taxonómica entre los ascomicetes. La caracterización fenotípica consistió principalmente en un estudio morfológico de los respectivos especímenes sobre sustrato natural y, una vez aislados, también sobre diferentes medios de cultivo incubados en la oscuridad a 25 °C. La caracterización molecular consistió en el análisis de secuencias correspondientes a la región D1/D2 del 28S y los espaciadores transcritos internos (ITS) del operón del DNA ribosómico. La integración de resultados nos ha permitido proponer los siguientes nuevos taxones: *Anapleurophragmium botulisporum* gen. & sp. nov. (Savoryellales, Sordariomycetes), un género morfológicamente similar a *Pleurophragmium* y *Pleurothecium*, pero diferenciado por presentar células conidiógenas con denticulos más largos y conidios pardo oscuros; *Conioscypha pleiomorpha* sp. nov. (Savoryellales), caracterizada por presentar conidios equinulados y producir un sinanamorfo tático en cultivo; *Neomycoleptodiscus minutisporus* gen. & sp. nov. (Magnaporthales, Dothideomycetes), morfológicamente similar al género *Mycoleptodiscus* pero con la producción de conidios sin setulas; *Parasympodiella lauri* sp. nov. que se distingue por producir los artroconidios más pequeños con respecto al resto de especies del género; y, por último, *Pirozynskiella laurisilva* sp. nov. caracterizada por producir largas cadenas simples de conidios verrugosos. Según los datos filogenéticos, la posición taxonómica de los géneros de estas dos últimas especies es incertae sedis entre los Sordariomycetes.

BC.P30. The effect of seasonality and microclimatic conditions on the photosynthetic activity of terricolous lichen species in semiarid grasslands

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Biological soil crusts consisting of lichens, mosses, algae, fungi and bacteria play an important role in the function of semiarid grasslands. Semiarid sandy grasslands with many endemic lichens are native vegetation types of Kiskunság Region, Hungary. The sand dunes ensure diverse microhabitats for terricolous lichen species having different environmental requirements. It is already known that photosynthetic activity of terricolous lichens changes with seasons and also that photosynthetic activity is different between sun and shade populations. However, it is not known how seasonal photosynthetic activity changes in different microhabitats. Therefore, we assessed the photosynthetic activity of terricolous lichens between two microclimatic conditions (North-East, NE and South-West, SW slope directions). Microhabitats differed mainly in moisture conditions as the North-East sites were humid, whereas the South-West sites were arid. Chlorophyll a fluorescence measurements were made on 7 species in all seasons for two years. Fv/Fm, ΔFv/Fm', qP, qNP and NPQ parameters were calculated. To studying microhabitat differences, microclimatic parameters were continuously monitored during the two years. Higher soil humidity and lower soil temperature ensured more favorable humidity conditions from spring to autumn on the sand dune sides with NE direction. In these microhabitats higher humidity and better light conditions early in the morning caused longer active period for lichens. In contrast, the relatively lower irradiation of NE slopes during the winter caused shorter photosynthetically active periods. In case of green algal species found in both microhabitats, there were seasonal changes in all fluorescence parameters. In most cases Fv/Fm and NPQ showed higher values during the year in humid microhabitats except in summer. During spring there were no differences between the two microhabitats (arid vs. humid) in terms of Fv/Fm and NPQ value in contrast to the other seasons. The seasonal fluctuation of Fv/Fm and NPQ values was lower in arid compared to humid microhabitats. Our results indicate that in arid habitats spring was the most favorable season for species and the summer seemed to be the least beneficial season in humid microhabitats. In contrast with above-mentioned observations the cyanobacterial *Collema tenax* showed reverse trend in Fv/Fm, NPQ values during the seasons.



BC.P31. Epiphyte diversity and ecology on retention trees in young forest stands in territory of Latvia

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In the recent years, one of the forest management practices used in Latvia is to leave a certain number of living trees, so called retention trees, in the clear-cuts. In Latvia the usual technique regulated by Cabinet of Ministers is to leave five retention trees per hectare in the clear-cuts. This technique may also enhance epiphytic bryophytes and lichens survival after harvest. In the present study, the goal was to determine the abundance of epiphytes on retention living trees in young forest stands. The relationships between substrate characteristics and epiphytic species richness also were examined. In total, 20 new forest stands with mean stand age 11 years were chosen covering the entire territory of Latvia. Five living trees were sampled for epiphytes in each stand for total 98 sampled trees.

In total, 100 epiphytes were recorded, from which 48 were lichens and 52 bryophytes. The most common epiphytes were facultative bryophytes – *Dicranum scoparium*, *Brachythecium salebrosum*, *Hypnum cupressiforme*, *Pylaisia polyantha* and one liverwort species *Radula complanata*. Between lichen species the most common were two foliose lichens – *Hypogymnia physodes* and *Melanelixia glabrata*, one fruticose lichen – *Cladonia coniocraea* and three crustose lichens – *Lecanora argentata*, *Lecidella elaeochroma* and *Phlyctis argena*. In total, 15 epiphytic indicator species of natural forests of Latvia were found on retention trees from which two bryophytes – *Lejeunea cavifolia* and *Barbilophozia attenuata* and one lichen – *Pertusaria pertusa* are protected species in Latvia.

The results showed that the main factor that explained the epiphyte richness was tree species. The significantly important tree species for high epiphyte richness were broad-leaved trees and *Populus tremula*. The total and bryophyte species richness were higher on *Populus tremula* substrate, but the average number of lichen species was higher on *Tilia cordata*, while the highest mean species number of indicators of natural forests was determined on *Ulmus glabra*. There were also differences in species composition according to location on the tree. More species were found on the north side of the tree trunk.

Summarizing, the retention trees could provide habitats for part of epiphytic species that are characteristic to forest, especially *Populus tremula* which is a high quality retention tree and increases epiphyte richness.

C.P32. Taxonomic account of nanno- and microphytoplankton off Madeira Island

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A list of phytoplankton taxa off Madeira Island (Northeast Atlantic) is provided, including historical records dating back to 1845. A total of 473 taxa was reported, with diatoms representing the main component of the phytoplankton community around Madeira Island with 55%, followed by the dinoflagellates with 33%, the haptophytes with 11%, cyanophytes with 1% and one planktonic chlorophyte. Compared to species numbers of the World Ocean, where diatoms equals more or less dinoflagellates, a discrepancy is observed. This could be due to the still scarce number of taxonomic studies dealing with phytoplankton. However, it provides a baseline for further studies of the regional marine phytoplankton community composition. It also constitutes valuable basic information for future assessments within management instruments like the European Water Framework Directive, the Marine Strategy Framework Directive and national regulations concerning marine food safety in light of first reports of Harmful Algae Blooms and related intoxications.



96 BC.P33. Water retention in Azorean native vegetation: the role of bryophytes

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Bryophytes are an important part of plant biodiversity in the Azores. They are thought to play essential roles in soil stabilization, nutrient recycling, carbon fixing and water flow regulation. Nevertheless, these roles and physiological features of bryophytes are not totally understood nor quantified.

In this study, we aim to quantify the internal water holding capacity of some of the most common bryophytes (liverworts and mosses) occurring in native vegetation stands at three different elevations in Terceira island, Azores. The questions are: how much water do bryophytes retain? Do all species retain the same amount of water? Does this amount vary with elevation? Does it vary seasonally?

For nine months, 14 species of bryophytes (six liverworts and eight mosses) were collected in three native vegetation areas: Farol da Serreta (40 m), Lagoinha (600 m) and Serra de Santa Bárbara (1000 m). Field, saturated and dry weights were obtained in the lab and used to calculate relative and absolute water content (RWC and AWC respectively).

All sampled species were found to be hydrated, especially specimens sampled during winter. Species collected from mid and high altitudes showed higher hydration state (RWC) than species collected at the lowest altitude, of which *Bazzania azorica* and *Thuidium tamariscinum* were the liverwort and the moss, respectively, with higher values. Data clearly showed that water is retained in the native vegetation during all year round and by all species, but the amount differs between species. The maximum value was obtained by moss *Sphagnum subnitens*, which can store a maximum of 30 g of water per 1 g of their dry weight. Bryophytes are a distinctive feature of Azorean native vegetation, especially in cloud forests. With this study, the role of several species on water retention is quantified. *Sphagnum subnitens* showed to be highly efficient at storing water in the ecosystem, its protection is thus essential. This type of data is essential in order to better understand the role of bryophyte species in the water cycle within the Azorean forests especially in the context of a changing environment.

BC.P34. Transplanting the leafy liverwort *Herbertus hutchinsiae* as a conservation measure

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Translocating plants for conservation purposes can be a promising tool to enhance existing populations, restore lost populations, or create new ones, but has rarely been done for bryophytes, especially liverworts. Here, the leafy liverwort *Herbertus hutchinsiae*, a representative species of oceanic-montane liverwort-rich heath, was translocated to unoccupied habitat within its current range, to establish whether its restricted distribution is due to habitat- or dispersal limitation. At the same time, feasibility of establishing new populations was assessed, both within and outside the current distribution range, the latter to test the suitability of the species for assisted colonisation. Furthermore, transplants were grown at degraded sites where the species had declined. Transplants grew at all sites, exhibiting best growth within range, indicating that the species could be dispersal limited. Assisted colonisation is an option for this species to overcome dispersal limitation and to track future climate space. Restocking of populations at degraded sites is only recommended if the pressure causing the degradation has been removed. These findings provide an evidence base for practical conservation management.



BC.P35. Herbarium exsiccatae as potentially valuable repositories for the recovery of rare and threatened pteridophytes

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The Tropical Research Institute (IICT) Herbarium (LISC) holds more than 300 000 specimens including some of the world's best collections of the African Portuguese-speaking countries (Angola, Mozambique, Guinea-Bissau, Cape Verde and São Tomé and Príncipe). These plant collections are essential to base-line knowledge of the tropical African vegetation and flora. In the last years, some studies have shown that herbaria collections may also contribute to the recovery of threatened plants, as the seeds and spores from several species can maintain their viability for long periods of time under controlled environmental conditions. This is particularly important to pteridophytes, which are very vulnerable to threats, as a consequence of their requirement for specialized habitats. The Tropical Botanic Garden (JBT/IICT) has been developing studies to evaluate the regeneration capacity of spores removed from pteridophyte exsiccatae preserved at the LISC Herbarium. These studies aim to evaluate the spore viability, to define effective protocols for in vitro germination, gametophyte development, successful raising of sporophytes and their acclimatization to ex vitro conditions. In the present work, the results concerning the culture response of spores from pteridophytes collected in Cape Verde (six and eight years of storage) and S. Tomé e Príncipe islands (13 years or more of storage) are presented. The S. Tomé e Príncipe pteridophytes under study include four endemic species, one of which is considered Critically Endangered (CR) (*Selaginella monodii*) and the remaining species are classified as Vulnerable (VU) according to IUCN criteria.

BC.P36. *Cyanidium* sp. (Cyanidiophyceae, Rodophyta) from low light aerophytic environments (Nerja Cave, Málaga): Combined phenotypic, molecular and ecological criteria

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The Nerja Cave is located four kilometres east of the town of Nerja town, in Málaga province (Spain). As part of our research, we have focused on the phototrophic organisms. In particular we focus on one morphospecies that fits into the description of the genus *Cyanidium*. *Cyanidium* are part of the Cyanidiophyceae, asexual, unicellular red algae; most of its members are found in thermal (50–55°C) or acidic (pH 0.5–3.0) conditions. Thermophily and acidophily are exceptional features for oxygenic photosynthesizing organisms, and because of that Cyanidiophyceae are considered extremophiles as a group. Due to their ecological importance we focused in this member of the group, which is the only morphospecies found in caves. Complementary microscopy techniques such as confocal laser, transmission and scanning electron microscopies and X-ray spectroscopy were used. All sampling sites in which the morphospecies were observed showed substrata with a mixture of calcite, with and without magnesium, sand particles and clay in varying proportions, as expected because all of them were taken from speleotems. Air temperature average is 18,8°C. PPFD range from 0.15 to 4.89 $\mu\text{E}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$. Air RH average is 91% whereas the sites where it was found had no dripping in any season. Cells are spherical with a multi-layered cell wall, a near spherical flat chloroplast lacking pyrenoid and a vacuole. Mother cells form four endospores tetrahedrally divided. *Cyanidium* sp. was attached to laminate of crystalline calcite either epilithic or chasmoendolithically. The colonies could be formed by a few live cells and empty sheaths or by groups with abundant dividing cells. They could be unique or as part of phototrophic thin biofilms, mainly formed beside cyanobacteria with the morphology of the genus *Chroococcidiopsis*. Pigments phycocyanin, allophycocyanin and chlorophyll a were identified. *Cyanidium* does not have phycoerythrin. Phylogenetic analyses with 16 rDNA gene sequences showed that this *Cyanidium* sp. could be related to mesophilic non-acidic and non-thermal lineage of *Cyanidium*, with species found in Chile and Italy.



98 **BC.P37. A revision of the moss genus *Oxystegus* (Limpr.) Hilp. in America (Pottiaceae)**

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Oxystegus (Limp.) Hilp. is a small genus belonging to the family Pottiaceae. It was first recognized as a subgenus within *Trichostomum* Bruch by Limpricht (1890). Hilpert (1933) elevated *Oxystegus* to the rank of genus. This view was reversed in Zander's (1993) treatment of the Pottiaceae, again suggesting the inclusion of *Oxystegus* in *Trichostomum* at the subgeneric rank. However, Werner et al. (2005) showed that the generitypes of *Trichostomum* and *Oxystegus* were not closely related. Since then, *Oxystegus* has been accepted by most authors. Nevertheless, the circumscription within *Oxystegus* is far from resolved and more studies are required to trace the relationships among its species.

Here, we present a taxonomic revision of *Oxystegus* in America. Our goals are to identify morphological synapomorphies that could support the monophyly of this genus and to determine the limits among its species in America.

This study is based on a morphological survey of more than 100 characters from the gametophyte and the sporophyte. Around 500 specimens from the following herbaria were analysed to carry out this study: BM, DUKE, E, F, FH, FLAS, H, HBG, JE, L, MERC, MEXU, MO, MUB, NY, PC, PMA, S, SP, U, UB and W. Likewise, we assessed the most relevant nomenclatural types, including several names traditionally belonging to *Trichostomum*.

As results, we present descriptions and LM photographs of the recognized species of *Oxystegus* from America. We provide distribution data, habitat preferences and a key to identification these species in the continent.

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BC.P38. Catálogo de los briófitos de la región de Midi-Pyrénées (sur de Francia).

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Se presenta el catálogo de briófitos obtenido para la región de Midi-Pyrénées, en el sur de Francia, que se extiende desde el sur del Macizo Central, a través de la llanura del río Garona hasta los Pirineos Centrales, incluyendo ocho departamentos. Esta región administrativa es la más extensa de Francia, con sus 45.347 km².

Las fuentes utilizadas han sido las bibliográficas (que incluyen 330 publicaciones), diferentes herbarios (BBF - Conservatoire botanique national des Pyrénées et de Midi-Pyrénées, BCB - Universidad Autónoma de Barcelona, CLF - Institut des Herbiers Universitaires de Clermont-Ferrand, PC - Muséum National d'Histoire Naturelle de Paris, TLM - Muséum d'Histoire Naturelle de Toulouse, VIT- Museo de Ciencias Naturales de Álava, BM - British Natural History Museum), datos inéditos provistos por diferentes colaboradores y los procedentes de las diferentes actividades y proyectos que se han llevado a cabo desde 2004 hasta finales de 2014 en el Conservatoire Botanique National des Pyrénées et Midi-Pyrénées.

Se aporta una breve reseña histórica sobre la exploración briológica de este territorio.

El resultado alcanza los 972 taxones, de los cuales 65 se consideran dudosos y serán estudiados en el futuro. Las hepáticas y antocerotas constituyen el 20% frente al 80% de los musgos.

Los departamentos más ricos son los del sur (Hautes-Pyrénées, Haute-Garonne y Ariège), que incluyen los Pirineos, siendo también los relativamente más explorados y mejor conocidos. Al contrario, los departamentos de la llanura (Gers y Tarn-et-Garonne), a priori menos interesantes, permanecen menos explorados y peor conocidos. En situación intermedia se hallan los departamentos del norte (Lot y Aveyron), que cubren las estribaciones sur del Macizo Central.



BC.P40. Effects of natural broadleaved generation vs. conifer reforestation on the bryophyte flora

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This research was conducted during 2012-2014 on Vidlič Mountain in Southeastern Serbia. Study area was at 1200 meters above the sea level on two permanent plots. First plot was positioned in the naturally regenerated Balkan beech forest (*Fagus moesiaca* (K. Maly) Czezc), while the second one was in Douglas-fir plantation (*Pseudotsuga menziesii* (Mirb.) Franco). Natural vegetation in this area is Fagetum moesiaca montanum Jov. 1953 (non Rudski 1949), but after wildfire, several parts of Vidlič Mountain were reforested with the alien conifer species - Douglas-fir. The aim of this study was to investigate stand replacement of the deciduous tree to conifer species and its possible effect on the bryophyte flora. Total number of 48 taxa (6 liverworts, 42 mosses) was found in beech forest, and 43 taxa (9 liverworts and 34 mosses) in Douglas-fir forest. Statistical analysis showed that the difference between liverwort proportions is not statistically significant. Sørensen's similarity index for these two sites has value 0.31. The share of epiphytes in total number of species is higher in beech forest, and the difference in epiphyte proportion is statistically significant (at $p \leq 0.05$). Also the diversity of terricolous bryophytes is significantly higher in Douglas-fir forest, probably because of the leaf litter which covers forest floor bryophytes and reduces their diversity in beech forest. Ellenberg's ecological indices for light, temperature, humidity and soil reaction were analyzed. In both forest the majority of species are ones which prefer half shade, lower temperatures and dry to moderately humid habitats. Also, the majority of species is acidophilous on both sites. The difference in abiotic factors between these two sites is in soil moisture, and that is one of the reasons for difference in species composition, while air temperature and humidity are not significantly different. Among recorded species, there is one species (*Brachythecium geheebii* Milde 1869) listed in Red data book of European bryophytes in rare (R) category. Also, according to the Bryophyte Red list of Serbia and Montenegro there is one species (*Leptobryum pyriforme* (Hedw.) Wilson, 1855) with "low risk" threat status. Both species were found only in beech forest. This study gives valuable insight into the bryophyte species composition and diversity in the areas reforested with alien tree species against autochthonous forests.

Keywords: mosses, liverworts, forest, beech, Douglas-fir



100 BC.P41. Lichen diversity of crustose Physciaceae from Alentejo, Azores and Madeira (Portugal) including a new species

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During several fieldtrips to Portugal (Alentejo, the Azores and Madeira) by the second author, lichens were collected from all kind of substrata, in lowland, coastal- and upland areas.

All material is deposited in the private herbarium of P. van den Boom. Lichen morphology was examined by standard techniques using stereo and compound microscopes. Chemical constituents were identified by TLC.

An annotated list including crustose Physciaceae is presented in this study. Among them a new species from Madeira, *Amandinea maderense*, characterized by 16-spored asci and Physconia-type ascospores is reported. The new species is compared with the other hitherto known *Buellia* s. lat. taxa with polyspored asci, such as *Amandinea errata*, *Buellia dives*, *Buellia (Hafellia) pleiotera*, *Gassicurtia chermesina* and *Stigmatochroma adaucta*. A key to these species is provided.

Additional information is given for ca. 50 species, of which the following are new records for the studied areas: *Buellia mediterranea*, *B. caloplacivora* and *B. schaeereri* are new to the Azores and *Rinodina guzzinii* is new to Madeira. Concerning the records from Alentejo, mostly are new for the province. Further, *Rinodina teichophila* and the lichenicolous fungi *Wernerella maheui*, growing on *Rinodina trachytica* and previously known from Morocco, France and Spain, are newly reported from Portugal. Finally, an additional record of the very rare species *Buellia indissimilis*, hitherto known only from two localities (type locality included) in the north of Portugal, is included.

Distribution data were taken from the checklists of Madeira (Carvalho et al. 2008), the Azores (Gabriel 2015), the Iberian Peninsula (Hladun & Llimona 2002-2007) and the Algarve (van den Boom & Giralt 2012). Additional data on Iberian *Rinodina* were obtained in Giralt (2001).

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BC.P43. The Azorean Biodiversity Portal –PORBIOTA: E-Infrastructure for small islands bryophyte conservation

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The Azorean Biodiversity Portal (ABP) is an e-infrastructure based in Azores Islands and now associated with Portuguese POBIOTA -LIFE-WATCH Europe and GBIF –Portugal. The ABP is a key e-infrastructure for the integrated management of biodiversity data of the Azores, providing a large number of specialized services supporting research, policy and education. This was the first Biodiversity Portal in Portugal, starting in 2008, and the only one which provides easy access to island biodiversity data. ABP is currently recognized as a valuable outreach, management and conservation tool for all who work in science and protection of biodiversity. The 3000 visits per day, the numerous international scientific collaborations, resulting in publications and academic thesis, and the connection with other prestigious databases demonstrate the Portal's scientific quality as well as its general appeal.

The great investment made to halt biodiversity loss



has yet to fulfill its expectations as species abundance and distribution continue to decrease, deferring many of the 2010 Biodiversity targets to the EU Biodiversity strategy to 2020. Nevertheless there is a wealth of biodiversity information, ever increasing, and managing all these data is a daunting task. Using a more collaborative framework and powerful information technologies will enhance the efficacy of conservation measurements. The main ABP action lines for the period 2015-2020 are: a) improve the informatics system of the e-infrastructure to allow complex queries and improve user-friendliness; b) guarantee a rigorous classification for every species, providing updated comprehensive checklists, ensuring accuracy on the compilation of biogeographical information; this is the backbone of the Portal and all its products and services; c) provide innovative biodiversity analytical tools for both researchers and community members and invite them to contribute data to the Portal, establishing effective science communication

Data collated by this project are relevant in contributing to the EU BEST Indicator Essential Biodiversity Variables for Islands and for the new IPBE platform. Moreover, we will contribute to Strategic Goal C of the Aichi Biodiversity Targets for 2020 as defined in the CBD 2011-2020 Strategic Plan (see www.cbd.int). Finally, we expect this project to provide strong baseline information regarding the processes structuring diversity on these outermost regions of Europe.

BC.P44. Guia para a identificação das Pteridófitas da Serra da Lousã

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A identificação de plantas é ainda uma tarefa difícil para o público em geral, estudantes e mesmo docentes de vários níveis de ensino. Para as plantas silvestres, as obras mais fiáveis e completas são, ainda, as floras, como a Nova Flora de Portugal e a Flora Iberica, em que a identificação é realizada com base em chaves de identificação e descrições extensas e repletas de termos científicos complexos, que desincentivam a maioria dos não especialistas. Guias de identificação baseados em fotografias ou gravuras não abundam e os que existem, resultam quase sempre de tradução de obras relativas à flora europeia ou espanhola, incluindo taxa que não ocorrem em Portugal, ou omitindo taxa portuguesas relevantes.

Alternativas disponibilizadas recentemente incluem chaves ilustradas, mais ou menos interativas, que auxiliam a identificação utilizando equipamentos multi-

média como PCs ou smartphones. No entanto, alternativas mais simples e económicas podem também ser usadas vantajosamente. Propõem-se aqui umas chaves elaboradas para serem disponibilizadas em formato pdf numa página web, que o público interessado pode simplesmente imprimir e levar para o campo, permitindo identificar as Peridófitas da Serra da Lousã. Estas chaves foram elaboradas de forma a permitir a identificação destas plantas, quase exclusivamente, com base em caracteres morfológicos macroscópicos, de forma a facilitar o seu uso no campo, sem necessidade de uma lupa, tal como acontece com as chaves incluídas nas obras acima mencionadas. Para além das chaves, também foram incluídas fotos de campo, com aspetos gerais e pormenores importantes para a identificação, bem como um glossário de termos botânicos, indicação de percursos pedestres em que podem ser observadas as Pteridófitas abordadas e uma ficha para cada taxon com informação adicional, nomeadamente de natureza etnobotânica e ecológica.

A restrição aos taxa de ocorrência confirmada na Serra da Lousã auxiliou na elaboração de chaves de uso mais fácil que as chaves convencionais. Adicionalmente, esta restrição permitirá a sua utilização, não só por alunos de botânica do ensino universitário, mas também uma utilização mais alargada no âmbito de atividades de educação ambiental e turismo científico, sensibilizando para a conservação deste importante grupo de plantas criptogâmicas.



102 BC.P45. Análisis del contenido de ADN nuclear de algas marinas de la Antártida

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Hasta el momento no existe ningún dato publicado sobre el valor del contenido de ADN nuclear de algas marinas de la Antártida. En dos trabajos final de máster (Vilajoliu, E., 2011; Martín, R., 2014) se ha estudiado la cantidad de ADN nuclear de 12 especies de algas marinas de la Antártida: 7 pertenecientes a la clase Rhodophyceae (*Ballia callitricha* (C. Agardh) Kützing, *Neuroglossum delesseriae* (Reinsch) M.J. Wynne, *Picconiella plumosa* (Kylin) De Toni, *Gigartina skottsbergii* Setchell et Gardner, *Austropugetia crassa* R.L. Moe, *Rhodymenia coccocarpa* (Montagne) M.J. Wynne e *Hymenocladopsis prolifera* (Reinsch) M.J. Wynne) y 5 a la clase Phaeophyceae (*Desmarestia antarctica* R.L. Moe et P.C. Silva, *Desmarestia menziesii* J. Agardh, *Phaeurus antarcticus* Skottsberg, *Ascoseira mirabilis* Skottsberg e *Himantothallus grandifolius* (A.Gepp & E.S.Gepp) Zinova).

El análisis del ADN nuclear se ha realizado mediante espectrofluorimetría, a partir de muestras conservadas en Carnoy y utilizando DAPI (4', 6-diamidino-2-phenylindole, dilactate) como marcador del ADN. Las imágenes obtenidas se han analizado mediante el software MetaMorph (Molecular Devices, Toronto, ON, Canada). El contenido de ADN nuclear, en picogramos (pg), se ha estimado por comparación de la intensidad de fluorescencia (if) de los núcleos de la muestra con la de los núcleos de eritrocitos de *Gallus gallus* (RBC), que se han usado como patrón ya que poseen un contenido de ADN nuclear estable de 2,4 pg.

Los valores del contenido de ADN nuclear para las algas rojas examinadas oscilan entre $2C=0,38$ picogramos en *Gigartina skottsbergii* y $2C=1,63$ pg en *Neuroglossum delesseriae*. En el caso de las algas pardas los valores varían entre $2C=0,18$ pg en *Desmarestia antarctica* y *Desmarestia menziesii*, y $2C=0,96$ pg en *Phaeurus antarcticus*.

Los resultados obtenidos se incorporarán a la base de datos de valores C de algas del Kew Royal Botanic Garden (<http://www.rbkew.org.uk/cval>).

BC.P46. El género *Ulota* D. Mohr (Orthotrichaceae) en la Región Biogeográfica del Cabo de Hornos

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El Archipiélago de Cabo de Hornos, ubicado en áreas meridionales de la Isla Grande de Tierra del Fuego, está limitado por el canal Cockburn en el NW, por la Cordillera Darwin en el CN y el canal del Beagle en el NE. Actualmente se considera una unidad biogeográfica para cuya definición tiene un papel importante el que la Cordillera Darwin suponga una divisoria de aguas que la distingue bioclimáticamente de áreas más septentrionales. La región representa una zona biológica y físicamente única, conocida por ser un centro de riqueza y endemidad para diferentes grupos. Desde 2005 es Reserva de la Biosfera de la UNESCO, para lo que influyó su riqueza en criptógamas (5% de las especies de líquenes y briófitos en el 0.01% de la superficie del planeta). Tradicionalmente se ha atribuido al género *Ulota* una diversidad paralela a su notable abundancia en la zona.

A pesar de que por su carácter insular meridional pudiera pensarse que climáticamente la Región es relativamente homogénea, existe un notable gradiente climático W-E que afecta considerablemente a su brioflora. Las precipitaciones varían entre 3.000 mm/año en el extremo occidental y menos de 500 mm/año en el oriental. Las elevadas precipitaciones de la sección occidental del archipiélago permiten que briófitos que no toleran el espray salino se localicen cerca del mar. El Archipiélago continua siendo una las zonas briológicamente menos exploradas del planeta, a pesar de que entre 2011-2014 se ha hecho un gran esfuerzo de herborización a través de un proyecto de la NSF, en el que se invitó a participar a numerosos expertos floristas o taxónomos. Hasta esta exploración, grandes zonas del archipiélago no habían sido herborizadas en absoluto o lo fueron en el siglo XIX por no especialistas. En comparación con otros territorios australes (Australia, Nueva Zelanda, Sudáfrica) su brioflora continua estando poco conocida, careciendo de tratamientos generales que sí existen, por ejemplo, para la Antártida.

Dentro del contexto más general de un estudio sistemático y biogeográfico del género *Ulota* en el hemisferio sur, se está analizando todas las muestras de Orthotrichaceae recolectadas en la zona, especialmente las numerosas colecciones del proyecto de 2011-2014.

Se presentan los primeros resultados de este estudio, entre los que destaca la descripción de dos nuevas especies. A pesar de ello, la diversidad de *Ulota* parece no ser tan alta como se estimaba. Finalmente, se muestra mediante una clave ilustrada la diferenciación de las especies reconocidas.



BC.P47. Estudio de las comunidades briofíticas antárticas afectadas por el turismo en Isla Barrientos, Shetland del Sur.

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The Antarctic Treaty, in order to avoid the disturbance of ecosystems, establishes a series of guidelines for visitors for the most frequented sites. Barrientos, a small island in the South Shetland archipelago, despite its reduced size (1.5 km in length, about 600 meters wide and 70 meters high) houses a remarkable fauna and landscape and has a unusually extensive bryophyte carpet covering the centre of the island. These elements, along with its good accessibility, make it particularly attractive for tour operators, and the island is among the 15 most popular places in Antarctica, with about 6,000 tourists landing a year.

Barrientos Island visitor guide suffered a modification in 2005, enabling a new route in order to allow the recovery of the trail used so far. This change resulted in serious damage to the bryophyte carpet of the island, which is why it is currently being studied to monitor the recovery and to provide the scientific information needed for a proper management of the territory.

This paper presents the floristic catalogue of the island, the description of the bryophyte communities affected by the touristic use, and the differences in the degree of sensitivity to trampling.

BC.P48. Agaricales epífitos de las Gándaras de Budiño (Pontevedra, España)

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El humedal de las Gándaras de Budiño (LIC, ZEPVN, Red Natura 2000) es una de las últimas zonas húmedas de Galicia con embalsamiento de agua natural y la más occidental de España (ALVITE-DÍAZ et al., 2002). Se localiza en la provincia de Pontevedra (O Porriño, Tui y Salceda de Caselas) y ocupa unas 700 ha. Se sitúa en el valle del río Louro, afluente del Miño,

que en su curso bajo forma grandes terrazas fluviales que originaron lagunas y charcas de agua dulce (en Galicia, «gándara»). Pese a la existencia de 2 polígonos industriales y una autopista que lo cruza la calidad de las comunidades vegetales y de las aguas todavía son aceptables (PÉREZ-BILBAO & GARRIDO, 2009).

Se asientan en el subsector Miñense de la provincia Astur-Galaica, encuadrada en la región Eurosiberiana y a sólo 30 m de altitud. Es una zona fuertemente afectada por el Cuaternario, por lo que presenta flora paleártica relictiva, semejante a la que aparece en los Pirineos a 2000 m, como *Eriophorum angustifolium*, *Arnica montana*, *Nymphaea alba*, *Potamogeton natans* o *Alisma plantago-aquatica* (SILVA-PANDO et al. 1987). Y, aparecen zonas permanentemente encharcadas en las que destacan islas turbosas con *Sphagnum*, mezcladas con poblaciones de *Drosera intermedia*, *Drosera rotundifolia* y *Rhynchospora alba*.

Es un enclave faunístico y florístico privilegiado para el noroeste ibérico porque se conservan buenos ejemplos de bosques húmedos (SILVA-PANDO et al., 1987). La aparición de troncos y ramas en descomposición son hábitats propicios para insectos xilófagos y hongos, aunque hasta ahora no se habían publicado trabajos referidos a su micobiota (REQUEJO & CASTRO, en prensa).

Para este trabajo se recopilan 51 especies de Agaricales recolectados, entre 2012 y 2014, fructificando tanto sobre madera (restos de troncos, ramas, etc.) de la ripisilva o procedentes de plantaciones forestales, como sobre restos herbáceos y/ o poblaciones muscícolas propias de estas zonas higrófilas.

Las micobiota estudiadas pertenece a los géneros: *Mycena* (15 especies), *Crepidotus* (3), *Hypholoma* (3), *Calyptella* (2), *Cortinarius* (2), *Gymnopilus* (2), *Gymnopus* (2), *Marasmiellus* (2), *Tubaria* (2) y *Typhula* (2 especies), además de otros géneros con un único representante específico: *Armillaria*, *Coprinellus*, *Coprinopsis*, *Crucibulum*, *Cyathus*, *Fistulina*, *Hohenbuehelia*, *Laccaria*, *Macrotyphula*, *Marasmius*, *Mucronella*, *Pholiota*, *Resupinatus*, *Roridomyces*, *Schizophyllum*, *Stropharia* y *Tricholomopsis*.



104 BC.P49. Marine cyanobacterial mats dominated by *Lyngbya*-like spp. from geographically close and ecologically similar sampling sites exhibit different bioactivities

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Some marine benthic cyanobacteria (e.g. *Lyngbya* spp., *Moorea* spp., *Microcoleus* spp., etc) are likely to develop into dense mats in coastal tidal or in other salt flat, undisturbed environments. During a sampling campaign along the Atlantic coast of Morocco, we have collected biological material from three of those mats, one from a rocky beach (Oualidia) and two from small saltern ponds located just behind the primary dune (Mrizika). The sampling sites were (1) geographically close, (2) ecologically related and (3) homogeneous in terms of species composition. Morphological-based identification of the cyanobacteria species present on the samples allowed to confirm the dominance of *Lyngbya*-like spp. on all of them.

Crude organic extracts were obtained for the three cyanobacterial mats and fractionated by Vacuum Liquid Chromatography (VLC). The resulting fractions were tested for antimicrobial activity against Gram-negative bacteria, *Escherichia coli* and *Pseudomonas aeruginosa*, Gram-positive bacteria, *Staphylococcus aureus* and *Bacillus subtilis*, and the yeast *Candida albicans*. Enzymatic inhibition assays (using the 20S proteasome and HDAC as targets) and in vitro cytotoxicity assays with human cell lines were also carried out using the same fractions. Remarkably, this activity screening has showed that comparable VLC fractions obtained from the three different mats (including the two very similar samples from Mrizika) exhibit highly dissimilar bioactivity profiles. This finding suggests that the specialized metabolite profile of the three mats is fundamentally different.

Bioassays results will allow the selection of promising (i.e. more active) fractions for downstream processing, namely bioassay guided isolation and structural elucidation of cyanobacterial secondary metabolites.

BC.P50. Seasonal dynamics of photosynthetic thermal stability and xanthophyll cycle pigments in some moss and lichen components of cryptobiotic crusts exposed at different habitat in Bugac, Hungary

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Cryptobiotic crusts (CBC) can be found on the soil surfaces in very harsh environment throughout the world. CBC form a community of cyanobacteria, algae, fungi, lichens and mosses and are exposed to the joint effect of many abiotic stress factors such as drought, high light, intense UV radiation and high temperature. Photosynthesis is the most sensitive process to high temperature stress. Heat sensitivity of plants is in tight connection with the thermal stability of PSII and can be well characterized by the critical temperature of the initial fluorescence level (F₀) of dark-adapted leaves. In this study, we investigated the seasonal variation of some chlorophyll fluorescence parameters such as the maximal photochemical quantum yield (F_v/F_m) of photosystem II (PSII), light adapted quantum yield of PSII ($\Delta F/F_m'$), non-photochemical quenching (NPQ) and the thermal stability of PSII in connection with the amount and ratio of chlorophylls and xanthophyll cycle pigments (VAZ) in numerous moss and lichen species collected from different habitat. Our sampling site is situated on the sandy dunes of Bugacpuszta in the Kiskunság National Park, Hungary. Critical temperatures (T_c) of mosses varied between 40 and 45°C while in lichens with green algae photobiont T_c's were between 42 and 50°C and 38-42°C in cyanolichens. In mosses collected from relatively cooler and moister steep North-East slope of sandy dune of the sampling site T_c reached its maximum in winter while species collected from relatively warmer and drier South-West slope reached their maximum peak in summer time. In most of the lichens critical temperatures were almost constant during the year and the highest value appeared in summer. Species collected from South-West site showed higher F_v/F_m, $\Delta F/F_m'$ values and higher chlorophyll content through the year compared to species from relatively cooler and moister habitat. Total Chl content increased from late autumn to a maximum found in winter. The Chl a/b ratio rose from winter to summer. Zeaxanthin content increased gradually from autumn and winter, reaching maximum values in spring and in summer in all collected moss and lichen species, respectively. The de-epoxidation state of xanthophyll cycle pigments (DEPS) and NPQ showed similar dynamics during majority of the year, reaching their maximum values in spring in all collected moss species. The VAZ content closely followed the zeaxanthin. All data show that mosses and lichen photobionts can acclimate not only to seasonal changes but to different microclimatic conditions that are very close to each other.



BEM.P1. Análisis de la influencia del soporte en muestras líquénicas trasplantadas

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En la actualidad muchos estudios de biomonitorización con líquenes utilizan trasplantes con el fin de valorar evolución y variaciones de los diferentes aspectos analizados en cada caso.

El presente estudio se centra en el análisis de la influencia del trasplante en muestras líquénicas.

Hemos utilizado muestras de *Parmelia sulcata* Tayl. en la localidad de Candanedo de Boñar, situada al norte de la provincia de León. Se han establecido tres puntos de muestreo distantes entre sí 100m. En cada punto, se han tomado muestras de *P. sulcata* presentes sobre el tronco del roble melojo (*Quercus pyreanica* Willd.). Con dichas muestras y en cada uno de los tres puntos analizados, se ha realizado un trasplante en el mismo roble del que se toman las muestras, y otro trasplante, en este caso sobre un soporte artificial elaborado con estacas de madera en las que se cuelgan bolsas de red plástica, situado en la base del roble elegido. Las muestras se analizan en el momento del trasplante (T0), a las tres semanas (T1), a las seis semanas (T2) y a las nueve semanas (T3) del trasplante.

Los análisis se centran en variación de la cinética de la fluorescencia de la clorofila *a* en las muestras trasplantadas en soporte natural y artificial, respecto a las no trasplantadas. Los diferentes parámetros de analizados son : Fo, Fm, Fv/Fm, Φ_{PSII} , atenuación fotoquímica, atenuación no fotoquímica, Fm' y Fo'.

Si analizamos cada uno de los tiempos por separado, observamos cómo no existen diferencias significativas entre las medidas de las muestras de los diferentes soportes.

El análisis estadístico de los resultados muestra que en Fv/Fm, Fm, Fm' y Fo' existen diferencias significativas entre las muestras situadas en el soporte y las muestras tanto presentes en el árbol trasplantadas sobre el mismo tronco, entre el T0 y el T3 . Estas variaciones pueden deberse a las variaciones debidas a la climatología, donde las condiciones reinantes en la última medida diferían sustancialmente del resto.

Podemos concluir que la realización de trasplantes es una técnica que puede ser utilizada en estudios de biomonitorización sin que se vea alterada la cinética de la fluorescencia de la clorofila *a*.

BEM.P2. Bioacumulación en líquenes epífitos en Velilla del Río Carrión: Variación de las concentraciones

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El presente estudio tiene como objetivo analizar la calidad del aire y evaluar el comportamiento de diversos contaminantes en los alrededores de Velilla del Río Carrión (Palencia, España). Se utilizaron dos especies líquénicas (*Parmelia sulcata* Tayl. y *Evernia prunastri* (L.) Ach.) y un musgo (*Pseudoescleropodium purum* (Hedw.) Fleisch.). A tal fin, se recolectaron talos en 17 puntos de muestreo situados en dirección N, S, E y W, a una distancia de 500m, 1000m, 2000m y 4000m respectivamente del centro de la zona de estudio, donde se encuentra la Central Térmica de Velilla del Río Carrión. En el caso del musgo, únicamente hemos obtenido ejemplares en los puntos de muestreo situadas en el transecto N a S. Dichas muestras fueron enviadas al Laboratorio de Técnicas Instrumentales de la Universidad de León donde se analizaron y se obtuvieron las concentraciones de los 11 elementos estudiados: Al, Cd, Co, Cr, Cu, Fe, Ni, Pb, S, V y Zn.

En base a los resultados obtenidos, se puede comprobar la diferente tasa de acumulación entre los dos líquenes utilizados, siendo esta mayor en *P. sulcata*. Por otro lado, se observan variaciones en la dispersión de algunos elementos analizados como el Al, Cr, Fe, Ni, S y V. Analizando los mapas de distribución de los diferentes elementos, se puede establecer el origen de los elementos analizados, observándose que, además de la central térmica, existen varios focos contaminantes en la zona, tanto fijos como difusos. Precisamente ese origen combinado puede ser el motivo de las variaciones observadas, junto con la climatología.

Además, en dichos mapas de distribución se pone de manifiesto que la dirección de los vientos dominantes reinantes en la zona de estudio dispersan los contaminantes hacia el E y SE. Se suma a la acción de dichos vientos, la altura a la que se produce la emisión y la orografía, como elementos determinantes en la dispersión de los contaminantes.



106 BEM.P3. Evaluación del efecto de la contaminación sobre las comunidades briofíticas saxícolas en carreteras secundarias de un área forestal en Gredos

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Las partículas contaminantes emitidas a la atmósfera por diferentes fuentes frecuentemente afectan a las comunidades de briófitos desarrolladas en las proximidades. No obstante, no existen estudios previos en los que se analice el efecto del tráfico rodado sobre las comunidades de briófitos saxícolas. En este contexto, este estudio pretende evaluar el uso de musgos saxícolas como bioindicadores indirectos de los contaminantes emitidos en carreteras secundarias poco y medianamente transitadas.

Se han estudiado dos carreteras con densidad vehicular diferente, situadas en la Sierra de Gredos, en la provincia de Ávila, España. La primera carretera es la Avp-418, localizada en el Parque Natural del Valle de Iruelas (zona ZEPA y LIC), el cual presenta un alto valor ecológico por albergar el área de nidificación del buitre negro, así como especies vegetales de interés (tejo, acebo, etc.). La segunda carretera es la CL-505, localizada entre las Sierras de Gredos y Guadarrama, y discurre por el este de la provincia de Ávila hacia Madrid. El muestreo en ambas carreteras, se realizó en una zona donde predomina el *Pinus pinaster* (pino resinero) y no existían briófitos epífitos ni terrícolas en abundancia suficiente.

En cada zona se recolectaron musgos saxícolas de 10 rocas, y se estudió, en función de la distancia a la carretera, la composición florística de briófitos saxícolas y la abundancia relativa de cada especie. Se trató de homogeneizar las rocas muestreadas, pero aun así, se tomó en consideración las variables de pinocha acumulada en la superficie, rugosidad de la roca, inclinación de la muestra, sombra, y orientación de la cara de roca muestreada. Posteriormente los datos florísticos obtenidos se analizaron estadísticamente mediante análisis de regresión lineal simple y ordenación (DCA).

Los resultados obtenidos en ambas carreteras no muestran efectos significativos sobre las comunidades de briófitos, aunque sí se han podido detectar ciertas tendencias. Esto indica que el método empleado no es adecuado para carreteras poco y medianamente transitadas. El efecto de los contaminantes sobre las comunidades de musgos saxícolas podría no ser tan notable como en musgos terrícolas, posiblemente debido al lavado de contaminantes. Para comprobar estas conclusiones, se recomendaría complementar este estudio con otros métodos, como el análisis de las concentraciones de contaminantes en los tejidos.

BEM.P4. Identificação das espécies fúngicas associadas à biodegradação da Sé de Lamego

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A Sé de Lamego é um monumento de elevado interesse cultural localizado no centro histórico da cidade de Lamego, norte de Portugal. A sua construção data do século XII e nela foram usadas, pelo menos, cinco rochas graníticas que afloram na região: granito biotítico de Lamego, granito de duas micas de Várzea de Abrunhais, granitos moscovíticos de Valdigem e das Meadas e um aplito. Todas as litologias revelaram, através da caracterização petrográfica, petrofísica e dinâmica, aspetos de alteração hidrotermal e meteórica, que conduziram à existência de fissuras inter e intragranulares, aumentando a rede de porosidade das pedras.

O estudo das patologias presentes na sua fachada principal e claustros do monumento, permitiu concluir a prevalência da colonização biológica, seguida de alterações cromáticas, pátinas, crostas negras, placas, desagregação granular, filmes negros e fissuras. A presença destas formas de alteração é responsável por danos graves nas alvenarias e contribui em muito para a perda do valor patrimonial do imóvel.

A colonização biológica dominada por líquenes caracteriza-se ainda pela presença de musgos e plantas superiores. A sua distribuição varia temporal e espacialmente e atinge, nalgumas áreas, o topo do edifício. Foram amostradas 27 espécies líquénicas para identificação molecular dos fungos associados através da amplificação por PCR e sequenciação da região ITS do DNA ribossómico. A maioria das 15 espécies identificadas pertence à divisão Ascomycota, sendo os géneros *Phoma*, *Epicoccum* e *Alternaria* os mais comuns. A diversidade de espécies deve-se ao tipo de substrato, à existência de detritos e à deposição de poluentes.

O decaimento da pedra provocado por estes organismos resulta da libertação de ácidos orgânicos, que promovem a dissolução de minerais, e da desintegração do material pétreo, devido à penetração das hifas. Uma vez que estas populações são dominadas por fungos negros, são muito resistentes à insolação e a tratamentos químicos.



BEM.P5. Respuesta a la desecación de macrolíquenes epífitos del bosque valdiviano. Parque Nacional Alerce Costero. Valdivia, Chile.

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La región valdiviana tiene un clima templado lluvioso con abundantes precipitaciones durante todo el año. En los bosques de esta región la cubierta de líquenes epífitos alcanza una de las biomásas más altas del planeta. A pesar de la gran cantidad de lluvia anual presenta una heterogeneidad en su distribución que tiene como consecuencias periodos de sequía estival que dejan a los epífitos poiquilohídricos expuestos a la desecación. En este sentido, nos preguntamos ¿Que tan sensibles son los líquenes a la desecación prolongada en estos bosques?. Estudios funcionales y evaluación a la desecación de estos organismos aun son escasos en Chile. De esta forma el objetivo de este trabajo fue estudiar la respuesta a la desecación en macrolíquenes de un bosque siempreverde de *Nothofagus nitida-Saxegothaea conspicua* presentes en el Parque Nacional Alerce Costero (Valdivia, Chile). Para ello, hemos seleccionado las especies más abundantes de este bosque (*Sticta ainoae* D. J. Galloway & J. Pickering, *Pseudocyphellaria nitida* (Taylor) Malme, *Pseudocyphellaria berberina* (G. Forst.) D.J. Galloway & P. James, *Pseudocyphellaria divulsa* (Taylor) Imshaug, *Pseudocyphellaria coerulescens* (Mont.) D.J. Galloway & P. James, *Sticta caulescens* De Not., *Bunodophoron australe* (Laurer) A. Massal. y *Leifidium tenerum* (Laurer) Wedin). Se midió el contenido relativo de agua, Rendimiento Cuántico Máximo (Fv/Fm), Rendimiento cuántico efectivo (YII) y la tasa de transporte de electrones (ETR). Nuestros resultados sugieren una respuesta específica de cada especie, con una rápida alteración fotosintética en la exposición temporal a la desecación medidas por fluorescencia. Este estudio también nos han permitido confirmar la baja tolerancia de este tipo de líquenes a altas radiaciones reflejados en el perfil de saturación obtenido para todo el set estudiado.

BEM.P6. Spatial variability of ultraviolet-absorbing compounds in an aquatic liverwort and their usefulness as biomarkers of current and past UV radiation: A case study in the Atlantic-Mediterranean transition 107

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The spatial variability of ultraviolet-absorbing compounds (UVACs) in the freshwater liverwort *Jungermannia exsertifolia* subsp. *cordifolia* was studied in mid-latitudes (the Atlantic–Mediterranean transition) across a wide latitudinal gradient, with the aim of testing the usefulness of UVACs as biomarkers of current ambient levels of UV radiation. We analysed 17 samples from streams located in the main mountain ranges of the Iberian Peninsula, differentiating methanol-soluble (SUVACs, mainly located in the vacuoles) and methanol-insoluble (IUVACs, bound to cell walls) compounds, since they represent different manners to cope with UV radiation. In both fractions, the bulk level of UVACs and the concentrations of several individual compounds were measured. In addition, we measured F_v/F_m , DNA damage and sclerophylly index (SI) as possible additional UV biomarkers.

UVACs showed a high variability, probably due not only to the gradients of macroenvironmental factors (UV radiation, PAR, and water temperature), but also to microenvironmental factors inherent to the dynamic nature of mountain streams. Two soluble coumarins were positively correlated with UV levels and could be used for ambient UV biomonitoring in the spatial scale. In contrast to the variability in UVACs, the relatively homogeneous values of F_v/F_m and the lack of any DNA damage made these variables useless for ambient UV biomonitoring, but suggested a strong acclimation capacity of this liverwort to changing environmental conditions (in particular, to UV levels). Finally, UVACs of fresh samples of the liverwort were compared to those of herbarium samples collected in the same latitudinal gradient. SUVACs were significantly higher in fresh samples, whereas IUVACs generally showed the contrary. Thus, IUVACs were more stable than SUVACs and hence more adequate for retrospective UV biomonitoring. In conclusion, UVAC compartmentation should be taken into account for bryophyte-based UV biomonitoring in future studies. We are grateful to the Ministerio de Ciencia e Innovación of Spain and FEDER funds (Project CGL2011-26977) for financial support. Laura Monforte and María-Ángeles Del-Castillo-Alonso benefited from respective grants of the Gobierno de La Rioja (PRED2010/16) and Universidad de La Rioja (Plan Propio 2014). Several institutions kindly authorized sample collection in protected areas of Spain.



108 BEM.P7. Bryophyte species used as indicators of raised bog degradation in Latvia

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In Latvia, different mire types (fens, poor fens, raised bogs) take about 3000 km² of the country area and nearly 40 % of all mires are under protection. However, large part of mires, especially raised bogs, are degraded due to former peat mining or transformed to agricultural or forested areas. To study the negative effect of mire degradation to vegetation and particularly to bryophyte layer, three Nature Reserves were investigated within the framework of LIFE project Wetlands. In total, 49 vascular plant, bryophyte, and lichen species were found using transect method. Vegetation and plant communities in 120 sample plots showed significant differences between natural and degraded raised bogs. From recorded 21 bryophyte species, seven were found exclusively or mostly in degraded mire areas (*Dicranum scoparium*, *Pleurozium schreberi*, *Polytrichum juniperinum*, *Sphagnum angustifolium*, *S. capillifolium*, *S. flexuosum*, *S. russowii*). Some of these are typical boreal forest species thus indicating to mire degradation that follows after drainage (mineralized peat, dry and shaded conditions). Whereas nine bryophyte species showed close connection with natural mire habitats (*Cladopodiella fluitans*, *Dicranum bonjeanii*, *Kurzia pauciflora*, *Mylium anomala*, *Sphagnum balticum*, *S. cuspidatum*, *S. fuscum*, *S. rubellum*, *S. tenellum*). Most of them were found in bog pools and wet hollows that are indicator features of natural raised bog microrelief in Latvia.

Obtained results are useful for mire habitat mapping, assessment of mire degradation intensity and degree, as well as for evaluation of management success in degraded raised bogs when restoration activities have been implemented.

BEM.P8. UV-absorbing compounds (UVAC) in the liverwort *Marchantia polymorpha*

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The ability of plants to tolerate high levels of UV radiation (UVR) is partly constitutive and partly adaptive, and is mostly based on the accumulation of UV-absorbing compounds (UVAC), specifically phenolics. This accumulation is the most consistent response of plants to increased UVR, and thus the synthesis of phenolic compounds would decisively contribute to the protection mechanisms that both cormophytes and bryophytes have developed against UVR.

Our objective was to analyze the UVAC global contents, as well as the most significant phenolic compounds, in field-grown samples of the liverwort *Marchantia polymorpha* L. collected in the Sierra de Cameros (La Rioja, Spain).

Samples were collected from sun-exposed populations in July 2014. After harvesting, the samples were immediately frozen in liquid nitrogen until study. We analyzed UVAC located in two different cell compartments: vacuoles, or soluble fraction (S-UVAC), and cell walls, or insoluble fraction (I-UVAC). The global contents of UVAC were analyzed by spectrophotometry, whereas identification and quantification of the phenolic compounds in both fractions was performed using UPLC-MS.

UVAC had similar concentration in both fractions. The S-UVAC were mainly flavonoids, while I-UVAC were hydroxycinnamic acids. The individual compounds identified in the soluble fraction were four flavones: apigenin-7-O-glucuronide, apigenin-7,3'-O-diglucuronide, luteolin-3-O-glucuronide and luteolin-7,3-O-diglucuronide. Apigenin-7,3'-O-diglucuronide was the most abundant compound (about 49%) and luteolin-3-O-glucuronide was the less abundant one (about 8%). In the insoluble fraction two hydroxycinnamic acids were identified: *p*-coumaric and ferulic acids. The first acid was the most abundant compound with 68%.

In conclusion, *Marchantia polymorpha* had great differences in the composition of phenolic compounds between the soluble and insoluble fractions, whereas the global content of UVAC was very similar. The fact that several compounds found in both fractions (flavones and hydroxycinnamic acids) are known to play an important role as antioxidants, suggests that these compounds could participate in the protection mechanisms of this species against UVR.



BEM.P9. Evaluation of levels of lead pollution from automobiles near Highway using phanerogamic and cryptogamic species in the city of Annaba (Algeria).

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Nowadays, a serious problem emerged in the natural environments of many countries: they are increasingly subjected to a large number of air pollution: industrial pollution, pollution related to agriculture, but also pollution related to transport. The pollution of lead has constantly evolved over time, due to the considerable increase in the number of vehicles on the market. Our work is based primarily on the use of plants as bio indicator of air pollution in the region of Annaba.

The evaluation of the pollution levels near the main roads is a complex exercise, given the many factors to consider at this scale. To do this, we chose three locations on three main roads Greater Annaba: ((RN 44): Annaba - El Kala; (RN 16): Annaba - El Hadjar; (RN 44): Annaba - Skikda), plants used are: phanerogamic namely species (*Fraxinus angustifolia*, *Eucalyptus camaldulensis*, and *Eriobotrya japonica*) and a fungal species: a lichen (*Ramalina farinacea*).

An appropriate sampling strategy, a spatio-temporal monitoring, a counting vehicle at our study sites and measurements of physiological parameters combined with the determination of lead allowed us to assess not only the state of the air quality but also the impact of this pollution on the environment caused by a heavy traffic in the area.

Keyword: Pollution, lead, bio indication, bioaccumulation, road traffic, Annaba, Algeria.

BEM.P10. Airborne spores of *Ustilago* and their relation with meteorological parameters 109

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Introduction. *Ustilago* includes Basidiomycetes fungi that are responsible for phytopathological diseases named smuts. They are quite abundant mainly as parasites of grasses, attacking principally inflorescences and causing relevant spoilage on cereal crops. Teliospores from *Ustilago* species are airborne dispersed and two of the most frequent are corn smut (*Ustilago maydis*) with rough teliospores and *Ustilago cynodontis* with smooth teliospores. This names may include other species that cannot be separated only by their teliospores.

Material and Methods. Sampling was carried out for one year, from April 2009 to March 2010 in Badajoz (SW of Spain). Air was aerobiological monitored with a Hirst spore trap 127 days distributed along the period studied. Petrolatum white was used as adhesive. Teliospores were identified and counted at x1000 magnification with one or two horizontal scans in the center of the slide using light microscope. Data were provided as daily or hourly spores concentration per cubic meter. Weather data were provided by a meteorological station close to the spore trap.

Results. Average concentration of teliospores was 150 and 170 spores/m³ for *U. cynodontis* and *U. maydis* respectively. For both fungi May was the month with the highest concentration were reached and February with the lowest ones; notwithstanding daily peaks may appear in other months. Daily peaks of concentration were recorded on November 10th for *U. cynodontis* (1474 spores/m³) and on May 28th for *U. maydis* (1772 spores/m³). Hourly airborne spore distribution did not showed a clear pattern in *U. cynodontis*, with barley differences along the day; nevertheless, for *U. maydis* maximum spores concentration were reached between 12:00-14:00 UTC and the lowest at 3:00 UTC. Daily data compared with meteorology showed statistically significant correlation positive for temperature and negative with rain and relative humidity for both fungi types.

Conclusions. Airborne smuts teliospores are present in the air nearly all the year but they are concentrated mainly in spring. Rain and relative humidity reduce their concentration but temperature originates an increase in their abundance. Hourly pattern appeared in *U. maydis* with maximum at noon and minimum at night; nevertheless, *U. cynodontis* did not showed hourly pattern of spore distribution.



110 BEM.P12. *Trentepohlia umbrina* (Chlorophyta) on Scots pine as a bioindicator of alkaline dust pollution

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The total emission of many air pollutants (e.g. SO₂, CO, C₆H₆) has decreased in Europe, but particulate matter is still a problematic pollutant as it poses a significant harm to human health and environment. Primary particulate matter or dust particles may be emitted to environment from rock quarrying, combustion processes, kiln grinding or from surfaces of gravel roads by intensive traffic, and deposit generally in the vicinity of power plants, cement industries, limestone quarries or unpaved roads. Dust pollution may have a considerable impact on local environment, for example it can alter the structure and productivity of plant communities through the changes in the pH value and element content of soils. The present study was driven by the wish to broaden the selection of ecological indicators for estimating the alkaline dust pollution. We studied the abundance of the algal species *Trentepohlia umbrina* on *Pinus sylvestris* trunks, an acidic substrate that it normally does not occupy. The study was carried out in northern Estonia in the surroundings of four major limestone quarries, considerable local-level sources of dust pollution. Spearman's correlation analyses revealed that the cover of *T. umbrina* on tree trunks was significantly higher near the quarries ($R_s = -0,74$; $n=32$; $p < 0,00001$), evidently due to the elevated bark pH, its maximum values reaching ca. 30% (mean of five trees studied per sample plot). The cover of the species decreased steeply at the distance of 800–900 m from the quarries; further than 1000 m from the quarries the maximum cover was already less than 4%, and further than 2000 m less than 1%. The correlation between the cover of *T. umbrina* and measured bark pH values indicated a steep increase in cover at about pH 3.8–3.9; the cover values varied between 0 and 4% below and between 10 and 31% above that pH. The results of Kruskal-Wallis test did not indicate significant differences in the cover of *T. umbrina* between the four quarries ($H(3,32)=1.54$; $p=0.67$). Our results confirm that *T. umbrina* could be used as an indicator species of alkaline dust pollution. We propose that using of *T. umbrina* on Scots pine as bioindicator of alkaline dust pollution in Northern Europe is quite applicable, but the situation might be different in other regions. The reddish powdery coating of *Trentepohlia* on bark is easily noticeable and recognisable at field; however, further certain indication the species without microscopical examination might be challenging.

BEM.P13. Lichen diversity of a pine forest is impacted by pollution from pulp mill industry

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The effects of a pulp mill's emissions on the lichen diversity of a coastal pine forest located at Figueira da Foz (Portugal) were evaluated. Lichen diversity and bark pH were studied at four sites at increasing distances from the pulp mill: 500, 1000, 1500 and 2000 m. Data regarding the accumulation of 28 elements on lichen transplants (*Flavoparmelia caperata*) exposed in the same sites during 180 days were obtained in another experiment (Rodrigues 2012).

Lichen diversity, evaluated through the calculation of Lichen Diversity Values (LDVs), was substantially reduced at 500 m from the pulp mill, and this was the only site where nitrophytic species occurred. A higher accumulation of N was observed in lichen transplants placed at this site, and bark pHs of pine trees were significantly higher at 500 m from the mill. These results, and the report of the emissions of the mill, substantiate that ammonia deposition was a key factor affecting lichen diversity. Moreover, bark pH significantly and negatively correlated with the frequencies of the acidophytes *Chrysothrix candelaris*, *C. flavovirens*, *Lecanora strobilina*, and *Pyrrhospora querneae*, while positively with the ones of *Parmotrema hypoleucinum* (an acidophyte) and *Physcia adscendens* (a nitrophyte).

At each site, elemental accumulation was not significantly correlated with LDVs, species frequencies, and bark pH. Despite that, bark pH increased with increasing concentrations of Ba, Cu, Hg, Mn, Mo, N, P, S, and Sb in lichen transplants. Although LDVs were not correlated with elemental accumulation on lichen transplants, the indicator species approach allowed to identify N, particularly in the form of ammonia, as a major factor affecting lichen diversity lichen diversity, alongside bark pH.

Rodrigues SA (2012) Lichen biodiversity and biomonitoring of atmospheric pollution. Departamento de Biologia. Universidade de Aveiro. Aveiro, Portugal. PhD thesis. 185pp.



BEM.P14. Airborne basidiospores of *Coprinus* and *Agrocybe* types and their influence of rain in spring

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Introduction. Airborne basidiospores are frequent in the air in spring; *Coprinus* and *Agrocybe* type are present in the air along the year. *Coprinus* type include the species from this genus characterized by the deep black color and *Agrocybe* type include species from diverse genus of Basidiomycetes with light to brown color, both elliptical to pyriform with prominent germ pore [1]. Aims of this work pretend to show daily and hourly pattern of these spores in the air in spring (21/3-21/6) and analyses weather parameters that may affect their distribution.

Material and Methods. Air was monitored with a Hirst type volumetric spore trap located on the terrace of a three floor building at the University of Extremadura in Cáceres (SW Spain) in 2014. Meteorological parameters were supplied by the Davis Vantage Pro2 Weather Station. Daily and hourly data of spores per cubic meters were used. Spearman correlation was used and hourly data were UTC.

Results. The average concentration for the period studied was 14.5 spores/m³ for *Coprinus* and 2.2 spores/m³ for *Agrocybe*. Peaks of concentration were reached with only one day of difference, 83.7 spores/m³ for *Coprinus* (10/4) and 11.7 spores/m³ for *Agrocybe* (11/4). Total rain reached 163 mm in 17 days and was clearly distributed in three periods of 89.8, 70.1 and 2.6 mm, the first period with the highest wind speed. Statistically significant correlation was obtained using daily data between *Coprinus* with wind speed (negative) and direction, and between relative humidity with *Agrocybe*. Hourly pattern of airborne spore distribution showed for *Coprinus* maximum concentration at 4:00 and minimum at 18:00-19:00 and for *Agrocybe* maximum concentration at 4:00 and minimum at 13:00.

Conclusions. In spring, airborne basidiospores of *Coprinus* appear mainly after rain and wind speed reduce their concentration, and airborne basidiospores of *Agrocybe* appear even within rain days and with high relative humidity. Both basidiospores types reach their hourly maximum concentration some hours before dawn.

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112 BEM.P15. Bryophytes as bio-sensors: co-opting traits to measure habitat disturbance

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Trait matrices are an important tool in plant ecology, used to investigate the relationship between a suite of traits and environmental variables, but have rarely been applied to bryophytes. From a conservation perspective, knowing which traits make species more susceptible to threats (e.g. habitat fragmentation, climate change) allows practitioners to put in place directed and effective protection measures.

Bryophytes (mosses, liverworts and hornworts) are major contributors to the functioning and biodiversity of many terrestrial ecosystems and are known to respond rapidly to changes in their habitat. Desiccation tolerance is a mechanism that allows bryophytes to survive periods of drought or low water availability. This tolerance, however, varies considerably between species ranging from desiccation-sensitive to highly desiccation-tolerant. These different tolerance levels allow us to determine which bryophyte species occupy which type of habitat and subsequently can be used as a measure of forest degradation.

In this study, a matrix was created to find bryophyte species with similar levels of desiccation-tolerance and thus exhibiting similar responses to changing microclimatic variables, namely: insolation and relative humidity. These two variables are among the first to change when canopy cover is removed. Data on 20 traits for epiphytic species from two study areas (Portugal and Madagascar) was compiled from the bryophyte ecological literature, herbarium specimens or interpolated from existing data. In addition, information on the species geographic range, biogeographic element, habitat and Red List status (where available) was included. Each species was assigned to a preliminary desiccation tolerance category based on the traits exhibited – therefore linked to their morphological traits. Traits were then correlated with environmental data to identify patterns and relationships in species' desiccation tolerance levels.

Several traits were correlated with environmental variables showing that morphological traits can be used

to predict the level of desiccation tolerance in bryophytes. This matrix represents a step-forward in the study of physiology of bryophytes, particularly tropical ones for which few data or information exists. Next steps include conducting analyses on species distributions and desiccation tolerance to create predictive maps of habitat quality, which will then be ground-truthed through fieldwork.

BEM.P16. Evaluation of the ecological quality of the river waters using diatom (Bacillariophyta) and relation with the land uses.

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Diatoms are one of the richest algal phyla ever described and they represent one of the main sources of information about water quality, being used as bioindicators all over the world. Because of this, many tools have been created, like diatom quality indexes, which give us the capability to evaluate the environmental status of aquatic systems in a precise way.

Our research has been performed from 34 sampling points which were distributed over several tributaries of the Ebro river (Segre, Noguera Ribagorçana, Noguera Pallaresa, and minor ones) in the Catalan territory. The main objective this study is to find any existing connection among the different land uses surrounding the sampling points of the water quality network of the Confederación Hidrográfica del Ebro, and the diatom indexes calculated of these sites. The land uses were typified by CORINE Land Cover classification system and the calculations of indexes (IPS, IBD, CEE and SLA) have been made with different species inventories extracted from every studied site, using diatom indexes. The results have been analyzed by statistical calculation tools. Although, the influence of 4 different physicochemical data (BOD, COD, Nitrate, Phosphate), have been checked.

Considering the little preceding information available in this field, the results have been analyzed with covariance methods as ANOVA and multivariable analysis, which have demonstrated the truthfulness of nearly all the proposed hypotheses, as the significance among IBD or CEE with the land uses. These data have been explained and discussed in detail, to give away for proper conclusions.



SEB.P1. On the brink of the Atlantic: the reckoning of a vulnerable bryophyte (*Dendrocryphaea lamyana*) through collections, time and Europe.

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The west-European bryophyte *Dendrocryphaea lamyana* (Mont.) P.Rao is a threatened taxon at the European level. Listed as Vulnerable on the Welsh Red-list and Near-Threatened in Great Britain, it receives special protection in several countries. Locally distributed in west and south Europe (south Britain, France, Portugal, Spain and Italy), and most likely erroneously cited in Switzerland and North Africa, it has been considered either as a euatlantic, atlantic, subatlantic, oceanic-submediterranean-montane or a southern-atlantic temperate species. These classifications have in common the distribution trends of this species towards the Atlantic Ocean territories.

Through time, bryologists and collectors have described this taxon as requiring very restricted fluvial ecological conditions, which translated into an equally restricted distribution. As more data is comprehensively gathered and chronologically classified, we observed the enlargement of its bioclimatic and hydrogeologic niche definition, and consequently, open the discussion of its, so far, vulnerable status.

In the present work we identified and gathered all the available information on this species and explored the most important parameters that allow the detailed description of species macro-and meso-ecology. Point occurrences from range wide herbarium specimens and field observations for the known species range were compiled to start exploring the European suitability area for this species and to establish its overall distribution. Furthermore, we aim to superimpose the species occurrence with macroclimatic and hydrologic variables to better understand species ecology.

By gathering all the available information on this taxon we hope to identify probable sampling gaps of this species in Europe and to obtain a present potential distribution range of the species at the European level that

could guide future field surveys. Additionally, we aim to discuss and propose an updated conservation status in Europe considering the results of this work and the present integrity of European fluvial scenarios.

SEB.P2. A shy glance to *Parmelina carporrhizans* photobiont

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Introduction: *Parmelina* is a small genus of Ascomycota belonging to the family *Parmeliaceae*. *Parmelina carporrhizans* is obligate sexually reproducing specie which needs re-lichenize every generation after spore germination. The knowledge on *Parmelina* photobiont is scarce, it was identified as *Trebouxia impressa* (Friedl et al 1999). Recently the genus *Parmelina* has shown to have the highest photobiont specificity among the *Parmeliaceae* genera studied (Leavitt et al submitted).

Material and Methods: We sequenced ITS of fungal and algal symbiont from 181 collections of *Parmelina carporrhizans* from 10 localities of Canary Islands, North-Africa, Iberian peninsula and Sicily.

To compare the variability of both symbionts the haplotype networks analyses with PopArt 1.7 were performed. Phylogenetic analyses were made just with algal sequences, and *Trebouxia gelatinosa* was used as outgroup. Due to taxonomical difficulties to delimit *Trebouxia* species we used Automated Barcode Gap Discovery (Puijandre N. Et al 2011).

Results: We obtain two DNA matrix, the fungal dataset had 181 sequences and 6 parsimony informative sites, and the algal matrix had 155 sequences and 23 parsimony informative sites. We found genetic structure in the photobiont including 4 clades well supported by bootstrap and posterior probability in the phylogenetic analyses. The OTUs delimitation analyses found 2 OTUs (ABGD).

Discussion: The photobiont showed much higher genetic variability than mycobiont in *Parmelina carporrhizans*.

The haplotype dominant in Tenerife is the less related to the rest of haplotypes (being separated by the rest by 8 mutations) and was identified as a different OTU by ABGD.

Our results are in accordance to previous studies in photobiont specificity of *Parmelina* genus being associated with just two putative *Trebouxia* species (Leavitt et al submitted). The photobiont distribution pattern showed in *P. carporrhizans* is coincident with those reported in *Ramalina farinacea* (del Campo et al 2010).

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114 SEB.P3. Ontogenia comparada del esporófito en dos musgos canarios. Estudio anatómico.

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Antecedentes: La adquisición de estomas funcionales es un paso significativo en la evolución del esporófito. Los estomas y la seta se interpretan como estructuras funcionales, al servicio del pie, para transferir nutrientes desde el gametófito que permitan la esporogénesis y la madurez de la cápsula.

Métodos: En este trabajo se estudia la anatomía de los estomas en distintas fases del desarrollo del esporófito (pie, seta y cápsula), en dos musgos pleurocárpicos canarios, *Leucodon canariensis* (Brid.) Schwägr y *Criptideptodon longisetus* Mont., usando microscopía óptica y electrónica.

Resultados: Se describe el tipo morfológico, el tamaño, la orientación, el número y la localización de estomas por cápsula. En algunos casos se observan estomas anormales, encriptados en surcos y en distribución cluster, con materiales cerosos depositados en los poros. Se discute su relación con las condiciones medioambientales. En todas las fases estudiadas de la ontogenia capsular la conducción en la seta se realiza a través de hidroides. La placenta tiene células de transferencia con paredes laberínticas en las dos fases en contacto.

Conclusiones: Del estudio comparado de la ontogenia del esporófito y de la morfología de los estomas se desprende que estos tienen un papel muy significativo en la desecación y dehiscencia de las cápsulas.

SEB.P4. Bases taxonómicas para la reinterpretación de la taxonomía de los géneros *Lemanea* y *Paralemanea* (Batrachospermales, Rhodophyta).

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Las algas rojas de los géneros *Lemanea* y *Paralemanea* (Batrachospermales, Rhodophyta) constituyen uno de los grupo más abundantes y conspicuos de algas rojas continentales en la Península Ibérica. Sus especies tienen una potencial capacidad aplicada como bioindicadores de calidad de agua bajo distintas aproximaciones (Harding & Whitton, 1981; Moreno et al., 2006; Scheneider & Lindstrøm, 2011), escasamente desarrolladas.

Hasta la actualidad se han citado en la Península Ibérica diversas especies de ambos géneros (Chapuís et al., 2013), si bien su caracterización resulta muy compleja debido a la ausencia de adecuados caracteres taxonómicos. El trabajo que se presenta forma parte de una amplia colaboración entre diversos equipos de Europa y del Norte de América.

Los primeros resultados de los análisis moleculares llevados a cabo en el proyecto de Flora Ibérica de Algas continentales (rbcL/COI) generan resultados de difícil interpretación, construyendo clados formados por poblaciones morfológicamente atribuibles a diferentes morfoespecies. Para poder desarrollar una taxonomía que permita una adecuada identificación de las especies biológicas, nos proponemos ensayar una batería de caracteres taxonómicos más fácilmente cuantificables que los actuales. Uno de ellos el tamaño y la morfología del carpogonio, de indudable validez en géneros "próximos" como *Batrachospermum*, *Kumanoa*, *Sheathia*, y otras algas rojas. Dada la estructura pseudoparenquimática del talo, éstos no son evidentes, de hecho nunca se han tenido en cuenta en la taxonomía de sus especies. La caracterización a microscopía óptica y electrónica de las carposporas es otro carácter a tener en cuenta en esta nueva aproximación taxonómica. Desde el punto de vista ecológico se tendrá en cuenta la caracterización físico-química del agua en la que habitan.

La metodología utilizada consiste en la realización de cortes semifinos y su posterior tinción y observación a microscopía óptica. De esta forma tratamos de localizar estructuras estables que constituyan una alternativa discriminante frente a los criterios tradicionales utilizados en todos los textos clásicos, incluso los más recientes (Kumano, 2002, Eloranta et al., 2011) escasamente discriminantes como, por ejemplo, distribución de las papilas espermatangiales, desde regular a irregular o tipo de ramificación, desde escasa a abundante; ... entre ambas opciones generalmente se desarrollan gran cantidad de casos intermedios de muy difícil clasificación. Como prueba de esta ambigüedad basta citar que hay poblaciones que a lo largo de la historia se han identificado como 5 especies diferentes (Ganesan et al., 2015).



SEB.P6. The end of a generalist? Geographically structured host associations of *Amanita phalloides* in Europe

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The deadly poisonous ectomycorrhizal (EM) fungus *Amanita phalloides* is native to Europe, but has been introduced to Australasia, Southern Africa, and South and North America. The fungus does not seem to be spreading from any of these points of introduction, except along the west coast of North America where *A. phalloides* is invasive. In California, the fungus is now widespread and associates almost exclusively with *Quercus agrifolia*, an endemic oak. In contrast, in the east coast it is considered relatively rare and appears most often in pine plantations. A current hypothesis suggests that if an EM fungus is a generalist in its native range, it may shift to a diversity of novel hosts in the introduced range and for this reason easily invade. Although according to European field guides *A. phalloides* is a generalist, available data on host associations of *A. phalloides* in North America is at odds with the hypothesis of generalist mutualists' flexibility in native and introduced ranges. We rigorously documented the host associations of *A. phalloides* in Europe, targeting Sweden, the United Kingdom and Portugal. We sampled EM root tips from under *A. phalloides* mushrooms, used a high-throughput diagnostic PCR for identifying *A. phalloides* mycorrhizas and DNA sequencing of plant barcoding regions (ITS2, in some cases also trnH and/or matK) to identify the host. Our results show that *A. phalloides* is not a generalist and rather exhibits geographically structured host specificity in Europe. We discuss the implications of our results in the context of the invasion biology of *A. phalloides* and to the concept of EM fungi specialization.

SEB.P7. Morphologic and molecular characterization of a endolithic microalgae from McMurdo Dry Valleys (East Antarctica) and some insights into possible microbial and photosynthetic eukaryote interactions.

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The McMurdo Dry Valleys constitute the largest ice free region of Antarctica (c.a. 0.03% of the continent) and one of the world's most extreme deserts. Typically, cold desert soils from Dry Valleys have low levels of carbon and nitrogen and are low in clay. Despite the low temperatures, dry and poor soils and katabatic winds, life exists. Milder microclimate conditions of the subsurface soil ease the growth of microbial life on such harsh environments. Soil acts as a refuge, protecting life from intense solar radiation and desiccation. In fact, some microbes are able to take advantage of those microenvironments, inhabiting the pore spaces of soil - frequently in porous rocks such as sandstones -, and constituting photosynthesis-based endolithic communities. In addition to cyanobacteria and microalgae (primary producers), other organisms present in the consortium play important, complementary ecological functions that contribute to sustain life in these environments. This kind of simple, microecosystems can also help us to better understand nitrogen-carbon cycle interactions.

In this study, a green microalga was isolated from an endolithic sample collected in McMurdo Dry Valleys (Victoria Land, East Antarctica) during the K020 expedition, in January 2013. Remarkably, the non-axenic eukaryotic isolate (LEGE Z-009) was originally isolated using BG110, a culture medium without a source of combined nitrogen. The strain was then characterized by morphology- and molecular-based methods (e.g. cell morphometry and ultrastructural characterization, phylogenetic analyses of nuclear and chloroplast SSU rRNA genes). Additionally to this culture-dependent approach, 16S rRNA gene amplicons from genomic DNAs extracted from various steps throughout the algal isolation process were analyzed by next-generation sequencing (NGS). The analysis showed that the endolithic community has drastically changed during the non-axenic algal isolation. Most of the prokaryotes now in co-culture with the alga belong to different groups of known N₂-fixers. Finally, the eco-biological interactions between organisms of this community and the existence of mutualistic relationships between the microalga and co-cultured bacteria was investigated by fluorescence microscopy (staining of DNA using DAPI), as well as by electron microscopy (TEM and SEM).



116 TH.P1. Analysis of growth, fatty acid composition, pigments and antioxidant activity of *Haematococcus pluvialis* Flotow ACOI 3380

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Microalgae can synthesize various substances and may have commercial application in several areas such as aquaculture, human health, chemical and pharmaceutical industries, among others.

The present study focuses on the biotechnological potential of *Haematococcus pluvialis* Flotow ACOI 3380, a strain from the Algoteca de Coimbra (ACOI). Growth of motile cells and cysts was analyzed, the fatty acid composition, main pigments and the antioxidant value were determined.

After 29 and 26 days of growth, the biomass of motile cells was 0.072g/L and the biomass of cysts was 0.278g/L. The motile cells were grown under a light intensity of 5.68 μmol m⁻² s⁻¹, a photoperiod of 16h:8h light/dark and room temperature of 23°C. For development of cysts, the cultures were submitted to identical conditions, changing the light intensity to 43.24 μmol m⁻² s⁻¹ and bubbling air. The most abundant fatty acids found in the motile cells and cysts were stearic acid (0.088mg fatty acid/g wet biomass) and palmitic acid (0.169mg fatty acid/g wet biomass and 1.097mg fatty acid/g wet biomass), respectively. The pigments identified in the cysts were β-carotene, astaxanthin and chlorophyll a, β-carotene being the most abundant. The antioxidant activity evaluated by the ABTS assay showed higher activity in the motile cells than the cysts, with a value of 6.59mg/L equivalent to ascorbic acid, comparable to that of carrot extracts (5.98 mg/L equivalent to ascorbic acid). The assessment made by a second method, the DPPH assay, was only possible in motile cells and confirmed the antioxidant value measured by ABTS.

The present work shows that this strain of *H. pluvialis* has some potential linked to the area of healthy nutrition, due to its fatty acid profile and, consequently, in the improvement of human health. In addition, its antioxidant activity, possibly due to the carotenoids identified in the cells, also indicates some potential of this strain to be cultivated for the production of β-carotene and astaxanthin, pigments with known applications in the food, chemical and pharmaceutical industries, among others. However, before any attempts are made for commercial purposes of this strain, detailed studies should be carried out to optimize growth and production of the compounds, since its growth is very slow.

TH.P2. Bioactive compounds from *Porphyridium purpureum* (Bory de Saint-Vincent) K.M. Drew & R. Ross and *Chrysothila lamellosa* P.L. Anand

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The interest in microalgae as a source of novel compounds has increased in recent years due to the diversity of metabolites produced, in particular lipids, polysaccharides, pigments, proteins, enzymes and toxins.

In this work two microalgae strains from the Coimbra Collection of Algae (ACOI), *Porphyridium purpureum* ACOI/SAG 1380 and *Chrysothila lamellosa* ACOI 339 were selected and the following aspects analyzed: (1) growth over 15 days; (2) combined fatty acids profile and respective quantification done by gas chromatography; (3) polysaccharide production and identification of sugars using high performance liquid chromatography; (4) the antioxidant potential measured by the ABTS and DPPH spectrophotometric assays, and (5) the value of the total biomass. For some strains of *Porphyridium purpureum* the ability to synthesize compounds of interest, mainly sulphated polysaccharides, phycoerythrin and fatty acids ω3 and ω6 has been reported. For *Chrysothila lamellosa* to our knowledge no report is available.

Under a photoperiod of 16:8 hours light:dark, a light intensity of 21.62 μmol/m²/s, air bubbling and a room temperature of 23°C, after 15 days of growth the biomass obtained of *Porphyridium purpureum* was 0.79g/L in reactors of 20L and 0.50g/L in 250mL flasks. In these conditions, it produces polyunsaturated fatty acids ω3 e ω6, especially arachidonic acid and eicosapentaenoic acid, in quantities of 2.7 and 0.6% of the total fatty acids. It also showed a production of 0.68g/L extracellular polysaccharides, consisting mainly of arabinose, mannose and galactose. Additionally, an antioxidant activity of 9.98mg/L equivalent to ascorbic acid was measured, a value higher than that of a carrot extract. Analysis of the total biomass revealed high percentages of carbohydrates and protein, 59.05% and 19.71%, respectively and 1.73% of lipids.

Under identical culture conditions, *Chrysothila lamellosa* showed a biomass growth of 0.64g/L in 20L reactors and 0.40g/L in 250mL flasks. This strain was also a producer of polyunsaturated fatty acids ω3, particularly eicosapentaenoic acid and docosahexaenoic acid, with ratios of 0.6 and 6.4% of total fatty acids, respectively. It showed a production of 0.18g/L of polysaccharides, mainly consisting of xylose. Its antioxidant capacity was equivalent to that of raspberry. Analysis of the total biomass value identified 41.17% of carbohydrates, 11.52% of protein and 2.68% of lipids.

In conclusion, this work indicates that both strains have an interesting nutritional potential resulting from the respective profile of polyunsaturated fatty acids, the antioxidant activity displayed and the capacity for carbohydrate production.



Promote biodiversity data publishing and usage: the role of data papers

Figueira R

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Data publishing is becoming a mainstream way of increasing the impact of the researchers' work. For example, scientific papers published with the public deposition of raw data, receive an higher number of citations. Furthermore, in some European countries it is being implemented the European Commission recommendation for the open access publishing of scientific data resulting from public funded projects. In Portugal, this requirement has become into force since 2014. But, more importantly, the willingness for data publishing may arise from other motivations, like attract the attention of specialists to our collection or database, ensure the long-term preservation of data, to potentiate new science, fulfil the institutional mission of public service, among others.

It is not sufficient, however, to make data available in a public repository. Data curators need to ensure that the information in a dataset will be discovered by the users to whom it could be valuable, data will be correctly used, not distorting the initial purpose or meaning, credits are given to the use of data, and it is possible to track the use of such data in research.

Data papers are one of the best ways to achieve these goals. A data paper is a scientific publication that, rather than testing an hypothesis and publishing conclusions, describes the dataset in terms of its origin, methodology, spatial, taxonomic and temporal context (for biodiversity data), and the quality assessment. Its structure is, in many ways, similar to a typical scientific article, but can be considered a metadata document. Data papers are published in many different scholarly journals, after a peer-reviewing process. Many editorial houses of scholar papers, including the ones of the top rated journals, have embraced this scientific format, either by creating journals dedicated to data papers, or including data papers as a type of manuscript acceptable for submission.

The Global Biodiversity Information Facility has developed a full strategy to promote the publishing of data papers by the GBIF publisher of data sets, with the aim of increasing discoverability, credit attribution and track usage of data. This involves the development of software tools related to data publishing to facilitate manuscript preparation, the inclusion of persistent Document Object Identifiers to datasets, partnering with scholar editors, training and other initiatives. In this presentation I will review this strategy, as well as latest developments for biodiversity data publishers, in the context of open access policies, and options for publication, as an account of data papers benefits for data curators of biological collections and biodiversity databases.



118 **BioDiversity4All - a Portuguese citizen science project**

Patrícia Tiago

Portugal has a high biodiversity value with many endemics and most of the species threatened at the European level. However, this biodiversity value remains largely unknown to the Portuguese society although many different citizens carry out activities connected to nature, having a unique knowledge on the biodiversity surrounding them. The non-profit organization Associação Biodiversidade para Todos – BioDiversity4All has, as its mission, to gather the cooperation of citizens in registering Portuguese biodiversity, which crystallizes valuable information. We further believe that, by making people involved and emotionally attached to biodiversity issues and activities, this will increase their awareness to the importance of biodiversity conservation.

BioDiversity4All is an open database (fed by user observations) on Portugal's biodiversity, accessible to all, from scientists and conservationists to the general public and school children allowing everyone to share their observations. As a result of citizen's participation it has over 200 thousand records of biodiversity (plants, animals and fungi) until now, which is a great success, considering the country's cultural constraints. All users can add observations of species or habitats to the database. Specialists and automatic rules validate these observations, especially the ones complemented with photos. The public and stakeholder outreach of BioDiversity4All is large, for Portugal, given the over 2200 registered users, around 5000 Facebook fans, 50 stakeholders' partners (companies, non-profit, municipalities and schools) and wide expert panels. A specific communication approach has been developed to get a closer relation with the different groups of users.

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XX SIMPÓSIO DE BOTÂNICA CRIPTOGÂMICA



PORTO, 22 A 25 DE JULHO DE 2015



**We hope you enjoyed the
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**See you in Aranjuez for the
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