Annual Report

2021

Botanischer Garten Berlin

Bo

#BoBerlin
International
Knowledge Hub
for Botany

Freie Universität Berlin

Annual Report 2020 – 2021
Botanic Garden and Botanical Museum Berlin

Botanischer Garten Berlin

Freie Universität Berlin

CONTENTS

FOREWORD

The goatsbeard species *Tragopogon tommasinii*.

Effective climate protection requires healthy, species-rich and therefore stable habitats such as forests and moors.

Prof. Dr Thomas Borsch
Director, Botanic Garden Berlin

The years 2020 and 2021 brought major challenges for all of us. The Covid-19 pandemic affected us personally and professionally in multiple ways. Sadly, the current Russian war of aggression against Ukraine is now another acute crisis in Europe, another challenge for us. Our heart goes out to those directly affected.

Against the backdrop of the pandemic, I am particularly pleased and thankful that everyone at the Botanic Garden Berlin showed solidarity and commitment, helping us to continue with our tasks even in those difficult circumstances. In this way, we were able to preserve our collections, which are unique in the world, and push ahead with our programmes and cooperation arrangements, while doing our utmost to protect our guests and staff.

Now, our visitors can once again enjoy the variety of plants, both outdoors and in the greenhouses, without Covid restrictions, and our constructive cooperation with colleagues and partners in Germany, Europe and the rest of the world can finally once more culminate in face-to-face meetings, so important to us as human beings. In the Freie Universität Berlin, and together with partners worldwide, we are pursuing our core concerns: preserving, researching and explaining plants, fungi and algae. Our collections form the basis for these activities. And so we continue to devote our work to the challenges that need our full attention. The biodiversity crisis with the rapid loss of species and their genetic variety threatens our well-being. This makes it all the more important to consider biodiversity protection and climate protection together, since effective climate protection requires healthy, species-rich and therefore stable habitats such as forests and moors.

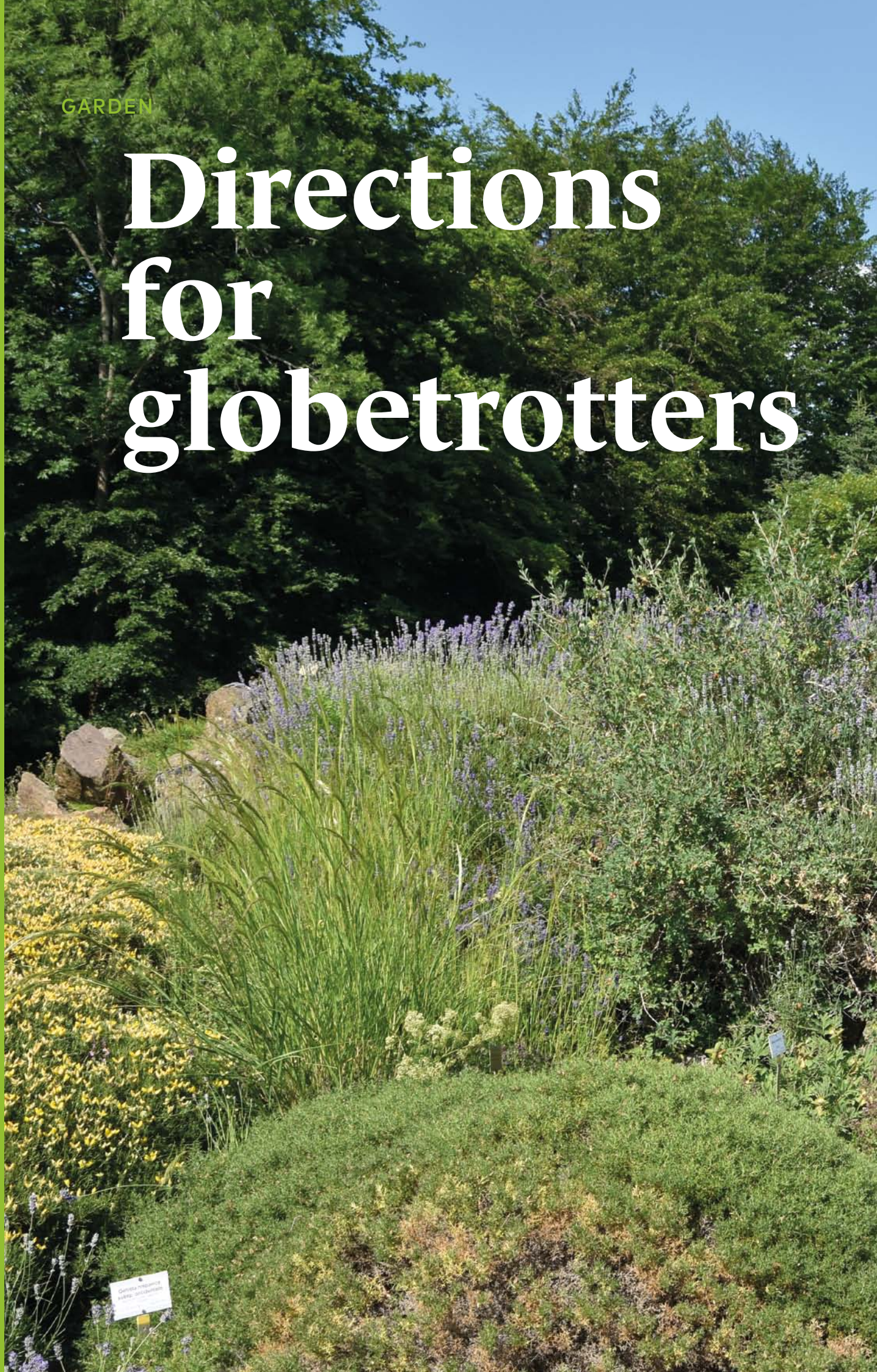
This report provides insights into the new information system for our visitors to the garden, details the digitisation of our largest collection in the herbarium, and describes the research into diatoms in the polar regions. In the new "News in brief" section, we bring you brief updates on projects, events and the results of our work in the garden, the museum, and in our research.

I conclude with heartfelt thanks to all colleagues who work with such passion for the Botanic Garden and Botanical Museum Berlin, as well as to all our donors and supporters. I hope you find the report both interesting and enjoyable to read!

With best wishes,

Berlin, October 2022

Directions for globetrotters



A visitor information system for the Botanic Garden's plant geography section

The journey around the world begins among our native copper beeches. Visitors who enter the Botanic Garden Berlin via the Königin-Luise-Platz entrance find themselves in familiar surroundings, with majestic trees. You may immediately recognise the typical Central European copper beeches. The paths leading from this spot, though, soon bring you to other, less well-known regions of Europe, and from there onwards to Asia, via the Caucasus, and then over the Bering Strait to North America. It is easy, in these travels, to lose sight of the floristic regions and landscapes of the world through which you are journeying.

In the future, however, it will be easier for visitors not only to find their way, but also to delve deeper into the secrets of the various floristic regions and their habitats. For the first time since it was established in Dahlem 120 years ago, an information system is being introduced to the 13 hectares of the plant geography section, with display boards and digital services for visitors.

"This department is at the heart of our outdoor display", explains Dr Gerald Parolly, curator of the temperate and Mediterranean living collections at the Botanic Garden. "There is no other garden in the world with such a detailed plant geography display." Mountains such as the Alps or the Carpathians are even represented by rock garden complexes that can be explored in three dimensions. Visitors can see which types of forest grow at the foot of the mountains, which plant communities thrive higher up, and what the landscape looks like above the tree line. They can also see the differences between the northern and southern faces of the mountains.

There is no other garden in the world with such a detailed plant geography display.

Dr Gerald Parolly,
curator of the temperate and Mediterranean living collections

Up to now, if you wished to understand all of this, you had to take a guided tour. "The new information system means, however, that in the future our guests will also be able to discover the plant geography section for themselves", says Gerald Parolly. Working with exhibition designer Yvonne Rieschl, he first developed the display boards. Digital information and other topic-related boards will follow later.

Visitors will be welcomed with a thorough introduction to the earth's flora and vegetation, and to the particularities of the Berlin plant geography display. For each of the 21 areas in this section there will also be a lectern-like sign with a vegetation map, as well as photos and texts in German and English. Here, visitors will discover, for example, that they are in the Alps, and what the most important ecosystems and landscape types there look like. The information board will also describe the climatic and soil conditions in the Alpine region, and how this affects the plants there. This gives visitors not only an impression of the landscapes and habitats of the individual regions: in addition, they learn how these come about and function.

Each of the 21 areas of the plant geography section is symbolised by a leaf of a typical tree species: for the "Alps", the green alder. This pictogram is repeated on the many smaller signs in the different plant geography areas within the Alps. These indicate, for example, that the reader is standing by a hill displaying the flora and vegetation of the southern Alps, such as the Dolomites. There they will see plants which grow in this area in the mountain forests and the high mountain regions.

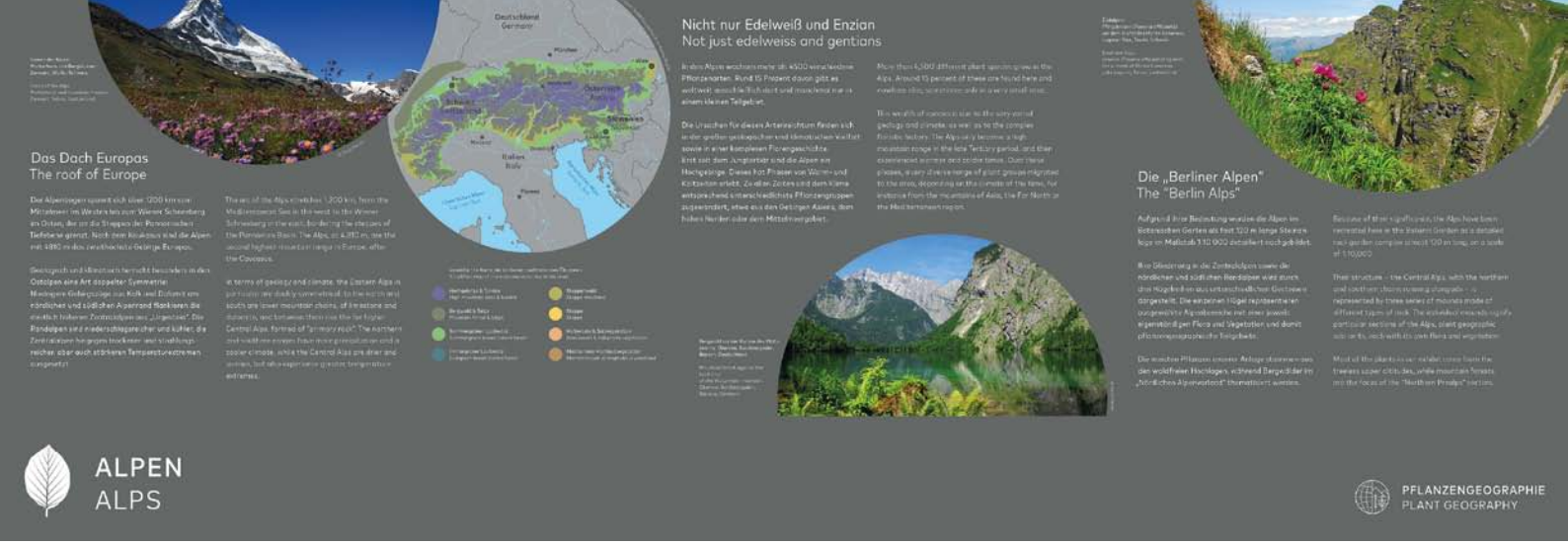
120 years

A living plant geography exhibit

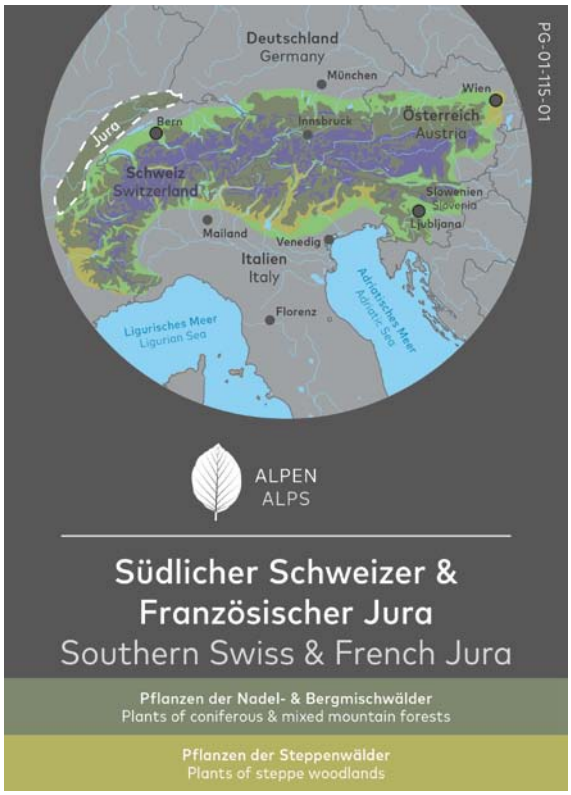
This was just the sort of geobotanical-ecological approach that Adolf Engler, the then director of the garden, had in mind when he designed the layout more than 120 years ago. Before Gerald Parolly started planning the new information system, he therefore delved into historical sources. "I wanted to grasp the original concept behind the display", recalls the biologist, "so I could then develop it further in line with our current understanding." He found it very exciting to see what has become of Engler's old plans in the intervening years, because quite a lot has changed in the plantings in Dahlem since then.

Today the only open-air sections you travel through are the temperate latitudes of Europe, Asia and America. Plants from the warmer regions of the world can only be admired in the greenhouses. Where nowadays you can see extensively managed and therefore species-rich, colourful meadows, in Engler's time even more areas were portrayed outdoors. These included, for example, the extratropical regions of the South American Andes, Australia or southern Africa. In addition to basic coverage with hardy vegetation, some species vulnerable to frost were also on display. These plants in tubs were brought inside in the winter: a huge amount of work which today would not be possible since, despite all the machinery, much still has to be done by hand. And while around 80 gardeners currently work in the Botanic Garden, in Engler's day there were around 300.

"This means that we always have to weigh up which habitats we can show at a justifiable cost", explains Gerald Parolly. Open, dry ecosystems such as steppes and prairies are particularly hard work to manage. They need intensive care, to stop the spreading of alien plants. After the Second World War this was not always possible, so that whole areas were invaded even by trees and shrubs. Today, the crowns of possibly the finest area of woodland in the garden provide shade on a hill once intended to represent the treeless high mountain vegetation of Japan.



Preview: Here you can see the new, modern look of our future information system. Large, lectern-like signs (above) give the key facts about the plant geography areas, as shown here for the Alps. The area signs (right) show the location of the individual planted areas (beds) and indicate the main habitats of the plants displayed in the individual sections. Our example shows the Jura as part of the Alpine display. There will also be a new, unobtrusive design for the plant labels (below).



Yet most of the plant geography section has been retained and allows visitors to experience the flora of the temperate latitudes of the northern hemisphere. The main expanses here represent the earth's three broadleaf deciduous forest zones and – in the rain shadow of the mountain systems which tower above or border on the woodland – steppes and semi-deserts. There are also large areas displaying the vegetation north and south of the deciduous forests, although the Berlin climate sometimes only allows an approximation of this flora. Winters here are too warm and there is not enough snow for the boreal forests, the taiga of Scandinavia, Siberia and North America. And the evergreen species of southern climes, with their Mediterranean sclerophyllous forests and fully humid laurel forests, often react badly to frost.

The whole section is a unique, self-contained whole, which invites comparisons. Where else can you study at your leisure the flora native to very distant areas, planted side by side? The similarity in the structure of the deciduous forests of Europe, East Asia and North America emerges clearly, as does the rhythm of the seasons as a catalyst for growth and decay. The plant labels show that the flora of the three deciduous forest regions is very similar in terms of plant families and genera. On the other hand, there are clear differences in the lists of species which grow on the three continents – and in the amount of

In the Japanese forest, visitors discover unknown trees and ornamental plants familiar from domestic gardens, such as hostas (*Hosta* sp.).

diversity. The magnolias, tulip trees and bald cypresses of East Asia and the Atlantic side of North America show the far greater wealth of species in these areas – and, therefore, highlight the climate-related loss of flora and vegetation in Europe. The ice ages had a much greater impact on our continent than elsewhere, since the position of the mountain ranges prevented the thermophilic plants moving southwards.

The greater quaking grass (*Briza maxima*) is native to the Mediterranean. In the plant geography section, visitors can see these pretty spikelets in the "Balkan Peninsula & Greece" area.

Climate, climate, climate! It seems to be changing in a sudden leap, which means huge challenges for this historic site. "We must make the plant geography section more climate-resilient and exchange species, without altering the landscape character of this heritage garden or losing one of its multi-layered narratives", says Gerald Parolly, looking towards the future. The experts from the Botanic Garden are, therefore, constantly checking the plants, bed by bed, moving species or replacing them with more suitable ones. Some parts will also be redesigned in the future. Even after more than 120 years, then, the living plant geography display is far from completed. The information system, however, is an important building block in the work of making the garden fit for the future, and accompanying visitors on their world tour through the garden.

In the spotlight of science

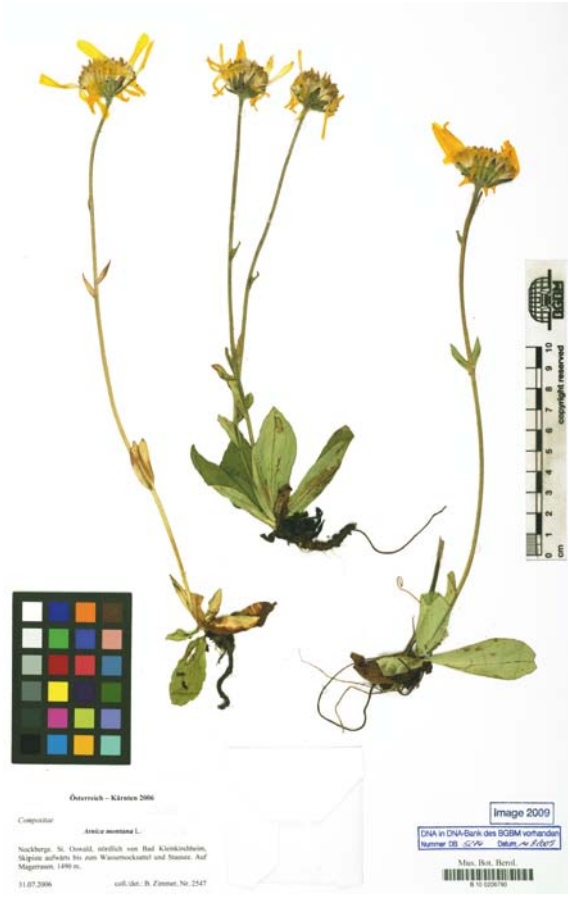
Every year, the herbarium of the Botanic Garden Berlin digitises thousands of specimens

Arnica – or, to use its scientific name, *Arnica montana* – is an eye-catching plant. In the summer, with its luminous yellow inflorescences, it paints a bright picture on mostly relatively damp, unfertilised meadows. It is also known and loved by many as a medicinal plant. Its gradual decline in the past decades has therefore not gone unnoticed, either by experts or by knowledgeable amateurs.

The floristic mapping carried out regularly since 1965 has shown that this plant species, once common in Germany, has now become a rarity. What is true for arnica is also true for many other plants in Germany, Europe and worldwide. Most of them are much less well known. For some, we still do not understand where the biological species boundaries lie between them and their closest relatives. Others are extremely difficult to differentiate from similar species, so that today not only is it unclear where they grow, but often we can no longer tell whether their distribution was correctly mapped in past decades. In this regard, Central Europe is in fact in a privileged position, as in many other countries no such extensive surveying has been done at all.

Herbaria are large collections of preserved plants, fungi or algae, assembled and documented over centuries by botanists or laypeople interested in botany. The specimens are glued onto strong paper sheets and labelled, indicating the place where they were found, the date of collection and the name of the collector. Millions of such herbarium specimens are stored in Germany's herbaria. Together with other natural science collections, they are the most reliable archive we have of life on earth. In a project run by the Botanic Garden Berlin and the Institute of Biology of the Freie Universität Berlin, arnica is being used as an example to check how well herbaria have documented biodiversity from the past up to the present day, and whether they may even enable us to draw conclusions as to the causes of this decline.

One key question in this work is how frequently scientists have collected arnica and deposited it in herbaria. It's not easy to find this out: while some specimens are already digitised and accessible through public databases, most are still hidden in collections, and can only be accessed by making personal requests to the individual institutions. "In our own herbarium, we have identified nearly 400 specimens which we have now digitised and made available, with high-resolution images, to the project and to the general public", says Dr Robert Lücking, curator in the Berlin herbarium. To do this, the Botanic Garden Berlin has created its own small imaging centre in the cellar. In a black tent, a camera is sus-



The colour chart and scale bar allow researchers to precisely determine the size and colour of the flower heads of this digitised arnica specimen.

pended over a table, on which the sheets with the pressed plants are placed. The images, which are later made available in the virtual herbarium (JACQ) and through the Global Biodiversity Information Facility (GBIF), all need to be presented in a similar way: before the photographs are taken, therefore, a colour scale, a ruler and the logo of the Botanic Garden are assembled on the herbarium sheets. "We were particularly pleased that via the citizen science project 'The Herbonauts', citizen scientists were also involved in deciphering the labels and describing the collected plants", emphasises Dr Eva Häffner, science policy coordinator at the Botanic Garden Berlin. "This has been a great help not just for the current arnica study, but ultimately also for other research projects which can later use the entered data. We are very grateful. Anyone who would like to take part in similar projects and help with the digitisation of the herbarium is warmly invited to join us at www.herbonauten.de."

3·9 million specimens

and around 30,000 more each year

"A virtual herbarium saves a huge amount of time and money", explains Dr Katja Reichel from the Institute of Biology. "If you wanted to ask where in Germany arnica occurrences were collected in the past, all you would have to do, once the German herbaria are fully digitised, is to carry out a simple search and there you would have the data. However, we're still far from this stage." Fortunately, for many years now there have at least been close links between the German herbaria. Katja Reichel and Eva Häffner therefore put out a request to Robert Lücking's colleagues throughout Germany, asking them who had arnica specimens in their collections. "Once again, people were very keen to help", explains Katja Reichel. She is currently supervising two bachelor theses that aim to compare current data on arnica incidence with information from the herbaria specimens. "We are also planning to take a look at past and present land use in places where there are records of arnica being found, to investigate whether this will enable us to draw conclusions as to general causes for the decline in arnica", explains the scientist. "If we link the virtual specimens with further data on, for example, climate and land use, a lot more information can be gleaned from them", says Eva Häffner. She has no doubt that, in the future, large data sets from digitised collections will reveal links that had previously been hidden, and that can make a key contribution to nature protection. The EU's biodiversity strategy aims to put Europe's biodiversity on a path to recovery by 2030. Using large, globally networked data sets, obtained from free-to-access digital specimens, positive and negative changes in the presence of species can be tracked in space and time, and prognoses even be made as to areas for future expansion.

www.herbonauten.de

Curator Dr Robert Lücking working in the herbarium.

The actual reason why most herbaria were first established and continue to grow steadily is somewhat different. While arnica is relatively easy to recognise, this is much more difficult in the case of, say, dandelion species. Anyone who thinks they have discovered a new species must compare its characteristics with those of all its already described relatives. Digitisation can vastly speed up this task too. Previously, you would have had to borrow all sorts of material from collections scattered across the globe, which could be damaged in the process or lost in the post. "Today, in theory, you would just need to search the database, and you could then see on the screen photos, names and distribution areas of all the dandelion species described to date", explains Eva Häffner. This already clears up many questions. Indeed, the high-resolution images show tiny hairs, ridges and other details, which can help in species delimitation. There are now even programmes whose artificial intelligence has been trained in herbarium specimens and that can accurately identify individual characteristics or even species. For the foreseeable future, though, human intelligence is still essential to identify the existence of an evolutionarily independent species. For this, the specialist area of integrative taxonomy frequently uses, in addition to the properties shown on photographs, information that can only be obtained from the physical specimen. However, if pollen grains have been prepared and imaged through an electron microscope, or if DNA sequences of a herbarium specimen have been generated in the laboratory, then this data too can be linked to the digital specimens.

It is also interesting to find out about the people who contributed the individual specimens to the collection. Which plants did a particular botanist (all male at the time) collect in the nineteenth century in Central Africa? Such data would make it possible to link herbarium specimens with other historical evidence, so as, for example, to reappraise colonial history. As the sheets in the herbaria are almost

Large occurrences of arnica, as in this mountain meadow in the Western Ore Mountains, can now only be found in protected zones.

always sorted by family and genus, and not by collection date or collector, these questions can only be fully answered using digital databases.

All these research approaches work better, of course, the more specimens are contained in the virtual collections. However, converting the precious specimens, some of which have been collected over centuries, into digital form is a mammoth task. The shelves of the Berlin herbarium alone house around 3.9 million specimens, to which about 30,000 are added each year. "We try to record and photograph new specimens straightaway", says Robert Lücking. In the case of the old specimens, the team concentrates first on those which are particularly valuable or are very often lent out, as the capacity of the site in the cellar is insufficient to digitise the whole collection. Two people can work there, and each of them can, in a day, view, clean up, photograph and give a QR code to maybe 250 sheets with pressed plants. There is still, therefore, a long way to go to a complete digital herbarium.

This digitised arnica specimen is probably from one of the earliest arnica collections in the Herbarium Berolinense, founded in 1819. It has no label giving information on where, when or by whom it was found.

Arnica meadows often also contain other rare plants, such as this wild orchid (*Dactylorhiza fuchsii*). These often share the same fate: species decline.

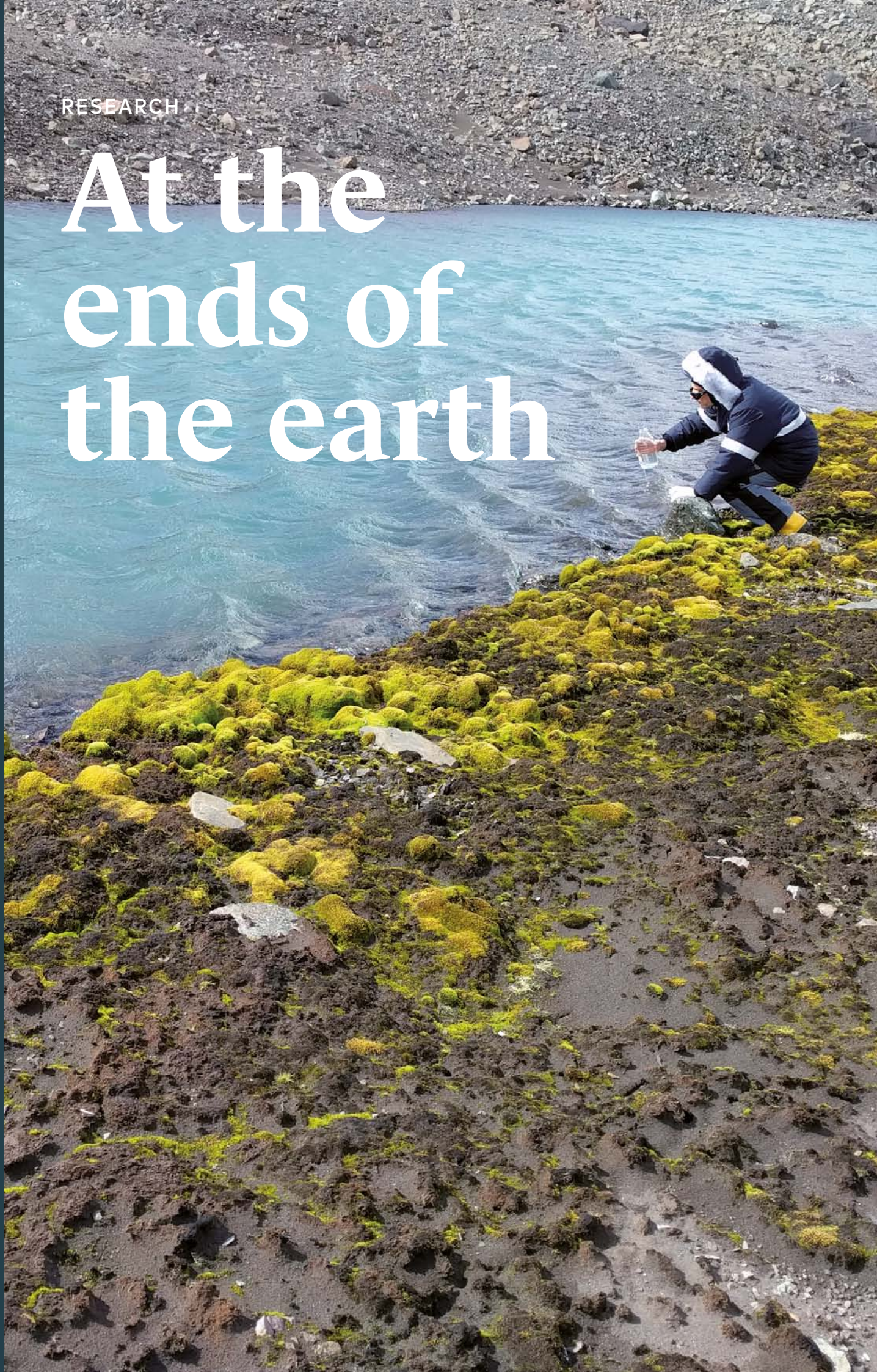
The situation is similar for other herbaria in Germany. According to an inventory taken in 2019, the 70 German herbaria were storing in total almost 23 million specimens, of which 87 per cent were still not digitised. Even for the already recorded items, the data available was mostly limited to written information, with no images. Yet experience from other countries such as France, the Netherlands, Finland, the US or Australia shows that today, with the right technology, it is indeed possible to carry out mass-digitisation of herbarium specimens. In particular, flat objects such as sheets of paper with pressed plants can be photographed as if on a conveyor belt – at an affordable cost and relatively quickly.

An initiative from botanical research institutions across Germany is calling for the German herbaria too to be fully digitised. These institutions have developed a plan for providing access to the herbaria in a single digital infrastructure, which could then be networked with other botanical collections – such as those in botanic gardens.

"We should start with the flat objects", believes Eva Häffner. Later, more difficult items such as living plants, seeds or specimens preserved in alcohol could be added to these. This would create a permanently growing library of biodiversity, constantly providing new insights into the fascinating world of plants, fungi and algae. "The technology exists", emphasises the scientist. "With appropriate support, we could begin tomorrow."

Article on the digitisation of herbaria.

At the ends of the earth



In a DFG-funded project, the diatoms research group is investigating diatom diversity in the polar regions.

In Potter Cove, on King George Island off the coast of the Antarctic Peninsula, climate change has already left its traces. In the last 50 years, the Fourcade Glacier has retreated by more than a kilometre, and the sea in the bay is now totally ice-free in the summer. This has consequences for the inhabitants of this harsh world in the deep south of the planet. For example, it affects the diatoms currently being studied by Dr Jonas Zimmermann and his diatoms research group from the Botanic Garden Berlin.

Which species of these microscopic organisms can be found in the Antarctic? Are they similar to those found in the Arctic? And how do these polar communities react to climate change? A project being carried out as part of the priority programme "Antarctic Research" of the German Research Foundation (DFG) is seeking to clarify such questions. To this end, the Berlin scientists have joined with a team led by Professor Ulf Karsten from the Department of Applied Ecology and Phycology at the University of Rostock.

"Only very little is currently known about the diatoms in polar regions", says Jonas Zimmermann. Yet these small, photosynthetic life forms are highly influential aquatic organisms, which pull a whole series of ecological strings in seas round the world. They contribute a quarter of global oxygen production, form fine biofilms to direct the exchange of oxygen and nutrients at the boundary between the water and seabed, and protect sediments from erosion. They are, in addition, a basic foodstuff for countless other living things. Moreover, since many of these diatoms have very specific requirements, they can be used as indicators of the condition of their habitats. There are sufficient grounds, then, to take a closer look at the various types of diatoms, including in the polar regions.

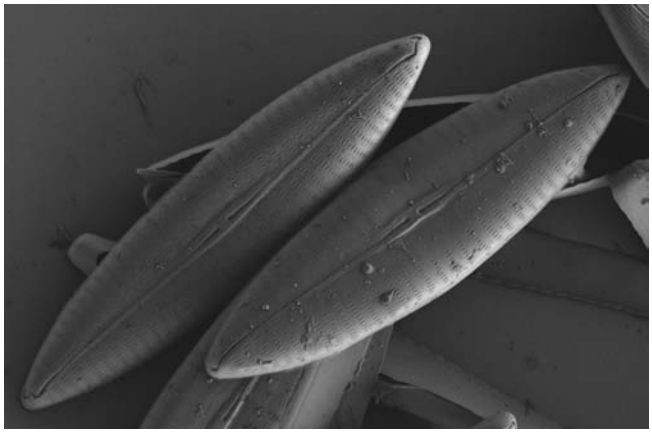
In January 2020, therefore, Jonas Zimmermann temporarily swapped his desk in Berlin for a work station in the Dallmann Laboratory in Potter Cove. Because of the strong winds, outdoor work can be difficult even in the polar summer, especially since fingers quickly become numb when collecting sediment samples from cold water at around 2.5 degrees, or when scraping diatom layers off the rocks. "We can't wear warm gloves for this work", explains the researcher, "or our hands are too clumsy".

But the discomfort was worth it. The samples arrived safely back in Berlin – transported by ship using the logistical services of the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven. However, they arrived in the spring of 2020, just when the Botanic Garden's laboratory was closed due to the Covid-19 pandemic. How could the diatoms be preserved outside their cold environment so that they could survive and supply useful information?

"We don't just study the environmental samples collected, with their original species mix", explains Jonas Zimmermann. The team also wishes to have as many diatoms as possible in pure cultures of just one species. To obtain these, they have to isolate cells from the water samples and divide them up into separate species in individual petri dishes. They are then grown in special media in a specific refrigerator, which can be set at a low temperature of three or four degrees. For this, the tiny, sensitive organisms need not only equivalent salt and nutrient conditions to those in their Antarctic homeland, but also a similar cycle of day and night.

Some varieties of diatoms may have disappeared before we even discovered them.

Jonas Zimmermann,
head of the diatoms research group



SEM image of a *Navicula* culture, isolated from a sample taken from 5 metres deep in Potter Cove, in the Antarctic. Morphological and molecular analysis suggests that it is probably a species that has not yet been described.

"To make sure nothing goes wrong, it's best to check the cultures every day to see how they're getting on", explains Jonas Zimmermann. Have they been contaminated by any cells from different species? Are the conditions still suitable or should the lighting or nutrients be adjusted slightly? Dr Oliver Skibbe from the diatoms research group has a lot of experience in such matters. And thanks to a special authorisation he was allowed to check the situation in the laboratory every other day, even when it was closed during the pandemic, so that the valuable samples could be saved.

As a result, PhD student Katherina Schimani and curator Nelida Abarca now have plenty of material from which to extract new information about the Antarctic diatoms. The team has already established about 250 cultures.

"We expect to find around 30 percent of new species in the cultures and environmental samples", says Katherina Schimani. These are identified partly by studying their appearance under the light and electron microscopes. Diatoms have varied, artfully shaped silica shells, and can be distinguished from each other by the design of these shells. "The problem is that no two shells are exactly the same, even among the same species", explains Nelida Abarca. The cells, therefore, also have to undergo genetic screening.

Data curator Wolf-Henning Kusber feeds all the information on the species found and their habitats into a database. High-resolution microscope images can be consulted here, as well as the so-called DNA barcode. This is a small extract of the genetic material which, when sequenced, makes it possible

PhD student Katherina Schimani using electron microscope images for her research in the laboratory of the Botanic Garden Berlin.

to identify individual species. The database is developing into a library of polar diatoms, which is growing over time. Following an expedition to Spitzbergen in 2022, Arctic species will also be added.

This data collection is a valuable source of information for scientists throughout the world, making it far easier for them to research biodiversity. Using modern methods of analysis such as metabarcoding (high-throughput sequencing), the team can record the DNA barcodes of all the diatoms in a water sample. They can then compare this with the sequences in the library, to identify which already known and new species are to be found in the particular region.

"The genetic variety within a species is also interesting", says Jonas Zimmermann. The more variability, the better the organisms can adjust to changes in their habitat. At a time of climate change, this can be a question of life or death. What will happen if the climate in Potter Cove becomes even warmer? How well will the various diatoms cope if further melting of the glacier creates even more fine sediment which clouds the water? "If we know more about the needs of the individual species, we can make this type of prognosis", explains the Berlin researcher. The team in Rostock therefore carries out experiments to test the tolerance of the individual species to changes in temperature, salinity and pollution.

"Some varieties of diatoms may have disappeared before we even discovered them", fears Jonas Zimmermann. "And that could have consequences for many other species." Potter Cove is now free of ice, which is bad news for all those diatoms that normally grow on the underside of the frozen ice sheets. This is also leading to a decline in the number of small crustaceans that graze on them, and then these krill are no longer available to feed a range of animals, such as Adélie penguins, crabeater seals, and several species of whale. Even the largest ocean-dwellers, therefore, are dependent on the survival of these tiny organisms with their decorative silica shells.

Review of the year 2020/2021

2020

January/February

360° sound installation in the Main Tropical Greenhouse: for four weeks, visitors can experience unique sound art at the Botanic Garden Berlin. At these interdisciplinary matinee performances, the culmination and highlight of the "Nature. After Humboldt" project, scientists and artists together consider their own contact with nature.

Project partners: Berlin-Brandenburg Academy of Sciences and Humanities, CTM-Festival for Adventurous Music and Art, Deutschlandfunk Kultur and Die Junge Akademie

March

Lockdown: for the first time since its reopening in 1946, the Botanic Garden Berlin must close its doors to visitors, due to the Covid-19 lockdown. The garden will only reopen, subject to certain conditions, in May. The greenhouses remain closed until June 2021.

November

Reorganisation: following a two-year strategy period, the board of the Freie Universität confirms the restructuring of the Botanic Garden and Botanical Museum. The new organisational structure binds research and practice even closer together; the biological collections and garden management are combined into one department (see organisational chart on pp. 30–31).

2021

March

Visit of the President: during a guided tour, Federal President Frank-Walter Steinmeier learns about the current projects and main areas of research of the Botanic Garden Berlin. With his wife, Elke Büdenbender, he visits various parts of the garden, including the herbarium, the Dahlem Seed Bank and the greenhouses.

2021

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

June

Open again, at last: after over a year, the greenhouses can reopen to visitors. Due to Covid-19, access is limited at first, and the most popular time slots are soon sold out. Great joy that we can again present our wide range of tropical and subtropical plants to our visitors.

August

We are BO Berlin – International Knowledge Hub for Botany: at the end of August, the Botanic Garden presents its future concept 2030, including a new visual identity, to national and international guests and on a livestream.

Video of the BO Berlin event.

August

Launch of a new open data management centre for biodiversity. In August, the Center for Biodiversity Informatics and Collection Data Integration (ZBS) begins its work. The interdisciplinary team of computer scientists, biologists and engineers focuses on research topics linked to biodiversity informatics and integration of the varied collection data of the Botanic Garden Berlin.

Contact person: Anton Güntsch, head of the ZBS, zbs@bo.berlin

October

Citizen science: October sees the start of the "Pflanze KlimaKultur!" (Plant Climate-Culture!) project, in which interested members of the public work with scientists from the Botanic Garden Berlin and the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig to study the influence of climate change on the seasonal development phases of plants (phenology). The project is receiving funding from the Federal Ministry of Education and Research.

Contact person: Birgit Nordt, project coordinator, pflanzeklimakultur@bo.berlin

November

Botanical education: in November, Beate Stoffers, State Secretary in the Senate Department for Education, Youth and Family, visits the Botany School in the Botanic Garden Berlin. This school was founded in 1987, in cooperation with the Berlin education authorities, and supports the city's teachers and schools in their teaching on environmental issues.

Contact persons: Stefanie Darius and Jan Ehlen, botanikschule@bo.berlin

Upping the speed on the data highway

The Global Genome Biodiversity Network is gaining an even more efficient digital infrastructure

In the future, traffic will flow even more smoothly on one of the data highways of biodiversity research. A five-year project, launched in 2021 under the leadership of the Botanic Garden Berlin, is making the digital infrastructure of the Global Genome Biodiversity Network (GGBN) fit for the future. The Federal Ministry of Education and Research is providing 0.8 million euros to help fund the project.

The GGBN database is already a valuable source of information. It provides an opportunity to carry out digital searches in currently 99 molecular biological collections from 33 countries, be it for bacteria, trees or great apes. If, for example, you wish to research the genetics of a particular plant genus, you can find out, with a few clicks of the mouse, where the relevant DNA samples can be found. It is generally even possible to see from which individual plants these were taken, since around three million digitised DNA, tissue and environment samples are linked to about two million specimens from herbaria and zoological collections.

The data portal runs on software developed by a team headed by Anton Güntsch and Gabi Dröge from the Botanic Garden's Center for Biodiversity Informatics and Collection Data Integration. The task is now to adjust this digital infrastructure to even greater quantities of data. Ultimately, it also needs to function quickly and reliably if and when the successful platform grows even further. And this it is expected to do. The current GGBN members already have an estimated 12 to 15 million samples in storage, housing exciting but dormant information about biodiversity on our planet.

The DNA samples at BO Berlin are stored at –80°C.

Order in the cactus world

There is now, for the first time, a complete online checklist with the names of all cactus species

Since 2021, anyone researching, breeding, collecting or protecting cacti has been able to get a much better overview of this group of plants than ever before. This is because an international team of 15 scientists, under the leadership of the Botanic Garden's Dr Nadja Korotkova, has created the first complete online checklist of all cactus species. What is special about this venture is that the team is made up of people who are either currently working on various issues relating to cactus species diversity, or are very familiar with several kinship groups from their own experience, or else are in a good position to assess the present state of research into evolutionary history based on what they've learned from their own projects.

The biggest challenge was the large number of more than 22,000 cactus names. Numerous species have been described several times, and almost all have been repeatedly placed in different genera. Many cacti have therefore been given 10 or 20, some even 40 different names over the course of time. But now there is a scientifically sound and freely available overview with all currently accepted names and their associated synonyms.

The variety of cactus species in the propagation greenhouses of the Botanic Garden Berlin.

Online checklist of cactus species

Diversity on the web

World Flora Online (WFO) offers the first complete compendium of the world's plant diversity

It's a truly mammoth project: the platform www.worldfloraonline.org went live at the end of 2020, setting a milestone in botany and international research cooperation. For more than six years, 48 botanical institutions from all over the world worked on the project, one of them being the Botanic Garden Berlin. Organised into various working groups co-ordinated by a council, the institutions and scientists worked cooperatively. Thanks to this particular way of working, it was possible to develop and implement a joint strategy. The aim was to create a freely accessible database that pools knowledge about all land plants on earth and acts as a reference for all currently known species.

Since then, this valuable source of information has been bubbling up. In addition to a list of around 350,000 hitherto known flowering plants, ferns and mosses, it also provides descriptions of the individual species and information about their endangerment status. As part of this, scientists from the Botanic Garden Berlin and the Instituto de Biología of the Universidad Nacional Autónoma de México are coordinating a so-called Taxonomic Expert Network (TEN) for the Caryophyllales order. These networks are an integral part of World Flora Online and aim at involving as many international experts for a plant group as possible – allowing the scientific community to participate broadly in the creation and further development of global biological information resources. The online cactus checklist was also created as part of this same framework, since cacti (just like spinach, sugar beet, cloves and sundews) belong to the diverse *Caryophyllales* order.

Other plant groups also have networks of experts, who are constantly expanding the information pool of the World Flora Online platform – which is necessary, given that around 2,000 new species of land plants are discovered every year.

www.worldfloraonline.org

Article on the WFO platform

New treasures from Central America

The Botanic Garden Berlin herbarium receives 8,700 specimens from Costa Rica

Since the lush flora of Costa Rica is an important building block in the priority research programme "Caribbean–Central America–Mexico", the herbarium of the Botanic Garden Berlin offers a particularly good overview of the flora of this Central American country. In order to investigate research questions collectively, the Botanic Garden agreed to partner with Costa Rica's Museo Nacional. The initial result of this partnership was the arrival in Berlin in February 2020 of a large number of herbarium sheets with pressed plants.

These specimens were collected by local institutions to document the biological diversity of Costa Rica: partly by a team from the biodiversity research institute INBIO – which has since become part of the Museo Nacional – and partly by employees of the La Selva field station. "In addition to the specimens, which cover a wide range of plant groups across the country, the digitised label data was also provided", explains Dr Robert Vogt, curator of the herbarium at the Botanic Garden Berlin.

The selection and preparation of the shipment was facilitated by the Botanic Garden Berlin. Once a variety of administrative and logistical hurdles had been overcome, it was then possible to dispatch the duplicate set – consisting of more than 8,700 specimens – to Berlin. And, as these have since been digitised, anyone interested can browse through them on any computer around the world without having to leave their own desk.

This is something to be excited about. Because only a few regions on earth can boast such rich fauna and flora as Costa Rica. With a good 51,000 square kilometres, the small country is not much larger than Lower Saxony. However, with more than 500,000 species, it is home to six per cent of all known animal and plant species in the world. "It is estimated that in Costa Rica alone there are 9,000 to 10,000 plant species", says Dr Nelson Zamora from the Museo Nacional. In the whole of Germany, there are around 4,200.

The Las Cruces research station site in the south of the country.

Understanding biodiversity

New study reveals details about the evolution of Caribbean flora

The Caribbean is not only a dream holiday destination, but also a hotspot of biodiversity: around 13,000 species of flowering plants alone grow in the region, many of which are not found anywhere else on the planet. The proportion of these so-called endemics among the 40 or so species of boxwood, for example, is around two-thirds. However, climate change, land use and other human influences are having a massive impact on green diversity – which is why it's all the more important to protect and explore this biological treasure trove.

With this goal in mind, the Botanic Garden Berlin has been working for years with institutions in Cuba, Mexico and Colombia. One of the focal points of the joint research is the evolutionary history of Caribbean flora: Where did the ancestors of the plant groups that grow there today come from? By what route did they get to the archipelago? When did the evolution of today's species begin and what factors encouraged the emergence of this enormous diversity of species?

In order to find answers to these questions, the botanists reconstruct the interrelationships of plants from the Caribbean and neighbouring regions in Central and South America using genomic data. In order to get a representative picture, it's important to compare different groups of plants. The latest results were published in 2021 by a team from the Botanic Garden in Havana, the Universidad del Norte in Barranquilla, Colombia, and the Botanic Garden in Berlin. The lead author, Astrid de Mestier (photo), researched the evolutionary history of the genus *Casearia* as part of her doctoral thesis. She determined that the ancestors of these members of the willow family originally came from South America and that they made multiple journeys from there to the Caribbean. Maybe they were washed there by sea currents or their seeds were carried by birds. In any case, they began to split into different species on the islands about 9.5 million years ago. To date, around thirty *Casearia* species have emerged in this natural experimental laboratory of plant evolution, at least half of which are endemic.

Article on the evolution and biogeography of the genus *Casearia* (*Salicaceae*)

Isolated, rare, threatened

A German-Chinese research team has discovered two new daisy genera

For around a hundred years, individual specimens of *Lactuca hirsuta* and *Lactuca scandens*, both members of the daisy family, had slumbered in herbaria in China, Europe and the USA. These plants, which don't open their yellow flowers until September, are dotted about in rocky regions of China (see photo). Only a few botanists had ever collected them, and their fruits, which are particularly important for identifying the species, had rarity value. Since the early twentieth century, no new material at all had been added. Inter-relationships and phylogenetic history therefore remained unclear.

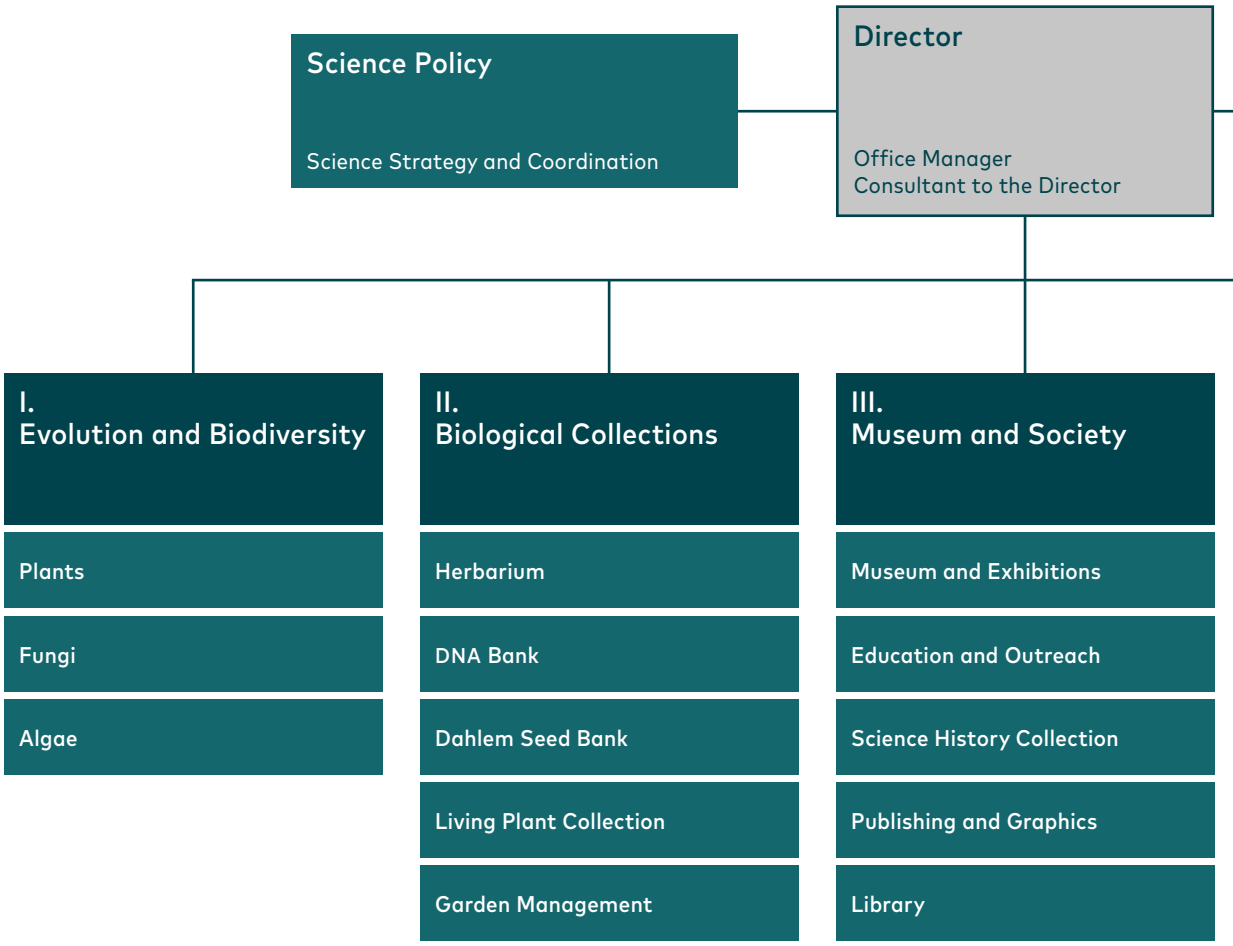
But now a team led by Dr Norbert Kilian from the Botanic Garden Berlin and Dr Ze-Huan Wang from Guizhou University of Traditional Chinese Medicine in Guiyang has rediscovered the plants in the mountains and re-examined the historic specimens. Genomic comparisons and electron microscopic examinations of pollen and fruits show that the two species are identical, but belong to a separate, hitherto undescribed genus. In the historical material and during field work, the researchers even stumbled across two other representatives of this genus, which has been dubbed *Sinoseris*. All three species only grow in Sichuan and Yunnan provinces.

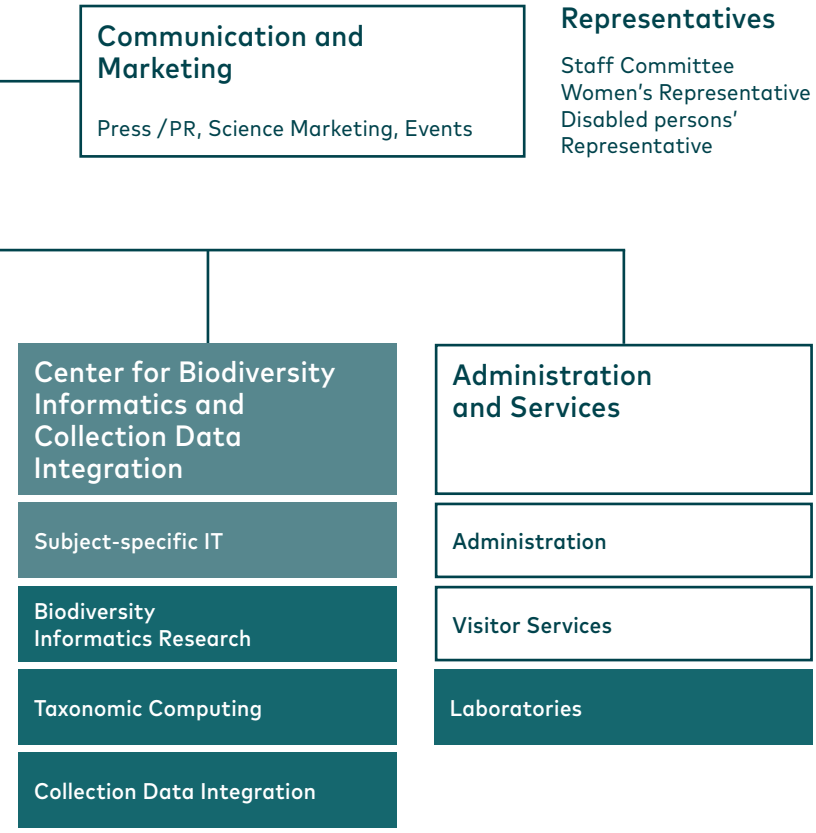
The distribution area of another new discovery, called *Mojiangia oreophila*, is even smaller. The German-Chinese team came across these rosette plants, which also have yellow flowers, in the cracks of a rock face in the mountains of Yunnan. Morphologically and genetically, they belong to an isolated new genus of which no other species are known. And no one has yet found a second population of these extremely rare relicts either. Since the rock face is in a tourist area, the newly discovered species had to be immediately classified as critically endangered.

Article on the rediscovery of *Mojiangia oreophila*

BOTANIC GARDEN BERLIN

Together we are a unique knowledge hub for botany.




Communication and Marketing
Press /PR, Science Marketing, Events
Representatives
Staff Committee
Women's Representative
Disabled persons' Representative
Center for Biodiversity Informatics and Collection Data Integration
Subject-specific IT
Biodiversity Informatics Research
Taxonomic Computing
Collection Data Integration
Administration and Services
Administration
Visitor Services
Laboratories

2020 – 2021

Facts & figures

STAFF

EMPLOYEES TOTAL

79
SUPPORTING STAFF

36
SCIENTISTS AND CURATORS

86
EMPLOYEES IN THE GARDEN

90
SUPPORTING STAFF

34
SCIENTISTS AND CURATORS

88
EMPLOYEES IN THE GARDEN

VISITING SCIENTISTS

incl. visiting scientists in the herbarium

TRAINEES

10
2020

11
2021

NATIONAL

13
2020

19
2021

VOLUNTARY ECOLOGICAL YEAR

1
2020

1
2021

INTERNATIONAL

19
2020

20
2021

DOCTORAL STUDENTS

2020/2021

2 NATIONAL
8 INTERNATIONAL

7 FEMALE
3 MALE

AFFILIATED AND HONORARY SCIENTISTS

2020/2021

Dr Neela Enke
Prof. Dr Werner Greuter
Dr Elham Hatami
Peter Hirsch
Dr Regine Jahn
Dr Katy Jones
Prof. Dr Hans-Walter Lack
Dr Demetrio Mora
Dr Thomas Raus
Michael Ristow
Dr Henricus Sipman
Prof. Dr Arne Strid
Prof. Dr Eckhard Willing
Dr Brigitte Zimmer (Prof. a.D.)

VOLUNTEERS

2020/2021

Evelin Bartels, Barbara Bartz, Lotte Burkhardt, Sonja-Maria Czérkus-Yavuz, Anne Döpfner, Regina Ehrich, Christian Feldt, Detlef Gustke, Anette Höner, Margit Jaroschewski, Margit Keipke, Hartmut Krebs, Marianne Kubicki, Erich Liebert, Gerhard Neumann, Regina Ostrower, Tjalda Picksak-Schmidt, Gudrun Scharte, Cora-Beate Schaumann, Birgit Schubert, Michael Schubert, Monika Senge, Regina Stark, Tom Stawowy, Dietmar Weinert.

Due to data protection regulations, we are only permitted to name volunteers who have explicitly given their consent. The BGBM is supported by numerous volunteers who are not named here but to whom we owe enormous thanks for their ongoing commitment.

PUBLICATIONS

2020

ARTICLES IN PEER-REVIEWED JOURNALS

Abarca N., **Zimmermann J.**, **Kusber W.-H.**, **Mora D.**, **Van A. T.**, **Skibbe O.** & **Jahn R.** 2020: Defining the core group of the genus *Gomphonema* Ehrenberg with molecular and morphological methods. – Bot. Lett. **167**: 114–159.

Andrade D. S., Aptroot A., **Lücking R.**, Cardoso Barbosa B. M., Cavalcante J. G. & Cáceres M. E. S. 2020: Crustose *Caliciaceae* in Restinga vegetation in Brazil with a new species of *Gassicurtia* and two identification keys. – Bryologist **123**: 75–83.

Anselm N., Rojas O., **Brokamp G.** & Schütt B. 2020: Spatiotemporal variability of precipitation and its statistical relations to ENSO in the High Andean Rio Bogotá Watershed, Colombia. – Earth Interact. **24**: 1–17.

Bailet B., Apothéloz-Perret-Gentil L., Baričević A., Chonova T., Franc A., Frigerio J.-M., Kelly M., **Mora D.**, Pfannkuchen M., **Proft S.**, Ramon M., Vasselon V., **Zimmermann J.** & Kahlert M. 2020: Diatom DNA metabarcoding for ecological assessment: comparison among bioinformatics pipelines used in six European countries reveals the need for standardization. – Sci. Total Environ. **745**(140948).

Borsch T., **Berendsohn W.**, Dalcin E., Delmas M., Demissew S., Elliott A., Fritsch P., Fuchs A., Geltman D., Güner A., Haevermans T., Knapp S., Le Roux M. M., Loizeau P. A., Miller C., Miller J., Miller J. T., Palese R., Paton A., Parnell J., Pendry C., Qin H. N., Sosa V., Sosef M., **Raab-Straube E. von**, Ranwashe F., Raz L., Salimov R., Smets E., Thiers B., Thomas W., Tulig M., Ulate W., Ung V., Watson M., Jackson P. W. & Zamora N. 2020: World Flora Online: placing taxonomists at the heart of a definitive and comprehensive global resource on the world's plants. – Taxon **69**: 1311–1341.

Borsch T., **Stevens A.-D.**, **Häffner E.**, **Güntsch A.**, **Berendsohn W. G.**, Appelhans M., Barilaro C., Beszteri B., Blattner F., Bossdorf O., Dalitz H., Dressler S., Duque-Thüs R., Esser H.-J., Franzke A., Goetze D., Grein M., Grünert U., Hellwig F., Hentschel J., Hörandl E., Janßen T., Jürgens N., Kadereit G., Karisch T., Koch M., Müller F., Müller J., Ober D., Porembski S., Poschlod P., Printzen C., Röser M., Sack P., Schlüter P., Schmidt M., Schnittler M., Scholler M., Schultz M., Seeber E., Simmel J., Stiller M., Thiv M., Thüs H., Tkach N., Triebel D., Warnke U., Weibulat T., Wesche K., Yurkov A. & Zizka G. 2020: A complete digitization of German herbaria is possible, sensible and should be started now. – Res. Ideas Outcomes **6**(e50675).

Brandenburger A., Buhr C., Burkart M., Heitzler S., Herrmann A., Heyers O., Kehl B., Kleinsteuber A., Krause J., Kummer V., Lauterbach D., Müller J., Pokorny I., Prasse R., Rätzel B., Rätzel S., Ristow M., Rohner M.-S., Rother M., Schmitz U., Seitz B., Uhlemann I. & **Zippel E.** 2020: Neuigkeiten zu den Farn- und Samenpflanzen von Berlin und Brandenburg II. – Verh. Bot. Vereins Berlin Brandenburg **152**: 151–227.

Buttler K. P. & **Vogt R.** 2020: Chromosomenzahlen in der Gattung *Leucanthemum* Mill. (*Compositae-Anthemideae*) in Deutschland. – Kochia **13**: 1–16.

Cáceres M. E. S., **Lücking R.**, Schumm F. & Aptroot A. 2020: A lichenized family yields another renegade lineage: *Papilionovela albothallina* is the first non-lichenized, saprobic member of *Graphidaceae* subfam. *Graphidoideae*. – Bryologist **123**: 144–154.

Calbi M., Clerici N., **Borsch T.** & **Brokamp G.** 2020: Reconstructing long term high Andean forest dynamics using historical aerial imagery: a case study in Colombia. – Forests **11**(788).

De Menezes A. A., Cáceres M. E. S., Bastos C. J. P. & **Lücking R.** 2020: Modeled lichen metacommunities in the Brazilian Atlantic Forest: do geopolitical regions and the Southern Tropic division reflect natural entities? – Phytocoenologia **50**: 211–233.

Elvebakk A. & **Sipman H. J. M.** 2020: *Gibbosporina* revisited: new records from Fiji, Indonesia, New Caledonia, Papua New Guinea and Queensland, with one species from the Solomon Islands transferred to Pannaria. – Australas. Lichenol. **87**: 52–57.

Fajardo-Gutiérrez F., Moreno D., Medellín-Zabala D., Rodríguez-Calderón Á., Urbano-Apraez S., Vargas C. A., Orejuela A., Muñoz J. A., Aguirre-Santoro J., Jara-Muñoz O. A., Rivera-Díaz O., Ávila F., Valencia-D J., Marín C., Montoya-Quiroga Á. M., Rivera-Daza Y. A., Cabrera-Amaya D. M., **Calbi M.**, **Brokamp G.**, **Borsch T.**, Contreras-Ortiz N., Castro C., Ramírez-Narváez P. N., Reina-E M., Risco A., Orozco N., Currea S., Ruíz Ó., Sarmiento J. C., Ariza W., Bernal J., Portillo A., Paternina F., Castillo J., Estrada D., Canal D., Diazgranados M. & Celis M. 2020: Inventario de la flora vascular de Bogotá D.C., Colombia. – Pérez-Arbelaezia **21**: 17–49.

Fajardo-Gutiérrez F., Olaya Ramírez T. L. & **Calbi M.** 2020: Flora de Bogotá: *Cunoniaceae*. – Pérez-Arbelaezia **21**: 177–215.

Fajardo-Gutiérrez F. & Santoro J. A. 2020: El proyecto Flora de Bogotá y su importancia para la ciudad. – Pérez-Arbelaezia **21**: 5–16.

Gasparyan A. & **Sipman H. J. M.** 2020: The first record of *Lobaria pulmonaria* from Armenia. – Herzogia **33**: 554–558.

Groom Q., **Güntsch A.**, Huybrechts P., Kearney N., Leachman S., Nicolson N., Page R. D. M., Shorthouse D. P., Thessen A. E. & Haston E. 2020: People are essential to linking biodiversity data. – Database **2020**(baaa072).

Hardy H., Knapp S., Allan E. L., Berger F., Dixey K., Döme B., Gagnier P.-Y., Frank J., Haston E. M., Holstein J., Kiel S., Marschler M., Mergen P., Phillips S., Rabinovich R., Sanchez Chillón B., Sorensen M. V., Thines M., Trekels M., **Vogt R.**, Wilson S. & Wiltschke-Schrotta K. 2020: Synthesys+ virtual access – report on the ideas call (October to November 2019). – Res. Ideas Outcomes **6**(e50354).

Hidalgo B. F., **Bazan S. F.**, Iturralde R. B. & **Borsch T.** 2020: Phylogenetic relationships and character evolution in neotropical *Phyllanthus* (*Phyllanthaceae*), with a focus on the Cuban and Caribbean taxa. – Int. J. Pl. Sci. **181**: 284–305.

Hongsanan S., Hyde K. D., Phookamsak R., Wanasinghe D. N., McKenzie E. H. C., Sarma V. V., Boonmee S., **Lücking R.**, Bhat D. J., Liu N. G., Tennakoon D. S., Pem D., Karunarathna A., Jiang S. H., Jones E. B. G., Phillips A. J. L., Manawasinghe I. S., Tibpromma S., Jayasiri S. C., Sandamali D. S., Jayawardena R. S., Wijayawardene N. N., Ekanayaka A. H., Jeewon R., Lu Y. Z., Dissanayake A. J., Zeng X. Y., Luo Z. L., Tian Q., Phukhamsakda C., Thambugala K. M., Dai D. Q., Chethana K. W. T., Samarakoon M. C., Ertz D., Bao D. F., Doilom M., Liu J. K., Pérez-Ortega S., Suija A., Senwanna C., Wijesinghe S. N., Konta S., Niranjan M., Zhang S. N., Ariyawansa H. A., Jiang H. B., Zhang J. F., Norphanphoun C., Silva N. I., Thiyagaraja V., Zhang H., Bezerra J. D. P., Miranda-González R., Aptroot A., Kashiwadani H., Harishchandra D., Sérusiaux E., Aluthmuhandiram J. V. S., Abeywickrama P. D., Devadath B., Wu H. X., Moon K. H., Gueidan C., Schumm F., Bundhun D., Mapook A., Monkai J., Chomnunti P., Suetrong S., Chaiwan N., Dayarathne M. C., Yang J., Rathnayaka A. R., Bhunjun C. S., Xu J. C., Zheng J. S., Liu G., Feng Y. & Xie N. 2020: Refined families of *Dothideomycetes*: *Dothideomycetidae* and *Pleosporomycetidae*. – Mycosphere Online **11**: 1553–2107.

Hongsanan S., Hyde K. D., Phookamsak R., Wanasinghe D. N., McKenzie E. H. C., Sarma V. V., **Lücking R.**, Boonmee S., Bhat J. D., Liu N.-G., Tennakoon D. S., Pem D., Karunarathna A., Jiang S.-H., Jones G. E. B., Phillips A. J. L., Manawasinghe I. S., Tibpromma S., Jayasiri S. C., Sandamali D., Jayawardena R. S., Wijayawardene N. N., Ekanayaka A. H., Jeewon R., Lu Y.-Z., Phukhamsakda C., Dissanayake A. J., Zeng X.-Y., Luo Z.-L., Tian Q., Thambugala K. M., Dai D., Samarakoon M. C., Chethana K. W. T., Ertz D., Doilom M., Liu J.-K., Pérez-Ortega S., Suija A., Senwanna C., Wijesinghe S. N., Niranjan M., Zhang S.-N., Ariyawansa H. A., Jiang H.-B., Zhang J.-F., Norphanphoun C., Silva N. I., Thiyagaraja V., Zhang H., Bezerra J. D. P., Miranda-González R., Aptroot A., Kashiwadani H., Harishchandra D., Sérusiaux E., Abeywickrama P. D., Bao D.-F., Devadatha B., Wu H.-X., Moon K. H., Gueidan C., Schumm F., Bundhun D., Mapook A., Monkai J., Bhunjun C. S., Chomnunti P., Suetrong S., Chaiwan N., Dayarathne M. C., Yang J., Rathnayaka A. R., Xu J.-C., Zheng J., Liu G., Feng Y. & Xie N. 2020: Refined families of *Dothideomycetes*: orders and families incertae sedis in *Dothideomycetes*. – Fungal Divers. **105**: 17–318.

Iliadou E., Bazos I., Kougioumoutzis K., Karadimou E., Kokkoris I., Panitsa M., **Raus T.**, **Strid A.** & Dimopoulos P. 2020: Taxonomic and phylogenetic diversity patterns in the Northern Sporades islets complex (West Aegean, Greece). – Pl. Syst. Evol. **306**: 1–17

Jahn R., **Abarca N.**, **Kusber W.-H.**, **Skibbe O.**, **Zimmermann J.** & **Mora D.** 2020: Integrative taxonomic description of two new species of the *Cocconeis placentula* group (*Bacillariophyceae*) from Korea based on unialgal strains. – Algae **35**: 303–324.

Jia Z. & **Lücking R.** 2020: A genus *Schizotrema* (*Graphidaceae*) new to China, with a world-wide key. – Guihaia **40**: 277–281.

Jiang S. H., Hawksworth D. L., **Lücking R.** & Wei J. C. 2020: A new genus and species of foliicolous lichen in a new family of *Strigulales* (*Ascomycota*: *Dothideomycetes*) reveals remarkable class-level homoplasy. – IMA Fungus **11**(1).

Jiang S. H. & **Lücking R.** 2020: *Tenuitholiascaceae*. [In: Hongsanan S. & al., Refined families of *Dothideomycetes*: orders and families incertae sedis in *Dothideomycetes*]. – Fungal Divers. **105**: 168–169.

Jiang S. H., **Lücking R.** & Sérusiaux E. 2020: *Strigulaceae*. [In: Hongsanan S. & al., Refined families of *Dothideomycetes*: orders and families incertae sedis in *Dothideomycetes*]. – Fungal Divers. **105**: 139–168.

Jiang S.-H., **Lücking R.**, Xavier-Leite A. B., Cáceres M. E. S., Aptroot A., Portilla C. V. & Wei J.-C. 2020: Reallocation of foliicolous species of the genus *Strigula* into six genera (lichenized *Ascomycota*, *Dothideomycetes*, *Strigulaceae*). – Fungal Divers. **102**: 257–291.

Jüttner I., Chudaev D. & **Kusber W.-H.** 2020: Re-examination of the type materials of *Navicula exilis* and *Navicula cryptocephala* (*Naviculaceae*, *Bacillariophyceae*). – Phytotaxa **472**: 123–134.

Knapp S., Vorontsova M. S. & **Turland N. J.** 2020: Indigenous species names in algae, fungi and plants: A comment on Gillman & Wright (2020). – Taxon **69**: 1409–1410.

Kusber W.-H., Bishop J., Kopalová K. & Van de Vijver B. 2020: Note on the type of *Sabbea* Van de Vijver, J. Bishop & Kopalová (*Naviculaceae*, *Bacillariophyceae*). – Notul. Algarum **160**.

Kusber W.-H., Cocquyt C. & **Jahn R.** 2020: Assessment of names in the genera *Iconella*, *Surirella* and Suriraya (*Bacillariophyceae*). – Notul. Algarum **156**.

Lack H. W. 2020: The botanical illustrations of Franz Scheidl (fl. 1770–1795). – Arch. Nat. Hist. **47**: 51–62.

Lack H. W. 2020: Theodor Kotschy in Iran, 1841–1843: Botanical collections and an early printed vegetation profile. – Candollea **75**: 31–43.

Lack H. W. & Barina Z. 2020: The early botanical exploration of Albania (1839–1945). – Willdenowia **50**: 519–558.

Lack H. W. & Slageren M. van 2020: The discovery, typification and rediscovery of wild emmer wheat, *Triticum turgidum* subsp. *dicoccoides* (*Poaceae*). – Willdenowia **50**: 207–216.

Lindgren H., **Moncada B.**, **Lücking R.**, Magain N., Simon A., Goffinet B., Sérusiaux E., Nelsen M. P., Mercado-Díaz J. A., Widhelm T. J. & Lumbsch H. T. 2020: Cophylogenetic patterns in algal symbionts correlate with repeated symbiont switches during diversification and geographic expansion of lichen-forming fungi in the genus *Sticta* (*Ascomycota*, *Peltigeraceae*). – Molec. Phylogenet. Evol. **150**(106860).

Lindon H. L., Hartley H., Knapp S., Monro A. M. & **Turland N. J.** 2020: XIX International Botanical Congress, Shenzhen: Report of the Nomenclature Section, 17th to 21st July 2017. – PhytoKeys **150**: 1–276.

Lücking R. 2020: Three challenges to contemporaneous taxonomy from a licheno-mycological perspective. – Megataxa **1**: 78–103.

Lücking R., Aime M. C., Robbertse B., Miller A. N., Ariyawansa H. A., Aoki T., Cardinali G., Crous P. W., Druzhinina I. S., Geiser D. M., Hawksworth D. L., Hyde K. D., Irinyi L., Jeewon R., Johnston P. R., Kirk P. M., Malosso E., May T. W., Meyer W., Öpik M., Robert V., Stadler M., Thines M., Vu D., Yurkov A. M., Zhang N. & Schoch C. L. 2020: Unambiguous identification of fungi: where do we stand and how accurate and precise is fungal DNA barcoding? – IMA Fungus **11**(14).

Lücking R., Aptroot A., Kashiwadani H., Moon K. H., Gueidan C., Schumm F. & Phokamsak R. 2020: *Monoblastiaceae*. [In: Hongsanan, S. & al., Refined families of *Dothideomycetes*: orders and families incertae sedis in *Dothideomycetes*]. – Fungal Divers. **105**: 100–112.

Lücking R., Kaminsky L., Perlmutter G. B., Lawrey J. D. & Dal Forno M. 2020: *Cora timucua* (*Hygrophoraceae*), a new and potentially extinct, previously misidentified basidiolichen of Florida inland scrub documented from historical collections. – Bryologist **123**: 657–673.

Lücking R., **Moncada B.**, **Sipman H. J. M.**, Bezerra Sobreira P. N., Viñas C., Gutíerrez J. & Flynn T. W. 2020: *Saxiloba*: a new genus of placodioid lichens from the Caribbean and Hawaii shakes up the *Porinaceae* tree (lichenized *Ascomycota*: *Gyalectales*). – Pl. Fungal Syst. **65**: 577–585.

Lücking R., Nadel M., Araujo E. & Gerlach A. 2020: Two decades of DNA barcoding in the genus *Usnea* (*Parmeliaceae*): how useful and reliable is the ITS? – Pl. Fungal Syst. **65**: 303–357.

Lücking R., Truong B. V., Huong D. T. T., Le N. H., Nguyen Q. D., Nguyen V. D., **Raab-Straube E. von**, **Bollendorff S.**, **Govers K.** & **Di Vincenzo V.** 2020: Caveats of fungal barcoding: a case study in *Trametes* s.lat. (*Basidiomycota*: *Polyporales*) in Vietnam reveals multiple issues with mislabelled reference sequences and calls for third-party annotations. – Willdenowia **50**: 383–403.

Lücking R., Zhang S.-N., Miranda-Gonzáles R. & Aptroot A. 2020: *Trypetheliaceae*. [In: Hongsanan S. & al., Refined families of *Dothideomycetes*: orders and families incertae sedis in *Dothideomycetes*]. – Fungal Divers. **105**: 173–193.

Marshall A. J., Blanchon D. J., **Lücking R.**, Lange T. J. P. & Lange P. J. 2020: A new *Ocellularia* (lichenized *Ascomycota*: *Graphidaceae*) from New Zealand indicates small-scale differentiation of an Australasian species complex. – New Zealand J. Bot. **58**: 223–235.

Martínez-Quezada D. M., Arias S., **Korotkova N.** & Terrazas T. 2020: The phylogenetic significance of the stem morpho-anatomy in the *Hylocereeae* (*Cactoideae*, *Cactaceae*). – Pl. Syst. Evol. **306**(8).

Mendonça C. d. O., Aptroot A., **Lücking R.** & Cáceres M. E. S. 2020: Global species richness prediction for *Pyrenulaceae* (*Ascomycota*: *Pyrenulales*), the last of the "big three" most speciose tropical microlichen families. – Biodivers. Conserv. **29**: 1059–1079.

Mercado-Díaz J. A., **Lücking R.**, **Moncada B.**, Widhelm T. J. & Lumbsch H. T. 2020: Elucidating species richness in lichen fungi: the genus *Sticta* (*Ascomycota*: *Peltigeraceae*) in Puerto Rico. – Taxon **69**: 851–891.

Miranda-González R., Aptroot A., **Lücking R.**, Flakus A., Barcenas-Peña A. & Herrera-Campos M. d. l. Á. 2020: The identity, ecology and distribution of *Polypyrenula* (*Ascomycota*: *Dothideomycetes*): a new member of *Trypetheliaceae* revealed by molecular and anatomical data. – Lichenologist **52**: 27–35.

Miranda-González R., **Lücking R.**, Barcenas-Peña A. & Ángeles Herrera-Campos M. 2020: The new genus *Jocatoa* (*Lecanoromycetes*: *Graphidaceae*) and new insights into subfamily *Redonographoideae*. – Bryologist **123**: 127–143.

Moncada B., **Lücking R.** & Lumbsch H. T. 2020: Rewriting the evolutionary history of the lichen genus *Sticta* (*Ascomycota*: *Peltigeraceae* subfam. *Lobarioideae*) in the Hawaiian islands. – Pl. Fungal Syst. **65**: 95–119.

Moncada B., **Sipman H. J. M.** & **Lücking R.** 2020: Testing DNA barcoding in *Usnea* (*Parmeliaceae*) in Colombia using the internal transcribed spacer (ITS). – Pl. Fungal Syst. **65**: 358–385.

Montilla-Álvarez T. A. & **Fajardo-Gutiérrez F.** 2020: Flora de Bogotá: *Ranunculaceae*. – Pérez-Arbelaezia **21**: 136–176.

Nelsen M. P., **Lücking R.**, Boyce C. K., Lumbsch H. T. & Ree R. H. 2020: The macroevolutionary dynamics of symbiotic and phenotypic diversification in lichens. – Proc. Natl. Acad. Sci. **117**: 21495–21503.

Nelsen M. P., **Lücking R.**, Boyce C. K., Lumbsch H. T. & Ree R. H. 2020: No support for the emergence of lichens prior to the evolution of vascular plants. – Geobiology **18**: 3–13.

Ortuño Limarino T. & **Borsch T.** 2020: *Gomphrena* (*Amaranthaceae*, *Gomphrenoideae*) diversified as a C4 lineage in the New World tropics with specializations in floral and inflorescence morphology, and an escape to Australia. – Willdenowia **50**: 345–381.

Ott T., Palm C., **Vogt R.** & Oberprieler C. 2020: GinJinn: an object-detection pipeline for automated feature extraction from herbarium specimens. – Appl. Pl. Sci. **8**(e11351).

Panitsa M., Iliadou E., Kokkoris I., Kallimanis A., Patelodimou C., **Strid A.**, **Raus T.**, Bergmeier E. & Dimopoulos P. 2020: Distribution patterns of ruderal plant diversity in Greece. – Biodivers. Conserv. **29**: 869–891.

Perlmutter G. B., Plata E. R., LaGreca S., Aptroot A., **Lücking R.**, Tehler A. & Ertz D. 2020: *Biatora akompsa* is revealed as a disjunct North American species of *Pentagenella* (*Opegraphaceae*) through molecular phylogenetic analysis and phenotype-based binning. – Bryologist **123**: 502–516.

Raab-Straube E. von & Lidén M. 2020: *Saussurea solaris* (*Asteraceae*, *Cardueae*), a new species from East Himalaya first collected by Francis Kingdon-Ward in 1938 and rediscovered in 2013. – Symb. Bot. Upsal. **40**: 130–133.

Raab-Straube E. von & **Raus T.** 2020: Euro+Med-Checklist Notulae 12 [Notulae ad floram euro-mediterraneam pertinentes No. 41]. – Willdenowia **50**: 305–341.

Raus T. & **Strid A.** 2020: New combinations in some Balkan *Centaurea* taxa. – Phytol. Balcan. **26**: 495–497.

Salinas V. H., **Mora D.**, **Jahn R.** & **Abarca N.** 2020: New species of *Pseudostaurosira* (*Bacillariophyceae*) including a tripolar taxon from mountain streams of Central Mexico. – Phytotaxa **464**: 193–206.

Santos V. M., Cáceres M. E. S. & **Lücking R.** 2020: Diversity of foliicolous lichens in isolated montane rainforests (Brejos) of northeastern Brazil and their biogeography in a neotropical context. – Ecol. Res. **35**: 182–197.

Simon A., **Lücking R.**, **Moncada B.**, Mercado-Díaz J. A., Bungartz F., Cáceres M. E. S., Gumboski E. L., Martins S. M. de A., Spielmann A., Parker D. & Goffinet B. 2020: *Emmanuelia*, a new genus of lobarioid lichen-forming fungi (*Ascomycota*: *Peltigerales*): phylogeny and synopsis of accepted species. – Pl. Fungal Syst. **65**: 76–94.

Sipman H. J. M. & Aptroot A. 2020: *Ikaeria serusiauxii*, a new *Caloplaca*-like lichen from Macaronesia and mainland Portugal, with a lichen checklist for Porto Santo. – Pl. Fungal Syst. **65**: 120–130.

Sipman H. J. M. & **Raus T.** 2020: Lichens and lichenicolous fungi on the island Skiros, Aegean Sea, Greece. – Parnassiana Arch. **8**: 19–49.

Sohrabi M., Ghiyasi A., Bordbar F., Safavi S. R., Alibadi F. & **Sipman H. J. M.** 2020: A checklist of lichenized fungi of Kerman province, SE, Iran. – Mycol. Iran. **6**: 21–32.

Soler L. F, García J. P., **Fajardo-Gutiérrez F.** & Zapata D. A. 2020: Flora de Bogotá: *Lauraceae*. – Pérez-Arbelaezia **21**: 100–135.

Stevanoski I., Kuzmanović N., Dimopoulos P., **Raus T.** & Lakušić D. 2020: Amended description and notes on *Campanula kamariana* (*C.* sect. *Quinqueloculares*, *Campanulaceae*), an endangered endemic of southern Peloponnesus, Greece. – Ann. Bot. Fenn. **57**: 357–366

Thines M., Aoki T., Crous P. W., Hyde K. D., **Lücking R.**, Malosso E., May T. W., Miller A. N., Redhead S. A., Yurkov A. M. & Hawksworth D. L. 2020: Setting scientific names at all taxonomic ranks in italics facilitates their quick recognition in scientific papers. – IMA Fungus **11**(25).

Thiyagaraja V., **Lücking R.**, Ertz D., Wanasinghe D. N., Karunarathna S. C., Camporesi E. & Hyde K. D. 2020: Evolution of non-lichenized, saprotrophic species of *Arthonia* (*Ascomycota*, *Arthoniales*) and resurrection of *Naevia*, with notes on *Mycoporum*. – Fungal Divers. **102**: 205–224.

Torres-Hormaza T., Baquero A., Jaramillo M. A. & **Fajardo-Gutiérrez F.** 2020: Flora de Bogotá: *Piperaceae*. – Pérez-Arbelaezia **21**: 50–99.

Torres-Montúfar A., **Borsch T.**, **Fuentes S.**, Gutierrez J. & Ochoterena H. 2020: It is not a disaster: molecular and morphologically based phylogenetic analysis of *Rondeletieae* and the *Rondeletia* complex (*Cinchonoideae*, *Rubiaceae*). – Pl. Syst. Evol. **306**(26).

Turland N. J. & Wiersema J. H. 2020: Procedures and timetable for proposals to amend the International Code of Nomenclature for algae, fungi, and plants. – Taxon **68**: 1372–1373.

Turland N. J., Wiersema J. H. & McNeill J. 2020: (007–008) Proposals to make clearer the circumstances under which a holotype can exist. – Taxon **69**: 626–627.

Turland N. J., Wiersema J. H. & McNeill J. 2020: (018–020) Proposals for a clearer and more concise article 40 and to resolve conflict between Art. 40.6 and Art. 9.10. – Taxon **69**: 633–635.

Van de Vijver B., **Kusber W.-H.**, Ector L., Schuster T. M. & Walter J. 2020: Original material of *Fragilaria gloiophila* (Grunow) Van de Vijver, Ector, T. M. Schuster & J. Walter (*Fragilariaceae*, *Bacillariophyta*) rediscovered in the Grunow collection. – Not. Algarum: **161**.

Van de Vijver B., Wetzel C. E., **Kusber W.-H.** & Ector L. 2020: Observations on and typification of *Synedra crotonensis* f. *belgica* Grunow and *Fragilaria crotonensis* var. *prolongata* Grunow (*Fragilariaceae*, *Bacillariophyta*) and the introduction of *Fragilaria prolongate* comb. et stat. nov. – Notul. Algarum **166**.

Wagner F., Ott T., Schall M., Lautenschlager U., **Vogt R.** & Oberprieler C. 2020: Taming the red bastards: hybridisation and species delimitation in the *Rhodanthemum arundanum*-group (*Compositae*, *Anthemideae*). – Molec. Phylogenet. Evol. **144**(106702).

Wang Z.-H., **Kilian N.**, Chen Y.-P. & Peng H. 2020: *Sinoseris* (*Crepidinae*, *Cichorieae*, *Asteraceae*), a new genus of three species endemic to China, one of them new to science. – Willdenowia **50**: 91–110.

Witkowski A., Ashworth M., Li C., Sagna I., Yatte D., Górecka E., Franco A. O. R., **Kusber W.-H.**, Klein G., Lange-Bertalot H., Dąbek P., Theriot E. C. & Manning S. R. 2020: Exploring diversity, taxonomy and phylogeny of diatoms (*Bacillariophyta*) from marine habitats: novel taxa with internal costae. – Protist **171**(125713).

Woo J.-J., **Lücking R.**, Oh S.-Y., Jeun Y.-C. & Hur J.-S. 2020: Two new foliicolous species of *Strigula* (*Strigulaceae*, *Strigulales*) in Korea offer insight in phorophyte-dependent variation of thallus morphology. – Phytotaxa **443**: 1–12.

Yazıcı K., Aslan A., Aptroot A., Etayo J., Karahan D. & **Sipman H. J. M.** 2020 Lichens and lichenicolous fungi from Bitlis province in Turkey. – Lindbergia **43**(linbg.01126).

Yazici K., Aslan A., Karahan D., Aptroot A. & **Sipman H. J. M.** 2020: Lichens and lichenicolous fungi from Muş Province in Turkey. – Acta Bot. Hung. **62**: 435–452.

Zaika M. A., **Kilian N.**, **Jones K.**, Krinitsina A. A., Nilova M. V., Speranskaya A. S. & Sukhorukov A. P. 2020: *Scorzonera* sensu lato (*Asteraceae*, *Cichorieae*) – taxonomic reassessment in the light of new molecular phylogenetic and carpological analyses. – PhytoKeys **137**: 1–85.

Zimmermann J., **Abarca N.**, **Bansemer J.**, **Bettig J.**, **Dröge G.**, **Kusber W.-H.**, **Luther K.**, **Mora D.**, Proft S., **Skibbe O.**, **Van A. T.**, Werner P. & **Jahn R.** 2020: German Barcode of Life 2 (GBOL2) – building a diatom DNA barcoding reference library for eDNA metabarcoding for water quality assessments in the context of the EU Water Framework Directive. – Acta ZooBot Austria **157**: 361–362.

MONOGRAPHS

Dimopoulos P., Bazos I., Kokkoris I. P., Zografidis A., Karadimou E., Kallimanis A. S., **Raus T.** & **Strid A.** 2020: A guide to the alien plants of Greece with reference to the Natura 2000 protected areas network. – Athens: Natural Environment and Climate Change Agency.

Dimopoulos P., Bazos I., Kokkoris I. P., Zografidis A., Karadimou E., Kallimanis A. S., **Raus T.** & **Strid A.** 2020: Odigos xenikon fitikon idon stin Ellada ke sto diktio prostatevomenon periochon Natura 2000. – Athina: Organismos Fisikou Periballontos ke Klimatikis Allagis.

Lack H. W. 2020: Pierre-Joseph Redouté: The book of flowers. Das Buch der Blumen. Le Livre des Fleurs. – Köln: Taschen.

Lack H. W. 2020: Pierre-Joseph Redouté: The book of flowers. Il libro dei fiori. El libro de los flores. – Köln: Taschen, 2020

EDITORSHIP

Turland N. J. 2020: Willdenowia: Annals of the Botanic Garden and Botanical Museum Berlin, 50. – Berlin: Botanic Garden and Botanical Museum Berlin, Freie Universität Berlin.

CONTRIBUTIONS TO SERIALS, POSITION PAPERS AND FESTSCHRIFTS

Grotz K. 2020: Nachruhm – die Humboldt-Orte. – In: Trabant J., Bredekamp H. & Ette O. (ed.), Wilhelm und Alexander von Humboldt – Berliner Kosmos. – Köln: Wienand.

Gutowski A., Foerster J., Knappe J., Linne von Berg K.-H., Hofmann G., Lange-Bertalot H., Werum M., Klee R., König C., Metzeltin D., Reichardt E. & **Kusber W.-H.** 2020: Checklisten und Rote Listen der Süßwasseralgen Deutschlands. – Pp. 319–324 in: Ergebnisse der Jahrestagung 2019 (Münster) der Deutschen Gesellschaft für Limnologie (DGL) und der deutschen und österreichischen Sektion der Societas Internationalis Limnologiae : Westfälische Wilhelms-Universität Münster (WWU), 23.–27. September 2019 – Essen: Eigenverlag der DGL.

Lack H. W. 2020: Leonhart Fuchs, Heinrich Füllmaurer, Albrecht Meyer and Veyt Rudolff Speckle. – In: Flower: exploring the world in bloom. – London: Phaidon Press Limited.

Lack H. W. 2020: Weberbauer, August. – In: Neue Deutsche Biographie 27: Vockerodt-Wettiner. – Berlin: Duncker & Humblot.

Lack H. W. 2020: *Helminthotheca* Zinn, *Leontodon* L., *Picris* L. – In: Ghazanfar S. A., Edmondson J. R. & Hind D. J. N. with the collaboration of the staff of the National Herbarium of Iraq of the Ministry of Agriculture, Baghdad (ed.), Flora of Iraq 6: Compositae. – Kew: Royal Botanic Gardens.

Lack H.-W. 2020: Die Gartenreise von Joseph Franz Edlen von Jacquin, Franz Bauer und Leonhard Gruber in den Jahren 1788–1790. – Pp. 255–272 in: Fischer H., Wolschke-Bulmahn J. & Beardsley J. (ed.), Reisen und Gärten vom Mittelalter bis in die Gegenwart. – München: Akademische Verlagsgemeinschaft (= CGL-Studies **26**).

Parolly G. 2000: The Anatolian high-mountain ranges – plant diversity between two seas. – [In: Noroozi J. (ed.), Plant biography and vegetation of high mountains of Central and South-West Asia]. – Plant and Vegetation **17**: 215–286.

CONTRIBUTIONS TO TAXONOMIC INFORMATION SYSTEMS

Raab-Straube E. von 2020+ (continuously updated): *Alstroemeriaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/2268306c-10e2-4273-9543-eef76ed98550

Raab-Straube E. von 2020+ (continuously updated): *Dioscoraceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/3e246022-4e7f-452c-86a9-32e944893372

Raab-Straube E. von 2020+ (continuously updated): *Ixioliriaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/58e5fbfb-0481-40a4-ae62-f3f61dae8f31

Raab-Straube E. von 2020+ (continuously updated): *Melanthiaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/972c76b9-ed48-43d7-b9cd-3c97bfdf263c

Raab-Straube E. von 2020+ (continuously updated): *Musaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/25e3496d-c89b-4b8c-950f-c4070047aec7

Raab-Straube E. von 2020+ (continuously updated): *Nartheciaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/93e176b1-f9fd-4842-bd3d-7c0b5660ef5a

Raab-Straube E. von 2020+ (continuously updated): *Sapotaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/da611d72-078a-480f-b1dc-b56d6a7a1526

Raab-Straube E. von 2020+ (continuously updated): *Smilacaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/b05b8674-d59d-47f2-b228-2e7d5ed07cbd

ARTICLES IN NON-PEER-REVIEWED JOURNALS

Häffner E., **Borsch T.**, **Stevens A.-D.**, **Güntsch A.** & **Berendsohn W.** 2020: Pflanzen, Pilze, Algen: Die ganze Vielfalt auf einen Klick: Ein Plädoyer für die rasche Digitalisierung von Deutschlands Herbarien. – GfBS-Newslett. **38**: 11–13.

Lack H. W. 2020: Der Botanische Garten der Theresianischen Akademie in Wien in der zweiten Hälfte des 19. Jahrhunderts. – Hist. Gärt. **26**: 24–27.

Lack H. W. & **Raus T.** 2020: Bernhard Zepernick (1926–2019). – Willdenowia **50**: 165–171.

Lack H. W. & **Vogt R.** 2020: Paul Hiepko (1932–2019). – Willdenowia **50**: 79–89.

Vitek E. & **Lack H. W.** 2020: Wilhelmina Rechinger: 1925–2019. – Ann. Naturhist. Mus. Wien B **122**: 5–10.

Wöhrmann F., Burkart M., Lauterbach D., Weißbach S., Poschlod P., Reisch C., Listl D., Lang J., Zachgo S., Borgmann P., Oevermann S., **Stevens A.-D.**, **Zippel E.**, **Tschöpe O.**, **Heinken-Smidová A.**, Becker U., Omlor R., Hahn F. & Schönhofer A. 2020: WIPs-De II – Wildpflanzenschutz in Deutschland: Botanische Gärten übernehmen Verantwortung. – Gärtn.-Bot. Brief **214**: 24–36.

2021

ARTICLES IN PEER-REVIEWED JOURNALS

Aime M. C., Miller A. N., Aoki T., Bensch K., Cai L., Crous P. W., Hawksworth D. L., Hyde K. D., Kirk P. M., **Lücking R.**, May T. W., Malosso E., Redhead S. A., Rossman A. Y., Stadler M., Thines M., Yurkov A. M., Zhang N. & Schoch C. L. 2021: How to publish a new fungal species, or name, version 3.0. – IMA Fungus **12**(11).

Baldesi G. & **Kilian N.** 2021: A new gypsicolous species of *Launaea* (*Asteraceae*, *Cichorieae*) from North Somalia. – Phytotaxa **501**: 195–200.

Bauer R. & **Korotkova N.** 2021: Neotypification of *Rhipsalis rhombea* (*Rhipsalideae*, *Cactaceae*) and its taxonomic history. – Haseltonia **27**: 95–101.

Bauer W., Gottschling M., Keupp H., **Kusber W.-H.** & Mertens K. N. 2021: Validation of the calcareous dinophyte *Wallidinellum* (*Peridiniales*), with notes on the status of fossils in the Code. – Phytotaxa **520**: 296–300.

Bilous O. P., Genkal S. I., **Zimmermann J.**, **Kusber W.-H.** & **Jahn R.** 2021: Centric diatom diversity in the lower part of the Southern Bug river (Ukraine): The transitional zone at Mykolaiv city. – PhytoKeys **178**: 31–69.

Borsch T. & **Zippel E.** 2021: Genetische Grundlagen für den botanischen Artenschutz in Deutschland: The genetic basis for plant conservation in Germany. – Natur Landschaft **96**: 450–460.

Caballero-Villalobos L., **Fajardo-Gutiérrez F.**, **Calbi M.**, Silva-Arias G. A. 2021: Climate change can drive a significant loss of suitable habitat for *Polylepis quadrijuga*, a treeline species in the sky islands of the northern Andes. – Frontiers Ecol. Evol. **9**(661550).

Calbi M., **Fajardo-Gutiérrez F.**, Posada J. M., **Lücking R.**, **Brokamp G.** & **Borsch T.** 2021: Seeing the wood despite the trees: Exploring human disturbance impact on plant diversity, community structure, and standing biomass in fragmented high Andean forests. – Ecol. Evol **11**: 2110–2172.

Callmander M. W., **Vogt R.**, Donatelli A., Buerki S. & Nepi C. 2021: Otto Warburg and his contributions to the screw pine family (*Pandanaceae*). – Willdenowia **51**: 5–31.

Dal Forno M., Lawrey J. D., Sikaroodi M., Gillevet P. M., Schuettpelz E. & **Lücking R.** 2021: Extensive photobiont sharing in a rapidly radiating cyanolichen clade. – Molec. Ecol. **30**: 1755–1776.

Ellis L. T., Bednarek-Ochyra H., Chandini V. K., Manju C. N., Nishida P. P., Menon S. S., Sruthi O. M., Rajesh K. P., Cottet A. C., Messuti M. I., Dulin M. V., Semenova N. A., Panyukov A. A., Teteryuk B. Y., Erzberger P., Fuertes E., Garilleti R., Gupta R., Asthana A. K., Gradstein S. R., Hedenäs L., Kiebacher T., Kučera J., Lara F., Mamontov Y. S., Nagy J., Németh C., Obabko R. P., Poponessi S., De Agostini A., Cogoni A., Porley R. D., Puglisi M., Sciandrello S., Schmotzer A., Širka P., **Sipman H. J. M.**, Ştefănuţ S., Vilnet A. A., Ignatov M. S., Ignatova E. A. & Pisarenko O. Y. 2021: New national and regional bryophyte records, 68. – J. Bryol. **43**: 387–402.

Fišer Ž., Aronne G., Aavik T., Akin M., Alizoti P., Aravanopoulos F., Bacchetta G., Balant M., Ballian D., Barazani O., Bellia A. F., Bernhardt N., Bou Dagher Kharrat M., Bugeja Douglas A., Burkart M., Ćalić D., Carapeto A., Carlsen T., Castro S., Colling G., Cursach J., Cvetanoska S., Cvetkoska C., Ćušterevska R., Daco L., Danova K., Dervishi A., Djukanović G., Dragićević S., Ensslin A., Evju M., Fenu G., Francisco A., Gallego P. P., Galloni M., Ganea A., Gemeinholzer B., Glasnović P., Godefroid S., Goul Thomsen M., Halassy M., Helm A., Hyvärinen M., Joshi J., Kazić A., Kiehn M., Klisz M., Kool A., Koprowski M., Kövendi-Jakó A., Kříž K., Kropf M., Kull T., Lanfranco S., Lazarević P., Lazarević M., Lebel Vine M., Liepina L., Loureiro J., Lukminė D., Machon N., Meade C., Metzing D., Milanović Đ., Navarro L., Orlović S., Panis B., Pankova H., Parpan T., Pašek O., Peci D., Petanidou T., Plenk K., Puchałka R., Radosavljević I., Rankou H., Rašomavičius V., Romanciuc G., Ruotsalainen A., Šajna N., Salaj T., Sánchez-Romero C., Sarginci M., Schäfer D., Seberg O., Sharrock S., Šibík J., Šibíková M., Skarpaas O., Stanković Nedić M., Stojnic S., Surina B., Szitár K., Teofilovski A., Thoroddsen R., Tsvetkov I., Uogintas D., Meerbeek K., Rooijen N., Vassiliou L., Verbylaitė R., Vergeer P., Vít P., Walczak M., Widmer A., Wiland-Szymańska J., Zdunić G. & **Zippel E.** 2021: ConservePlants: An integrated approach to conservation of threatened plants for the 21st Century. – Res. Ideas Outcomes **7**(e62810).

Gravendyck J., Fensome R. A., Head M. J., Herendeen P. S., Riding J. B., Bachelier J. B. & **Turland N. J.** 2021: Taxonomy and nomenclature in palaeopalynology: Basic principles, current challenges and future perspectives. – Palynology **45**: 717–743.

Güntsch A., Groom Q., Ernst M., **Holetschek J.**, Plank A., **Röpert D.**, **Fichtmüller D.**, Shorthouse D. P., Hyam R., Dillen M., Trekels M., Haston E. & Rainer H. 2021: A botanical demonstration of the potential of linking data using unique identifiers for people. – PLOS ONE **16**(e0261130).

Güzel M. E., Coşkunçelebi K., **Kilian N.**, Makbul S. & Gültepe M. 2021: Phylogeny and systematics of the *Lactucinae* (*Asteraceae*) focusing on their SW Asian centre of diversity. – Pl. Syst. Evol. **307**(7).

Hardisty A., Addink W., Glöckler F., Islam S., Weiland C. & **Güntsch A.** 2021: A choice of persistent identifier schemes for the Distributed System of Scientific Collections (DiSSCo). – Res. Ideas Outcomes **7**(e67379).

Jahn R., **Abarca N.**, Al-Handal A., **Kusber W.-H.**, **Zimmermann J.** & **Skibbe O.** 2021: Integrative taxonomic description of the marine species *Cocconeis crawfordii* (*Bacillariophyceae*) based on unialgal strains. – Nova Hedwigia Beih. **151**: 85–105.

Kanjer L., **Kusber W.-H.** & Van de Vijver B. 2021: Observations and typification of *Exilaria fulgens* Greville (*Fragilariaceae*, *Bacillariophyta*) and its transfer to the genus *Ardissonea* De Notaris, 1870. – Notul. Algarum **215**.

Keller B., Ganz R., Mora-Carrera E., Nowak M. D., Theodoridis S., **Koutroumpa K.** & Conti E. 2021: Asymmetries of reproductive isolation are reflected in directionalities of hybridization: integrative evidence on the complexity of species boundaries. – New Phytol. **229**: 1795–1809.

Kilian N. & Al-Fatimi M. 2021: The identity of a succulent *Euphorbia* shrub in southern Yemen with spirally twisted branches. – Euphorbia World **17**: 5–12.

Kohlbecker A., **Güntsch A.**, **Kilian N.**, **Kusber W.-H.**, **Luther K.**, **Müller A.**, **Raab-Straube E. von** & **Berendsohn W.** 2021: A pragmatic approach to concept-based annotation of scientific names in biodiversity and environmental research data. – In: Gesellschaft für Informatik e.V. (GI) (ed.), INFORMATIK 2021, Computer Science & Sustainability. – Lecture Notes Informatics (LNI) **P-314**: 539–546.

Kohlbecker A., Karam N., Paschke A. & **Güntsch A.** 2021: Preserving taxonomic change and subsequent taxon relationships over time. – In: Sanfilippo E. M. (ed), Joint Ontology Workshops, JOWO 2021. Proceedings. Online resource: Episode VII: The Bolzano Summer of Knowledge; co-located with the 12th International Conference on Formal Ontology in Information Systems (FOIS 2021), and the 12th International Conference on Biomedical Ontologies (ICBO 2021), Virtual & Bozen-Bolzano, Italy, September 11-18, 2021. – CEUR Workshop Proc. **2969**(7).

Korotkova N., Aquino D., Arias S., Eggli U., Franck A., Gómez-Hinostrosa C., Guerrero P. C., Hernández H. M., **Kohlbecker A.**, Köhler M., **Luther K.**, Majure L. C., Metzing D., **Müller A.**, Nyffeler R., Sánchez D., Schlumpberger B. & **Berendsohn W.** 2021: *Cactaceae* at Caryophyllales.org – a dynamic online species-level taxonomic backbone for the family. – Willdenowia **51**: 251–270.

Kougioumoutzis K., Kokkoris I. P., **Strid A.**, **Raus T.** & Dimopoulos P. 2021: Climate-change impacts on the southernmost Mediterranean arctic-alpine plant populations. – Sustainability **13**: 13778.

Koutroumpa K., Warren B. H., Theodoridis S., Coiro M., Romeiras M. M., Jiménez A. & Conti E. 2021: Geo-climatic changes and apomixis as major drivers of diversification in the Mediterranean Sea lavenders (*Limonium* Mill.). – Frontiers Pl. Sci. **11**(612258).

Kusber W.-H., Garcia da Silva T., Bock C., Krienitz L. & Guiry M. D. 2021: Revised treatment of Reinsch's *Selenastrum* taxa and *Messastrum* (*Chlorophyta*) with remarks on their original material and molecularly analysed reference strains. – Notul. Algarum **218**.

Kusber W.-H. & **Jahn R.** 2021: Christian Gottfried Ehrenbergs Zeichnungen: Eine frühe wissenschaftliche Dokumentation mikroskopischer Organismen. – HiN – Alexander von Humboldt im Netz. – Int. Z. Humboldt-Stud. **22**: 105–117.

Kusber W.-H., Lange-Bertalot H. & Hofmann G. 2021: New combinations of diatom names (*Bacillariophyta*) from the German checklist and Red List with remarks on their indicator values. – Notul. Algarum **209**.

Lack H. W. 2021: From Ethiopia to Fiesole, Kew and Paris: The discovery, naming and typification of *Cadia purpurea* (*Fabaceae*). – Fl. Medit. **31** (Special Issue): 9–21.

Lack H. W. & Barina, Z. 2021: The early botanical exploration of Albania (1839–1945). – Willdenowia **50**: 519–558

Lack H. W., Böhme K. & Callmander M. W. 2021: Augustin-Pyramus de Candolle's L'Heritier Reliquiae: a volume of miscellaneous prints kept in Geneva. – Candollea **76**: 145–165.

Lack H. W. & Callmander M. W. 2021: The discovery, naming and typification of *Michauxia campanuloides* (*Campanulaceae*) with notes on its introduction into cultivation. – Willdenowia **51**: 195–208.

Lauterbach D., **Zippel E.**, Becker U., Borgmann P., Burkart M., Lang J., Listl D., Oevermann S., **Heinken-Smidová A.**, **Stevens A.-D.**, **Tschöpe O.**, Weißbach S., Wöhrmann F., Zachgo S. & Poschlod P. 2021: Gefährdete Pflanzen erhalten – Wiederansiedlungen als Artenschutzmaßnahme. – Natur Landschaft **9/10**: 475–481.

Lücking R. 2021: Peter D. Crittenden: meta-analysis of an exceptional two-decade tenure as senior editor of the flagship journal of lichenology. – Lichenologist **53**: 3–19.

Lücking R., Aime M. C., Robberts B., Miller A. N., Aoki T., Ariyawansa H. A., Cardinali G., Crous P. W., Druzhinina I. S., Geiser D. M., Hawksworth D. L., Hyde K. D., Irinyi L., Jeewon R., Johnston P. R., Kirk P. M., Malosso E., May T. W., Meyer W., Nilsson H. R., Öpik M., Robert V., Stadler M., Thines M., Vu D., Yurkov A. M., Zhang N., Schoch C. L. 2021: Fungal taxonomy and sequence-based nomenclature. – Nature Microbiol. **6**: 540–548.

Lücking R., Högnabba F. & **Sipman H. J. M.** 2021: *Lasioloma antillarum* (*Ascomycota*: *Pilocarpaceae*), a new lichenized fungus from the Antilles, and the importance of posterior annotations of sequence data in public repositories. – Willdenowia **51**: 83–89.

Lücking R., Leavitt S. D. & Hawksworth D. L. 2021: Species in lichen-forming fungi: balancing between conceptual and practical considerations, and between phenotype and phylogenomics. – Fungal Divers. **109**: 99–154.

Lücking R., **Moncada B.**, Soto-Medina E., Simijaca D. & **Sipman H. J. M.** 2021: Actualización nomenclatural y taxonómica del Catálogo de Líquenes de Colombia. – Rev. Acad. Col. Cien. Exactas Fís. Nat. **45**: 147–189.

Lücking R., **Moncada B.**, Widhelm T. J., Lumbsch H. T., Blanchon D. J. & de Lange P. J. 2021: The *Sticta filix* – *Sticta lacera* conundrum (lichenized *Ascomycota*: *Peltigeraceae* subfamily *Lobarioideae*): unresolved lineage sorting or developmental switch? – Bot. J. Linn. Soc. **199**: 706–727.

Mabberley D. J., **Lack H. W.** & Henwood M. J. 2021: Nomenclatural notes on New South Wales flannel flowers (*Actinotus* spp., *Umbelliferae/Apiaceae*) and Leopold Trattinnick's other Australian plant-names. – Telopea **24**: 395–409.

Malíček J., Bouda F., Konečná E., **Sipman H. J. M.** & Vondrák J. 2021: New country records of lichenized and non-lichenized fungi from Southeastern Europe. – Herzogia **34**: 38–54.

Maltsev Y., Maltseva S., Kociolek J. P., **Jahn R.** & Kulikovskiy M. 2021: Biogeography of the cosmopolitan terrestrial diatom *Hantzschia amphioxys* sensu lato based on molecular and morphological data. – Sci. Rep. **11**(4266).

Marcano V. & **Sipman H. J. M.** 2021: Diversity and distribution of lichens from the Cerro Duida and adjacent areas, Alto Orinoco, Amazonas, Venezuela. – Anales Jard. Bot. Madrid **78**(e114).

Marcer A., Haston E., Groom Q., Ariño A. H., Chapman A. D., Bakken T., Braun P., Dillen M., Ernst M., Escobar A., **Fichtmüller D.**, Livermore L., Nicolson N., Paragamian K., Paul D., Pettersson L. B., Phillips S., Plummer J., Rainer H., Rey I., Robertson T., **Röpert D.**, Santos J., Uribe F., Waller J. & Wieczorek J. R. 2021: Quality issues in georeferencing: from physical collections to digital data repositories for ecological research. – Divers. Distrib. **27**: 564–567.

Martínez-Colín P., **Lücking R.** & Herrera-Campos M. A. 2021: Diversity begets diversity: phorophyte and microsite relations of foliicolous lichens in the lowland rain forest at Los Tuxtlas Biosphere Reserve (Veracruz, Mexico). – Ecol. Res. **36**: 313–328.

Moncada B., Mercado-Díaz J. A., Magain N., Hodkinson B. P., Smith C. W., Bungartz F., Pérez-Pérez R.-E., Gumboski E., Sérusiaux E., Lumbsch H. T. & **Lücking R.** 2021: Phylogenetic diversity of two geographically overlapping lichens: isolation by distance, environment, or fragmentation? – J. Biogeogr. **48**: 676–689.

Moncada B., Mercado-Díaz J. A., Smith C. W., Bungartz F., Sérusiaux E., Lumbsch H. T. & **Lücking R.** 2021: Two new common, previously unrecognized species in the *Sticta weigelii* morphodeme (*Ascomycota*: *Peltigeraceae*). – Willdenowia **51**: 35–45.

Moncada B., Smith C. W. & **Lücking R.** 2021: A taxonomic reassessment of the genus *Sticta* (lichenized *Ascomycota*: *Peltigeraceae*) in the Hawaiian archipelago. – Lichenologist **53**: 177–133.

Mora D., Stancheva R. & **Jahn R.** 2021: *Cocconeis czarneckii* sp. nov. (*Bacillariophyta*): a new diatom species from Lake Okoboji (Iowa, USA), based on the strain UTEX FD23. – Phycologia **61**: 1–15.

Nascimento E. L. L., Maia L. C., Cáceres M. E. S. & **Lücking R.** 2021: Phylogenetic structure of lichen metacommunities in Amazonian and Northeastern Brazil. – Ecol. Res. **36**: 440–463.

Nordt B., Hensen I., Bucher S. F., Freiberg M., Primack R. B., **Stevens A.-D.**, Bonn A., Wirth C., Jakubka D., Plos C., Sporbert M. & Römermann C. 2021: The PhenObs initiative: a standardised protocol for monitoring phenological responses to climate change using herbaceous plant species in botanical gardens. – Funct. Ecol. **35**: 821–834.

Ognjanova-Rumenova N., Buczkó K., Pipik R. & **Jahn R.** 2021: *Aulacoseira scala* (Ehrenberg) comb. nov. – typification, morphology and biostratigraphic significance. – Nova Hedwigia Beih. **151**: 27–41.

Parolly G. 2021: The serpentine vegetation of Sandras Dağı revisited. Phytosociological studies on high-mountain plant communities of the South Anatolian Taurus Mountains, 4. – [In: Abdaladze O., Pedrotti F. & Raimondo F. M. (ed.), Phytogeography and vegetation of high mountains of Eurasia. Dedicated to Professor emeritus George Nakhutsrishvili (Ilia State University, Tbilisi) on occasion of his 85th birthday]. – Bocconea **29**: 203–244.

Petzold H. & **Raus T.** 2021: Der Beginn der neueren Steinkauz-Forschung im mittleren Westfalen vor 50 Jahren (1968–1972). – Eulen-Rundblick **71**: 55–59.

Raab-Straube E. von & **Raus T.** 2021: Euro+Med-Checklist Notulae, 13 [Notulae ad floram euro-mediterraneam pertinentes No. 42]. – Willdenowia **51**: 141–168.

Raab-Straube E. von & **Raus T.** 2021: Euro+Med-Checklist Notulae, 14 [Notulae ad floram euro-mediterraneam pertinentes No. 43]. – Willdenowia **51**: 355–369.

Reich D., Gutermann W., Bardy K., Rainer H., **Raus T.**, Sonnleitner M., Tan K. & Lachmayer M. 2021: The type specimens in Eugen von Halácsy's Herbarium Graecum. – Phytotaxa **493**: 1–156.

Rimet F., Aylagas E., Borja Á., Bouchez A., Canino A., Chauvin C., Chonova T., Ciampor Jr F., Costa F. O., Ferrari B. J. D., Gastineau R., Goulon C., Gugger M., Holzmann M., **Jahn R.**, Kahlert M., **Kusber W.-H.**, Laplace-Treyture C., Leese F., Leliaert F., Mann D. G., Marchand F., Méléder V., Pawlowski J., Rasconi S., Rivera S., Rougerie R., Schweizer M., Trobajo R., Vasselon V., Vivien R., Weigand A., Witkowski A., **Zimmermann J.** & Ekrem T. 2021: Metadata standards and practical guidelines for specimen and DNA curation when building barcode reference libraries for aquatic life. – Metabarcoding Metagenomics **5**(58056).

Simijaca D., **Lücking R.** & **Moncada B.** 2021: Two new species of *Astrothelium* (*Trypetheliaceae*) with amyloid ascospores inhabiting the canopy of *Quercus humboldtii* trees in Colombia. – Phytotaxa **508**: 229–234.

Simon A., Goffinet B., Wang L.-S., Spribille T., Goward T., Pystina T., Semenova N., Stepanov N. V., **Moncada B.**, **Lücking R.**, Magain N. & Sérusiaux E. 2021: Global phylogeny and taxonomic reassessment of the lichen genus *Dendriscosticta* (*Ascomycota*: *Peltigerales*). – Taxon **71**: 256–287.

Thiyagaraja V., **Lücking R.**, Ertz D., Coppins B. J., Wanasinghe D. N., Karunarathna S. C., Suwannarach N., To-Anun C., Cheewangkoon R. & Hyde K. D. 2021: Sequencing of the type species of *Arthopyrenia* places *Arthopyreniaceae* as a synonym of *Trypetheliaceae*. – Mycosphere **12**: 993–1011.

Thiyagaraja V., **Lücking R.**, Ertz D., Karunarathna S. C., Wanasinghe D. N., Lumyong S. & Hyde K. D. 2021: The evolution of life modes in *Stictidaceae*, with three novel taxa. – J. Fungi **7**(105).

Thiyagaraja V., **Lücking R.**, Ertz D., Samarakoon M. C., Wanasinghe D. N., Karunarathna S. C., Cheewangkoon R. & Hyde K. D. 2021: *Mendogia diffusa* sp. nov. and an updated key to the species of *Mendogia* (*Myriangiaceae*, *Dothideomycetes*). – Biodivers. Data J. **9**(e67705).

Van de Vijver B., Hamilton P. & **Kusber W.-H.** 2021: Corrections in the description of *Stauroneis crassula* (*Stauroneidaceae*, *Bacillariophyta*). – Notul. Algarum **206**.

Van de Vijver B., Hürlimann J., Potapova M., Bahls L., Ballings P., Levkov Z., **Kusber W.-H.** & Ector L. 2021: Observations and typification of *Fragilaria cyclopum* (Brutschy) Lange-Bertalot (*Fragilariaceae*, *Bacillariophyta*). – Notul. Algarum **204**.

Van de Vijver B., Schuster T. M., **Kusber W.-H.**, Hamilton P., Wetzel C. E. & Ector L. 2021: Revision of European *Brachysira* species (*Brachysiraceae*, *Bacillariophyta*): I. The *Brachysira microcephala* – *B. neoexilis* enigma. – Bot. Lett. **168**: 467–484.

Van de Vijver B., Schuster T. M., **Kusber W.-H.**, Kennedy B., Hamilton P., Albert R.-L., Ballings P., Wetzel C. E. & Ector L. 2021: Revision of European *Brachysira* species (*Brachysiraceae*, *Bacillariophyta*): III. Species formerly included in the *Brachysira serians*-complex. – Bot. Lett. **169**: 83–105.

Van de Vijver B., Schuster T. M., **Kusber W.-H.**, Williams D. M., Wetzel C. E. & Ector L. 2021: Revision of European *Brachysira* species (*Brachysiraceae*, *Bacillariophyta*): II. The *Brachysira styriaca* and *B. zellensis* group. – Bot. Lett. **168**: 503–511.

Van de Vijver B., Schuster T. M., Williams D. M. & **Kusber W.-H.** 2021: Was *Fragilaria pararumpens* Lange-Bertalot, G.Hofmann & Werum 2011 new to science? – Notul. Algarum **180**.

Vogt R., Wagner F. & Oberprieler C. 2021: The genus *Heteromera* (*Compositae*, *Anthemideae*). – Willdenowia **51**: 233–249.

Voitk A., Saar I., **Lücking R.**, Moreau P.-A., Corriol G., Krisai-Greilhuber I., Thorn R. G., Hay C. R. J., **Moncada B.** & Gulden G. 2021: Surprising morphological, ecological and ITS sequence diversity in the *Arrhenia acerosa* complex (*Basidiomycota*: *Agaricales*: *Hygrophoraceae*). – Sydowia **73**: 133–162.

Wiersema J. H., Prado J. & **Turland N. J.** 2021: (081–082) Proposals to allow the use of a hyphen to be treated as a correctable error in all nothogeneric names that are condensed formulas. – Taxon **70**: 459–459.

Wilk K., Pabijan, M., Saługa M., Gaya E. & **Lücking R.** 2021: Phylogenetic revision of South American *Teloschistaceae* (lichenized *Ascomycota*, *Teloschistales*) reveals three new genera and species. – Mycologia **113**: 278–299.

Wirth V., Hauck M. & **Sipman H. J. M.** 2021: Anmerkungen zu flechtenfloristischen Angaben für Thüringen und Umgebung. – Herzogia **34**: 339–353.

Zimmermann J., **Abarca N.**, **Kusber W.-H.**, **Skibbe O.** & **Jahn R.** 2021: Kieselalgen – winzig, aber wichtig: Biodiversität und Sauerstoffproduktion in einer Glasschachtel. – Biol. Unserer Zeit **51**: 132–141.

Zippel E., **Heinken-Smidová A.**, **Tschöpe O.**, Burkart M., Lauterbach D. & Weißbach S. 2021: Maßnahmen zum Schutz seltener und bedrohter Verantwortungsarten im Rahmen des WIPs-De-Projektes in Berlin-Brandenburg. – Verh. Bot. Vereins Berlin Brandenburg **153**: 209–217.

Zippel E., Rohner M.-S., **Heinken-Smidová A.**, **Tschöpe O.** & Lauterbach D. 2021: Erprobung von Ansiedlungsmaßnahmen zum Erhalt der Pfingst-Nelke (*Dianthus gratianopolitanus*) bei Bad Freienwalde. – Verh. Bot. Vereins Berlin Brandenburg **153**: 65–84.

MONOGRAPHS

Gaya E., Vasco-Palacios A. M, Vargas-Estupiñan N., **Lücking R.**, Carretero J., Sanjuan T., **Moncada B.**, Allkin B., Bolaños-Rojas A. C., Castellanos-Castro C., Coca L. F., Corrales A., Cossu T., Davis L., dSouza J., Dufat A., Franco-Molano A. E., Garcia F., Gómez-Montoya N., González-Cuellar F. E., Hammond D., Herrera A., Jaramillo-Ciro M. M., Lasso-Benavides C., Mira M. P., Morley J., Motato-Vásquez V., Niño-Fernandez Y., Ortiz-Moreno M. L., Peña-Cañón E. R., Ramirez-Castrillón M., Rojas T., Ruff J., Simijaca D., **Sipman H. J. M.**, Soto-Medina E., Torres G., Torres-Andrade P. A., Ulian T., White K. & Diazgranados M. 2021: ColFungi: Colombian Resources for Fungi Made Accessible. – Kew: Royal Botanic Gardens.

Lack H.-W. 2021: A Garden Eden / Ein Garten Eden / Un jardin d'Éden, ed 4; A Garden Eden / Un jardín del edén / Un giardino dell'eden. – Köln: Taschen Verlag.

EDITORSHIP

Turland N. J. 2021: Willdenowia: Annals of the Botanic Garden and Botanical Museum Berlin, **51**. – Berlin: Botanic Garden and Botanical Museum Berlin, Freie Universität Berlin.

Greuter W., **Rankin Rodríguez R.** & González Gutiérrez P. A. (ed.) 2021: Flora de la República de Cuba. Fascículo 26. *Cistaceae*. *Onagraceae*. *Polygonaceae*. – Berlin: Botanischer Garten und Botanisches Museum Berlin.

CONTRIBUTIONS TO SERIALS, POSITION PAPERS AND FESTSCHRIFTS

Lack H.-W. 2021: Systematische Botanik an der Universität Breslau 1884–1925 – Engler, Prantl & Pax. – Pp. 247–264 in: Keil G. & Kiefer J. (ed.), Die deutsch-polnische Wissenschaftslandschaft Schlesien. – Düren: Shaker Verlag, 2021 (= Engelhardt D. v., Kästner I., Kiefer J. & Reich K. (ed.), Europäische Wissenschaftsbeziehungen **16**)

Oberprieler C. & **Vogt R.** 2021: *Asteraceae-Anthemideae* (excl. *Achillea*). – In: Müller F., Ritz C. M., Welk E. & Wesche K. (ed.), Rothmaler – Exkursionsflora von Deutschland. Gefäßpflanzen: Grundband. – Berlin: Springer.

Trzaska L. 2021: Joel Löwe – ל"ירב לאוי. Biographie (Version I, 2021). – In: Christoph Schulte (ed.), haskala.net. Das online-Lexikon zur jüdischen Aufklärung, https://www.uni-potsdam.de/de/haskala/haskala-in-biographien/levi-1

Zimmermann J., **Mora D.**, Tapolczai K., Proft S., Chonova T., Rimet F., Bouchez A., Fidlerová D., Makovinská J. & Weigand A. 2021: Metabarcoding of phytobenthos samples. – In: Liška I., Wagner F., Sengl M., Deutsch K., Slobodník

J. & Paunović M (ed.), Joint Danube Survey 4. Scientific Report: A shared analysis of the Danube river. – Vienna: ICPDR – International Commission for the Protection of the Danube River.

CONTRIBUTIONS TO TAXONOMIC INFORMATION SYSTEMS

Raab-Straube E. von 2021+ (continuously updated): *Araceae* (excl. *Lemnoideae*). – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/e977a2b1-bea3-4edc-a2e2-d14bc3914227

Raab-Straube E. von 2021+ (continuously updated): *Asphodelaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/63fd0256-d7e9-4dd6-99b4-e6a290221d09

Raab-Straube E. von 2021+ (continuously updated): *Colchicaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/ed761d48-d7f5-45e9-9156-036af2957dc2

Raab-Straube E. von 2021+ (continuously updated): *Commelinaceae*. – In: Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. – Published at https://europlusmed.org/cdm_dataportal/taxon/0c3fa092-a7db-4787-987b-7c228449bf7a

ARTICLES IN NON-PEER-REVIEWED JOURNALS

Raus T. 2021: Bernhard Zepernick (1926–2019) und sein Blick auf Herbert Sukopp. – Verh. Bot. Vereins Berlin Brandenburg **152**: 13–27.

SPECIES NEWLY DESCRIBED BY BGBM AUTHORS

2020/2021

LICHENS

NAME	COUNTRY OF ORIGIN
Andina citrinoides Wilk, Pabijan & Lücking[32)]	Bolivia
Aridoplaca peltata Wilk, Pabijan & Lücking[32)]	Peru
Astrothelium mordonialense Simijaca, Lücking & B. Moncada[28)]	Colombia
Astrothelium rogitamae Simijaca, Lücking & B. Moncada[28)]	Colombia
Bogoriella complexoluminata Aptroot & Lücking[6)]	Brazil
Cinnabaria boliviana Wilk, Pabijan & Lücking[32)]	Bolivia
Cora timucua Dal Forno, Kaminsky & Lücking[7)]	USA (Florida)
Gymnographopsis corticicola R. Miranda, Herrera-Camp. & Lücking[11)]	Mexico
Ikaeria serusiauxii Sipman[16)]	Portugal
Lasioloma antillarum Lücking, Högnabba & Sipman[25)]	Netherlands Antilles
Ocellularia jacinda-arderniae A. J. Marshall, Blanchon, Lücking & de Lange[9)]	New Zealand
Redonographa parvispora R. Miranda, Barcenas-Peña & Lücking[11)]	Mexico
Serusiauxiella filifera S. H. Jiang, Lücking & J. C. Wei[4)]	China
Serusiauxiella flagellata S. H. Jiang, Lücking & J. C. Wei[4)]	China
Serusiauxiella sinensis S. H. Jiang, Lücking & J. C. Wei[4)]	China
Sticta acyphellata B. Moncada & Lücking[12)]	USA (Hawaii)
Sticta andina B. Moncada, Lücking & Sérus[26)]	Colombia
Sticta antoniana B. Moncada & Lücking[12)]	USA (Hawaii)
Sticta borinquensis Merc.-Díaz & Lücking[10)]	Puerto Rico
Sticta densiphyllidiata Merc.-Díaz & Lücking[10)]	Puerto Rico
Sticta emmanueliana B. Moncada, Lücking & Lumbsch[12)]	USA (Hawaii)
Sticta flynnii B. Moncada & Lücking[12)]	USA (Hawaii)
Sticta harrisii Merc.-Díaz, B. Moncada & Lücking[10)]	Puerto Rico
Sticta hawaiiensis B. Moncada & Lücking[12)]	USA (Hawaii)
Sticta scabrosa B. Moncada, Merc.-Díaz & Bungartz[26)]	Colombia
Sticta scabrosa subsp. *hawaiiensis* B. Moncada, Lücking & C. W. Smith[26)]	USA (Hawaii)
Sticta smithii B. Moncada & Lücking[12)]	USA (Hawaii)
Sticta waikamoi B. Moncada & Lücking[12)]	USA (Hawaii)

LICHENS

NAME	COUNTRY OF ORIGIN
Strigula depressa Woo, Lücking & Hur[19)]	South Korea
Strigula multiformis Woo, Lücking & Hur[19)]	South Korea
Tenuitholiascus porinoides S. H. Jiang, Lücking & J. C. Wei[5)]	China

VASCULAR PLANTS

NAME	COUNTRY OF ORIGIN
Euphorbia radfanensis Al-Fatimi & N. Kilian[24)]	Yemen
Launaea calmadowensis Baldesi & N. Kilian[21)]	Somalia
Mojiangia oreophila Ze H. Wang, N. Kilian & H. Peng[33)]	China
Rhodanthemum × *pseudoredieri* Flor. Wagner, Vogt & Oberpr.[17)]	Morocco
Rhodanthemum quezelii subsp. *ijallabenense* Flor. Wagner, Vogt & Oberpr.[17)]	Morocco
Saussurea solaris Raab-Straube & Lidén[13)]	India
Sinoseris changii Ze H. Wang, N. Kilian & H. Peng[18)]	China

DIATOMS

NAME	COUNTRY OF ORIGIN
Brachysira confusa Van de Vijver, R. L. Albert, B. Kennedy & Kusber[31)]	Finland
Cocconeis coreana R. Jahn & B. M. Suh[3)]	South Korea
Cocconeis crawfordii R. Jahn & Skibbe[23)]	Germany
Cocconeis czarneckii Stancheva, L. D. Mora & R. Jahn[27)]	USA (Iowa)
Cocconeis sijunghoensis R. Jahn & B. M. Suh[3)]	South Korea
Gomphonema acuminatum var. *cryptoacuminatum* N. Abarca & R. Jahn[1)]	Germany
Gomphonema neotropicum N. Abarca & L. D. Mora[1)]	Mexico
Gomphonema subclavatum var. *pomeranicum* N. Abarca & R. Jahn[1)]	Germany
Pseudostaurosira caballeroae V. H. Salinas, L. D. Mora, R. Jahn & N. Abarca[14)]	Mexico
Pseudostaurosira carmonae V. H. Salinas, L. D. Mora, R. Jahn & N. Abarca[14)]	Mexico
Pseudostaurosira iztaccihuatlii V. H. Salinas & L. D. Mora[14)]	Mexico

FUNGI

NAME	COUNTRY OF ORIGIN
Mendogia diffusa Thiyagaraja, Ertz, Lücking, Samarak. & K. D. Hyde[30)]	Thailand
Ostropomyces pruinosellus Thiyagaraja, Lücking, Ertz & K. D. Hyde[29)]	Thailand
Ostropomyces thailandicus Thiyagaraja, Lücking, Ertz & K. D. Hyde[29)]	Thailand
Sphaeropezia shangrilaensis Thiyagaraja, Lücking, Ertz & K. D. Hyde[29)]	China

NEWLY DESCRIBED FAMILIES AND GENERA

2020/2021

NAME	ORGANISM	REGION OF ORIGIN	FAMILY / GENUS
Andina Wilk, Pabijan & Lücking[32]	lichen	Bolivia	new genus
Aridoplaca Wilk, Pabijan & Lücking[32]	lichen	Peru	new genus
Cinnabaria Wilk, Pabijan & Lücking[22]	lichen	Bolivia	new genus
Dictyonematinae Dal Forno & Lücking[22]	lichen	worldwide	new subtribe
Emmanuelia Ant. Simon, Lücking & Goffinet[15]	lichen	pantropical	new genus
Flagellostrigula Lücking, S. H. Jiang & Sérus[6]	lichen	Costa Rica	new genus
Lipschitzia Zaika, Sukhor. & N. Kilian[20]	vascular plant	China (Mongolia)	new genus
Macroconstrictolumina Lücking, R. Miranda & Aptroot[6]	lichen	pantropical	new genus
Mojiangia Ze H. Wang, N. Kilian & H. Peng[33]	lichen	China	new genus
Ostropomyces Thiyagaraja, Lücking, Ertz & K. D. Hyde[29]	fungus	Thailand	new genus
Pseudobogoriella Lücking, R. Miranda & Aptroot[6]	lichen	pantropical	new genus
Ramaliella Zaika, Sukhor. & N. Kilian[20]	vascular plant	Africa, Asia	new genus
Rubikioideae Lücking, M. Cáceres & Aptroot[2]	lichen	worldwide	new subfamily
Saxiloba Lücking, B. Moncada & Viñas[8]	lichen	USA (Hawaii)	new genus
Schummia Lücking, R. Miranda & Aptroot[6]	lichen	Portugal	new genus
Serusiauxiella S. H. Jiang, Lücking & J. C. Wei[4]	lichen	China	new genus
Sinoseris N. Kilian, Ze H. Wang & H. Peng[18]	vascular plant	China	new genus
Swinscowia S. H. Jiang, Lücking & Sérus[6]	lichen	Brazil	new genus
Tenuitholiascaceae S. H. Jiang, Lücking & J. C. Wei[5]	lichen	China	new family

SOURCES

THE FULL BIBLIOGRAPHIC REFERENCES CAN BE FOUND IN THE LIST OF PUBLICATIONS ON PP. 35–47:

1) Abarca & al. 2020 – Bot. Lett. 167: 114–159.
2) Cáceres & al. 2020 – Bryologist 123: 144–154.
3) Jahn & al. 2020 – Algae 35: 303–324.
4) Jiang & al. 2020 – Fungal Divers. 102: 257–291.
5) Jiang & al. 2020 – IMA Fungus 11(1).
6) Hongsanan & al. 2020 – Fungal Divers. 105: 17–318.
7) Lücking & al. 2020 – Bryologist 123: 657–673.
8) Lücking & al. 2020 – Pl. Fungal Syst. 65: 577–585.
9) Marshall & al. 2020 – New Zealand J. Bot. 58: 223–235.
10) Mercado-Diaz & al. 2020 – Taxon 69: 851–891.
11) Miranda-González & al. 2020 – Bryologist 123: 127–143.
12) Moncada & al. 2020 – Pl. Fungal Syst. 65: 95–119.
13) Raab-Straube & al. 2020 – Symb. Bot. Upsal. 40: 130–133.
14) Salinas 2020 – Phytotaxa 464: 193–206.
15) Simon & al. 2020 – Pl. Fungal Syst. 65: 76–94.
16) Sipman & al. 2020 – Pl. Fungal Syst. 65: 120–130.
17) Wagner & al. 2020 – Molec. Phylogenet. Evol. 144(106702).
18) Wang & al. 2020 – Willdenowia 50: 91–110.
19) Woo & al. 2020 – Phytotaxa 443: 1–12.
20) Zaika & al. 2020 – PhytoKeys 137: 1–85.
21) Baldesi & al. 2021 – Phytotaxa 501: 195–200.
22) Dal Forno & al. 2021 – Molec. Ecol. 30: 1755–1776.
23) Jahn & al. 2021 – Nova Hedwigia Beih. 150: 85–105.
24) Kilian & al. 2021 – Euphorbia World 17: 5–12.
25) Lücking & al. 2021 – Willdenowia 51: 83–89.
26) Moncada & al. 2021 – Willdenowia 51: 35–45.
27) Mora & al. 2021 – Phycologia 61: 60–74.
28) Simijaca & al. 2021 – Phytotaxa 508: 229–234.
29) Thiyagaraja & al. 2021 – J. Fungi 7: 105.
30) Thiyagaraja & al. 2021 – Biodivers Data J. 9(e67705).
31) Van de Vijver & al. 2021 – Bot. Lett. 169: 95.
32) Wilk & al. 2021 – Mycologia 113: 278–299.
33) Yin & al. 2021 – Pl. Divers. 44: 83–93.

ONLINE RESOURCES AND DATABASES

1. DIGITISED COLLECTIONS AT THE BGBM

Virtual Herbarium – Digital Specimen Images at the Herbarium Berolinense – access to the Berlin data in the JACQ System (see below)
https://ww2.bgbm.org/herbarium/default.cfm

BoGART – database of the BGBM's living collection
https://ww2.bgbm.org/bogartdb/BogartPublic.asp

BioCASe-BGBM – Biological Collection Access Service for Europe. Portal for BGBM Collections (gemeinsamer Zugang zu den Sammlungsdaten des BGBM) *https://search.biocase.org/bgbm*

LICHCOL – Lichen (& Fungus) Herbarium Database *https://archive.bgbm.org/scripts/ASP/lichcol* [will be integrated into the BGBM Herbarium database in the JACQ system – see below].

DNA-Bank – information system for the BGBM's DNA collection (access via the portal of the Global Genome Biodiversity Network)
https://data.ggbn.org/ggbn_portal/search/result?institution=BGBM%2C+Berlin

MuseumPlus database of the BGBM in the Europeana Collections Portal
https://www.europeana.eu/en/search?query=europeana_collectionName%3A%2211635_OpenUp_MuseumPlus%22

2. TAXONOMIC INFORMATION SYSTEMS ON ORGANISMAL GROUPS

AlgaTerra – Information System on Terrestrial and Limnic Micro Algae (regularly updated)
http://www.algaterra.net

Campanula Portal – global online monograph of the genus *Campanula* (bellflowers) (regularly updated) fortlaufend aktualisiert) *https://campanula.e-taxonomy.net*

Cichorieae Portal – global online monograph of the *Cichorieae* (daisy family) (regularly updated) fortlaufend aktualisiert) *https://cichorieae.e-taxonomy.net*

Caryophyllales Portal – A Global Synthesis of Species Diversity in the Angiosperm Order *Caryophyllales* (regularly updated) *https://caryophyllales.org*

PhycoBank – registration system for nomenclatural acts of algae *https://phycobank.org*

3. FLORAS AND CHECKLISTS

Euro+Med PlantBase – The Information Resource for Euro-Mediterranean Plant Diversity (regularly updated) *https://ww2.bgbm.org/EuroPlusMed/query.asp*

Med-Checklist – A Critical Inventory of Vascular Plants of the Circum-Mediterranean Countries (as published in book form) *https://ww2.bgbm.org/mcl*

Flora Hellenica Database (Arne Strid) *https://www.florahellenica.com*

Flora of Greece – Vascular Plants of Greece: An Annotated Checklist *https://portal.cybertaxonomy.org/flora-greece*

Flora of Cyprus – A Dynamic Checklist (online Flora of the vascular plants of Cyprus with illustrations, distribution maps and identification keys – regularly updated) *https://flora-of-cyprus.eu*

Flora of Cuba Database – Base de Datos de Especímenes de la Flora de Cuba – con Mapas de Distribución Versión 10.0 (2014) a Versión 11 (2016) (database of Cuban flora herbarium specimens with distribution maps) *https://ww3.bgbm.org/FloraOfCuba*

The Spermatophyta and Pteridophyta of Cuba – A Preliminary Checklist *https://portal.cybertaxonomy.org/flora-cuba*

Dendroflora de El Salvador – *https://portal.cybertaxonomy.org/salvador/listado*

4. SERVICE PORTALS FOR COLLECTIONS DATA

BioCASe – Biological Collection Access Service for Europe. Portal for European Biodiversity *https://search.biocase.org/europe* (direct access to search catalogue)

BioCASe – Biological Collection Access Service for Europe. Portal for German Phytodiversity *https://search.biocase.de/botany* (direct access to search catalogue)

EDIT – Specimen and Observation Explorer for Taxonomists (access portal for collection data worldwide, optimised for taxonomists) *https://search.biocase.org/edit*

GBIF-D Algae & Protozoa (database for algae and single-celled organisms) *http://protists.gbif.de*

VH/de – Virtual Herbarium Germany (digitised collections information from German herbaria) *https://herbarium.gbif.de*

GGBN – Global Genome Biodiversity Network *https://www.ggbn.org*

WFO Specimens – World Flora Online Initiative, Specimen Explorer for Phytotaxonomists (Prototype) *http://wfospecimens.cybertaxonomy.org*

Botanic Garden Berlin Observations (BoBO) *https://bobo.biocase.org*

Caucasus Plant Biodiversity Initiative – specimen explorer with focus on Caucasian plants *https://caucasus.e-taxonomy.net*

gardens4science – online collections catalogue for German botanic gardens *https://gardens4science.biocase.org*

5. WEB SERVICES

UTIS – Unified Taxonomic Backbone for the European Biodiversity Observation Network (EU BON) *https://cybertaxonomy.org/eu-bon/utis*

Name catalogue REST API (access to the data held in the databases of the EDIT platform, e.g. including the "Catalogue of Life") *https://cybertaxonomy.org/cdmlib/rest-api-name-catalogue.html*

BioCASe – Biological Collections Access Service (machine-readable access to the collections data of the BGBM) *https://ww3.bgbm.org/biocase*

6. SOFTWARE

EDIT Platform for Cybertaxonomy – Open Source Software Tools and Services Covering All Aspects of the Taxonomic Workflow *https://cybertaxonomy.org*

BioCASe Network Software Components (for the networking and preparation of collections data in the BioCASe, GBIF and GGBN network) *https://www.biocase.org/products/index.shtml*

AnnoSys – Online annotation of biodiversity data (Online-Annotation von Biodiversitätsdaten) *https://annosys.bgbm.fu-berlin.de*

AnnoSys – online annotation of biodiversity data *https://www.jacq.org/#collections*

Die Herbonauten – Das Herbar der Bürgerwissenschaften (botanical missions for citizen scientists) *https://herbonauten.de*

B-HIT Berlin Harvesting and Indexing Toolkit (software platform for the harvesting of dispersed collection and observation data) *https://wiki.bgbm.org/bhit*

MetBaN – Automated Pipeline for Metabarcoding Data Using Taxonomical/Phylogenetical Classification of Organisms *https://github.com/sproft/MetBaN*

7. ARCHIVED SYSTEMS

The following information systems are still available for consultation, but are no longer updated:

Bohlmann Files – A Database of Natural Substances in the *Compositae*. Access: ***n.kilian@bo.berlin***

DERMBASE – Names of *Dermateaceae* (*Ascomycetes*) ***https://ww2.bgbm.org/projects/dermbase/query.cfm***

IOPI-GPC – International Organization for Plant Information, Provisional Global Plant Checklist ***https://ww2.bgbm.org/IOPI/GPC/default.asp***

Names in Current Use for Extant Plant Genera (NCU-3e) (standard list of generic names and publication citations for algae, fungi and plants) ***https://archive.bgbm.org/iapt/ncu/genera/Default.htm***

IAPT Registration of Plant Names Trial (International Association for Plant Taxonomy's trial database for the registration of newly published plant names) ***https://archive.bgbm.org/registration/QueryForm.htm***

EXTERNALLY FUNDED RESEARCH PROJECTS

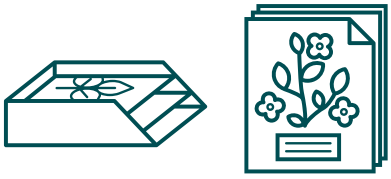
FUNDING ORGANISATION	PROJECT TITLE	PROJECT MANAGER(S)	TERM
Alexander von Humboldt-Stiftung (AvH)	Grant for a research fellow from Brazil	Thomas Borsch	2021–2021
AvH	Grant for a research fellow from Peru	Thomas Borsch	2021–2023
Bundesamt für Naturschutz (BfN)	WIPs-De II – Reintroducing and supporting populations of endangered species for which Germany has a special responsibility (WIPS-De II) (FKZ 3518685B01)	Albrecht-Dieter Stevens/Elke Zippel	2018–2023
Bundesministerium für Bildung und Forschung (BMBF)	ColBioDiv – Cooperation with the Botanic Garden of Bogotá and the Universidad del Norte Barranquilla (01DN17006)	Thomas Borsch	2017–2020
BMBF	VietBio – Innovative methods of recording biodiversity: capacity building with partner countries in Southeast Asia using the example of Vietnam	Thomas Borsch	2018–2022
BMBF	ColCari – Cooperation with the Universidad del Norte Barranquilla on integrative biodiversity research in the Colombian Caribbean (01DN19004)	Thomas Borsch	2019–2021
BMBF	EvoBoGa – Joint project: Plants of botanical gardens: Living resources for integrative evolution research. Sub-project: Cacti: analysis of evolution, species conception and development of the living collection as a resource for research and species protection (01UQ1708A)	Thomas Borsch/ Anton Güntsch	2017–2020
BMBF	Pflanze KlimaKultur! – Citizen scientists investigate the effects of climate change on the development of plants in the city – TP FU Berlin (01 BF2114A)	Gerald Parolly	2021–2024
Deutsches Zentrum Kulturgutverluste	Provenance research at the BGBM library relating to cultural property confiscated as a result of Nazi persecution	Norbert Kilian	2021–2023
Deutsche Forschungsgemeinschaft (DFG)	GFBio III – German Federation for the Curation of Biological Data (GU 1109/3-3)	Anton Güntsch	2018–2021

FUNDING ORGANISATION	PROJECT TITLE	PROJECT MANAGER(S)	TERM
DFG	SPP 1991 – Creation and validation of a bioinformatic pipeline for species delimitation and for phylogenetic network reconstruction in polyploid complexes (Taxon-OMICS VO 1595/3-1)	Robert Vogt	2017–2020
DFG	SPP 1991 – The CARRARA Pipeline: Using machine-learning techniques for automated species delimitation in intensively hybridising plant genera based on herbarium specimens (VO 1595/4-1)	Robert Vogt/ Norbert Kilian	2020–2023
DFG	SPP 1158 – Biodiversity and biogeography of marine benthic diatoms in Antarctic and Arctic shallow water coastal zones to evaluate the degree of endemism using fine-grained taxonomy and eDNA metabarcoding (ZI 1628/2-1)	Jonas Zimmermann	2019–2022
DFG / Nationale Forschungsdateninfrastruktur (NFDI)	NFDI4BioDiversität consortium – Biodiversity, ecology and environmental data (NFDI 5/1)	Anton Güntsch	2020–2025
Europäische Union (EU)	SYNTHESYS PLUS – Synthesis of systematic resources, Network Activities (Horizon 2020-INFRAIA) (GA no. 823827)	Anton Güntsch	2019–2023
EU	EU-Horizon 2020 – INRADEV-02-2019-2020 – DiSSCo Prepare: Distributed System of Scientific Collections – Preparatory Phase Project (GA no. 871043)	Anton Güntsch	2020–2023
EU	EU-Horizon 2020 – H2020-INFRAIA-2018-2020 – BiCIKL: Biodiversity Community Integrated Knowledge Library (GA no. 101007492)	Anton Güntsch	2021–2024
EU	SYNTHESYS PLUS – Synthesis of systematic resources, DE-TAF Access (Horizon 2020-INFRAIA) (GA no. 823827)	Robert Vogt	2019–2023
Kulturstiftung des Bundes (KSB)	Light, Air and Shit: Archaeologies of Sustainability. Bauhaus exhibition 2019 (BHF.0127)	Patricia Rahemipour	2018–2020
KSB	Connect – Comprehend – Communicate: Amazonia as a Future Laboratory	Thomas Borsch	2020–2023
Schwandt-Stiftung	Gardening and landscaping	Sylke Gottwald	2021–2025

FUNDING ORGANISATION	PROJECT TITLE	PROJECT MANAGER(S)	TERM
Senatsverwaltung für Umwelt, Verkehr und Klimaschutz	Development of a metabarcoding method for benthic diatoms in urban surface waters	Jonas Zimmermann	2020–2020
Smithsonian Institution	GGBN – Data standards and data quality	Anton Güntsch	2019–2021
Swedish University of Agricultural Sciences (SLU) Uppsala	Barcoding of freshwater taxa for improved assessment of biodiversity (FUB 2020000134)	Jonas Zimmermann	2019–2022
Universität Duisburg-Essen / International Commission for the Protection of the Danube River (ICPDR)	JDS4 – (e)DNA research activities during JDS4	Jonas Zimmermann	2019–2021
University of Gothenburg	Formas: Basen i den marina födovären – Biodiversitet genom DNA barcoding (The basis of the marine food chain – biodiversity through DNA barcoding)	Jonas Zimmermann	2020–2021
Verein der Freunde des Botanischen Gartens und Botanischen Museums Berlin-Dahlem e.V. (Association of Friends of the BGBM)	*Caryophyllales*: taxonomic backbone and *Cactaceae*	Walter Berendsohn	2020–2020
Verein der Freunde	Visiting scientist at the BGBM to work on including Costa Rica in the biogeographical and taxonomic research into Caribbean flora	Walter Berendsohn	2020–2020
Verein der Freunde	Continuation of the Flora de Cuba project and the project to research the endemism of the flora of Cuba and the Caribbean	Thomas Borsch	2019–2021
Verein der Freunde	Technical update and optimised maintenance of the herbarium platform for citizen scientists ("Die Herbonauten") for the year 2020/21	Anton Güntsch	2020–2021
Verein der Freunde	Acquisitions for the library	Norbert Kilian	2020–2020
Verein der Freunde	Support for revising the garden's North America plant geography area	Gerald Parolly	2021–2021
Verein der Freunde	Cultivation and study of new diatom cultures to support future project proposals	Jonas Zimmermann	2020–2020
VolkswagenStiftung	Kaukasus II – Developing tools for conserving the plant diversity of the South Caucasus (Az 89 950)	Thomas Borsch	2016–2020

COLLECTIONS

LIVING COLLECTION



HOLDINGS	2020	2021
Families	317	318
Genera	3,263	3,304
Taxa (species, subspecies, varieties etc.)	18,445	18,800
Accessions	31,951	32,640
Wild provenances (in %)	59.65	59.94

ARRIVALS/RELEASES	2020	2021
Accessions	2,802	1,585
Deaccessions	3,505	896

RELEASE OF MATERIAL	2020	2021
Total release of material, accessions	527	697
Total release of material, plant (parts)	1,392	4,287
Accessions to other gardens	220	350
Plant (parts) to other gardens	242	675
Accessions for teaching	90	166
Plant (parts) for teaching	654	3,163
Accessions for research	209	141
Plant (parts) for research	472	312
Schools accessions	8	40
Schools plant (parts)	24	137

DAHLEM SEED BANK	2020	2021
Holdings, number of accessions	13,438	13,912
New additions, number of accessions	490	474
projects	166	177
long-term storage (Base Collection)	258	207
Index Seminum (Access Collection)	66	90
Inclusions in the Index Seminum, of which	3,557	3,557
seed samples sent out	1,888	861
domestic	1,055	270
international	833	591
Recipients of seed samples	89	50

COLLECTIONS

HERBARIUM

HOLDINGS	2020	2021
Total number of specimens	3.99 m	3.95 m
Type specimens	>40,000	>40,000
Garden herbarium	52,006	52,223

NEW ADDITIONS	2020	2021
Total new additions, of which	43,139	18,500
through donation	34,403	16,580
through exchange	615	1,440
through purchase	8,007	100
through our own collecting activities	114	271
New additions to the garden herbarium	374	244

LOANS, EXCHANGES, VISITORS	2020	2021
Loan requests	190	200
Loans from Herbarium Berolinense to other institutions, number of specimens	1,714	1,714
Number of shipments	90	85
Loans to Herbarium Berolinense from other institutions, number of specimens	1,093	4,806
Number of shipments	9	22
Number of institutions with which we had loan exchanges	117	139
Specimens permanently given to exchange partners	1,085	979
Visiting scientists	29	34

DIGITAL HERBARIUM	2020	2021
Newly digitised specimens, of which	27,834	39,155
as a result of loan requests	1,066	1,622
in the context of projects	26,768	37,533
Total number of specimens available online	639,215	678,370
Hits / downloads	125,745	130,213

DNA BANK	2020	2021
Holdings (number of DNA samples)	41,236	43,125
New additions	4,570	1,889
DNA samples sent out (number)	23	54
DNA samples sent out (recipients)	10	9

LIBRARY

HOLDINGS AND CATALOGUES	2020	2021
Monographs and journal volumes	217,539	218,854
Current journals with print editions	574	515
Offprints	144,863	145,030
CD-ROMs, DVDs and video cassettes	503	508
Microfilm and microfiche titles	4,178	4,178

NEW ADDITIONS	2020	2021
Monographs, of which	798	751
through purchase	234	391
through exchange / donation	564	360
Bound journals, of which	1,053	570
through purchase	162	115
through exchange / donation	378	455
offprints	139	176
CD-ROMs and DVDs	4	5
Expenditure on contributions to databases and online journal packages	€13,720	€10,513

BGBM PRESS PUBLICATIONS

2020

WILLDENOWIA

Willdenowia 50(1) https://bioone.org/journals/willdenowia/volume-50/issue-1
Willdenowia 50(2) https://bioone.org/journals/willdenowia/volume-50/issue-2
Willdenowia 50(3) https://bioone.org/journals/willdenowia/volume-50/issue-3

ANNUAL REPORT

Netzwerken für die Vielfalt. BGBM-Jahresbericht 2017 – 2019. – Berlin: Botanischer Garten und Botanisches Museum Berlin, Freie Universität Berlin.

OTHER PUBLICATIONS

Willing E. 2020: 40th Willing Contribution to Flora Hellenica / Flora of Greece. Field records 2018. – Berlin: Botanic Garden and Botanical Museum Berlin. https://doi.org/10.3372/wfr2018

Willing E. 2020: 41st Willing Contribution to Flora Hellenica / Flora of Greece. Field records 2019. – Berlin: Botanic Garden and Botanical Museum Berlin. https://doi.org/10.3372/wfr2019

2021

WILLDENOWIA

Willdenowia 51(1) https://bioone.org/journals/willdenowia/volume-51/issue-1
Willdenowia 51(2) https://bioone.org/journals/willdenowia/volume-51/issue-2
Willdenowia 51(3) https://bioone.org/journals/willdenowia/volume-51/issue-3

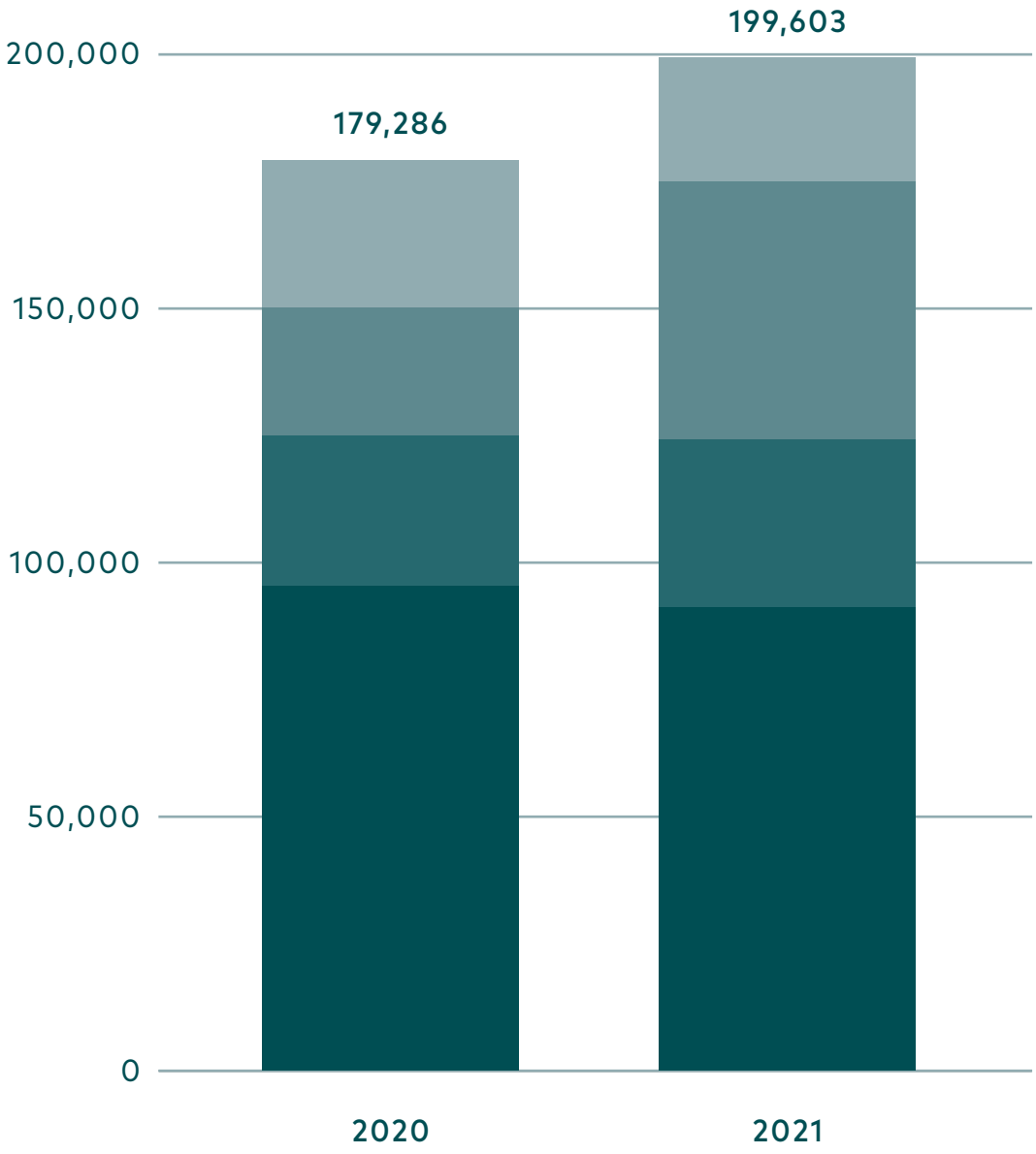
ANNUAL REPORT

Networking for Diversity. BGBM Annual Report 2017 – 2019. – Berlin: Botanic Garden and Botanical Museum Berlin, Freie Universität Berlin. – https://doi.org/10.3372/JB.2017-2019.en.1

OTHER PUBLICATIONS

Greuter W., Rankin Rodríguez R. & González Gutiérrez P. A. (ed.) 2021: Flora de la República de Cuba. Fascículo 26. Cistaceae. *Onagraceae. Polygonaceae.* – Berlin: Botanischer Garten und Botanisches Museum Berlin.

VISITORS*



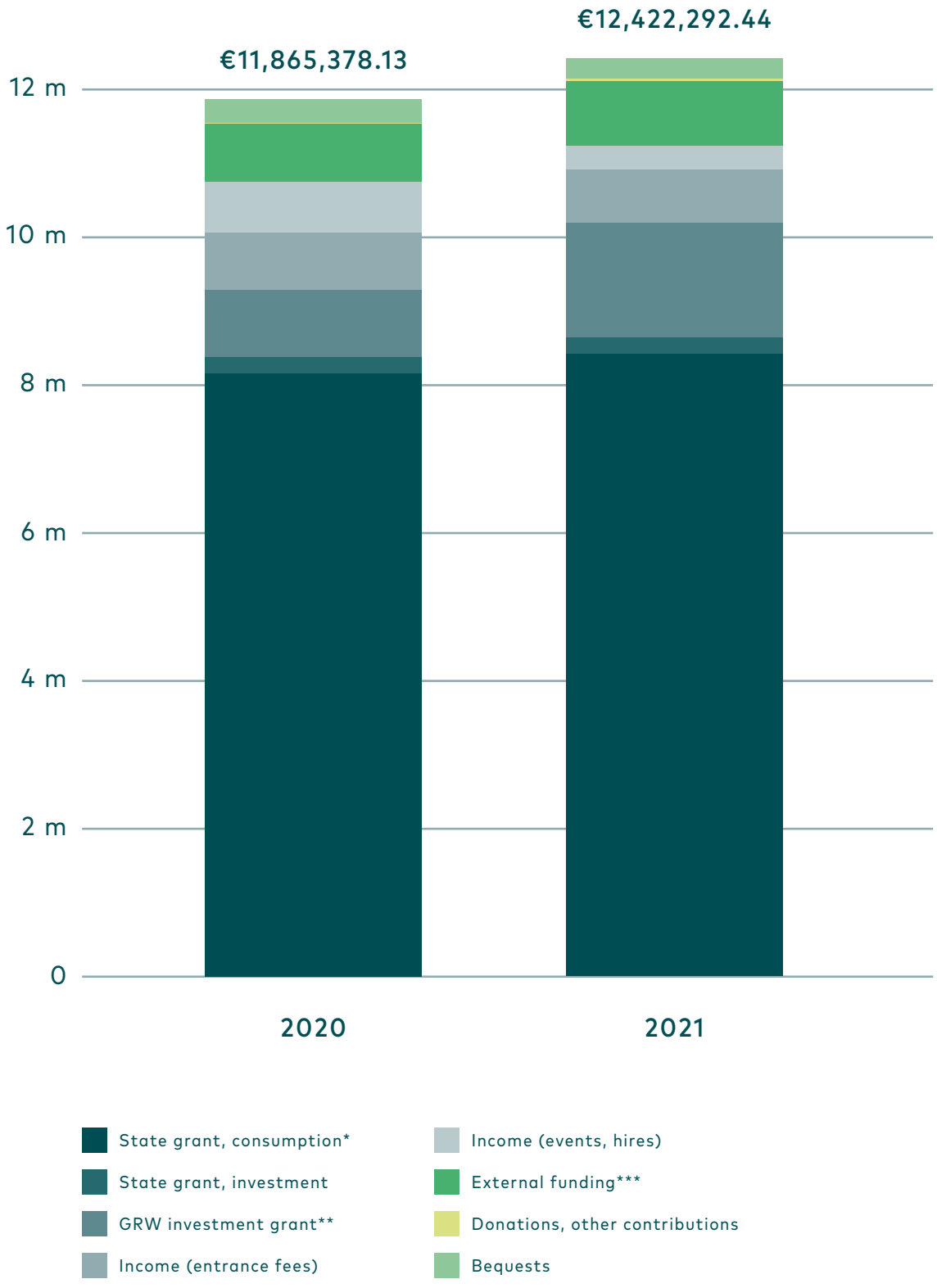
ENTRY

STANDARD CONCESSIONS WITH ANNUAL PASS FREE

(e.g. small children or students in the context of courses)

* On account of the pandemic, which caused the garden and greenhouses to close and led to the cancellation of events (including the Berlin Perennials Market, the Botanical Night and the Christmas Garden), visitor numbers fell by almost a half compared with pre-2020 levels.

BUDGET



* Since 2018, the state consumption grant has included special funding from the Institutional Contract (Sondertatbestand Hochschulvertrag) as well as €200,000 from FU Berlin central funds to compensate for the tariff-related additional costs of the former BGBM operating company.

** GRW is the national scheme for improving regional economic structures.

*** BMBF, DFG, EU, VolkswagenStiftung, among others.

Publication information

We would like to thank Kerstin Viering for writing the thematic texts (pp. 6–21, pp. 12–17 together with Dr Eva Häffner and Dr Katja Reichel) and our colleagues Dr Gerald Parolly and Dr Jonas Zimmermann for their support. Special thanks are due to Dr Robert Lücking and to Dr Eva Häffner for compiling the list of newly described families, genera and species, and to Dr Norbert Kilian for editing the publication entries.

German-to-English translation: Sarah Kane

1st German edition (print and PDF), December 2022
1st English edition (PDF), February 2023

Publisher: BGBM Press 2023

Project coordinator: Nadine Csonka
Cover image: SEM image of the diatom *Gomphonella tegelensis* (diatoms research group)
Design and layout: publicgarden GmbH, Berlin
Typeface: Mark Pro Narrow

Photo credits: Juliane Bettig, p. 21; Nadine Csonka, p. 23 below; Michael Fahrig, p. 5; Diatoms research group, cover image, p. 20; Herbarium Berolinense, pp. 13, 16; Stephanie Henkel, p. 22 above; Christine Hillmann-Huber, p. 24; Nils Köster, p. 25; Robert Lücking, pp. 15, 27; Birgit Nordt, p. 8; Gerald Parolly, pp. 4, 6, 7, p. 10 below; Christiane Patic, p. 2, p. 10 above, p. 11, p. 12, p. 23 above; Katja Reichel, p. 17; Mario Reichel, p. 16; Bernd Wannenmacher, p. 22 below, p. 23 middle; Zhi-Jian Yin, p. 29; Oscar Rojas Zamora, p. 28; Jonas Zimmermann, pp. 18, 20.

ISBN: 978-3-946292-45-6
DOI: https://doi.org/10.3372/JB.2020-2021.en.1

#insights
#botany
#debate
#sustainability
#forum
#diversity
#welcome

Freie Universität Berlin
ZE Botanischer Garten und Botanisches Museum Berlin
Königin-Luise-Straße 6–8 | 14195 Berlin