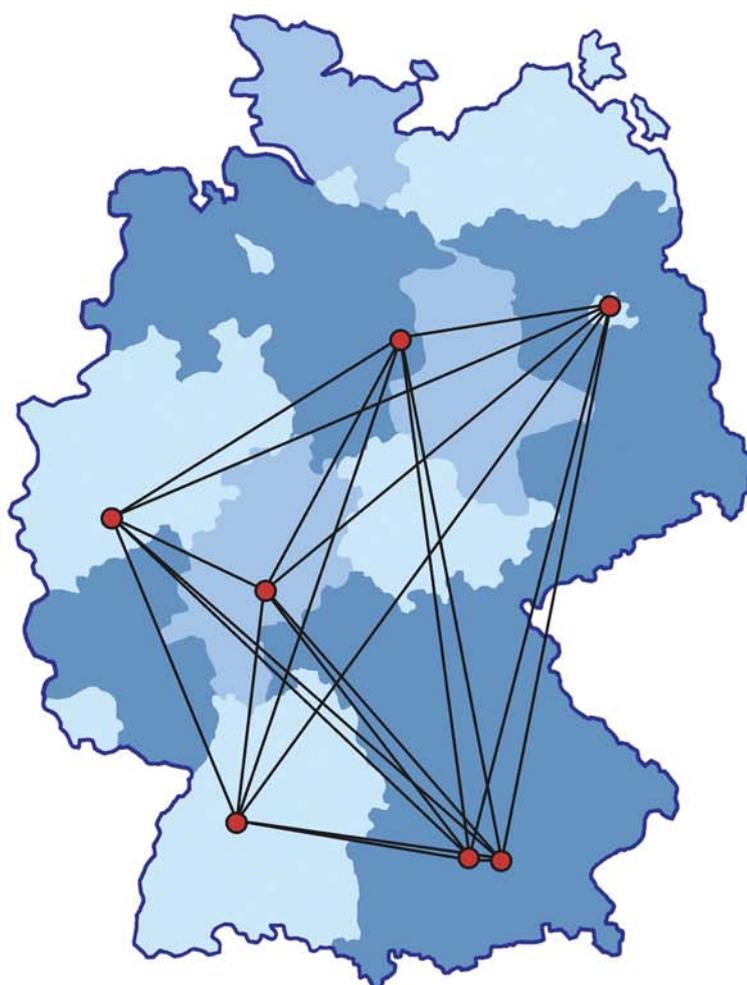




GBIF-Deutschland

German Participation in the Global Biodiversity Information Facility Status Report 2004



Prokaryotes & Viruses

Mycology

Botany

Invertebrates I

Invertebrates II

Invertebrates III

Vertebrates

BIOLOG AlgaTerra

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GBIF-D: German Participation in the Global Biodiversity Information Facility

Projects in the German National Programme for the Global Biodiversity Information Facility 2003-2006

Status Report 2004

Edited by

Walter G. Berendsohn and Susanne Oehlschlaeger

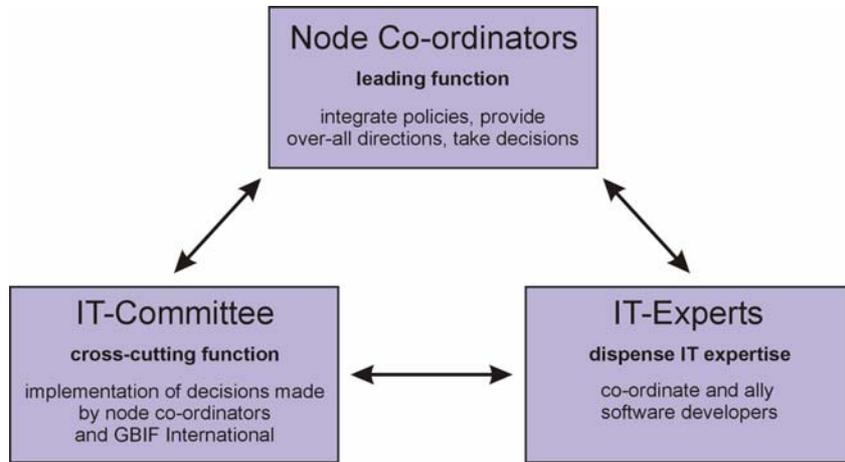
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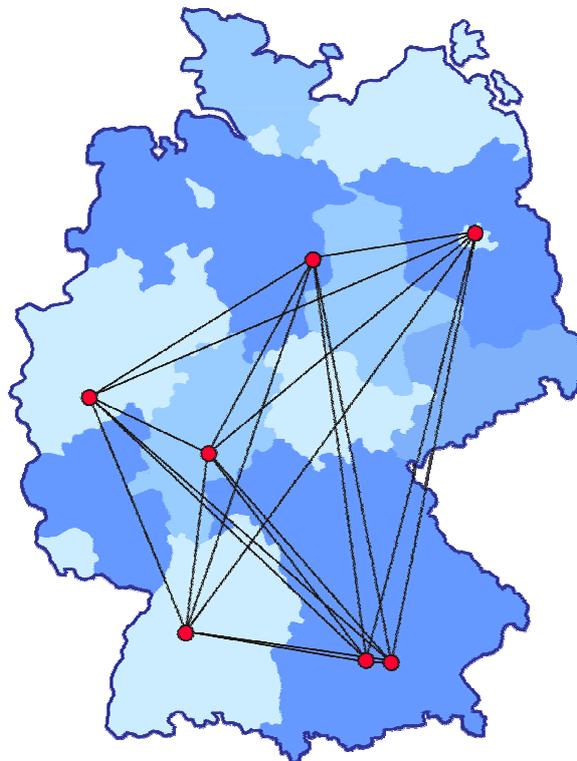
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Co-ordination of GBIF-Germany (GBIF-D)



Co-ordination structure of GBIF-D



Network of GBIF-D nodes

Introduction to the German National Programme for the Global Biodiversity Information Facility

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Keywords: GBIF-Germany, GBIF-D, collection data networking, taxonomic networking, biodiversity information

Abstract

GBIF-D, the German National Node System of the Global Biodiversity Information Facility (GBIF), substantially contributes to GBIF's primary mission, namely, making the world's primary data on biodiversity freely and universally available via the Internet. The GBIF-D system is already fully integrated into GBIF's interoperable network of biodiversity databases and information technology tools, actively working on the development of worldwide capacity to access the vast amount of already existing biodiversity data. The globally co-ordinated approach provides the framework for a rapid expansion of the network on national, European and global levels. GBIF and GBIF-D are opening new possibilities for the utilisation of research data.

Results

GBIF was founded in 2001. In October 2004, participation has grown to 41 countries and 26 organisations committed to contribute data to the GBIF information structure and to work towards an interoperable network. An important aspect is the sharing of biodiversity data with the countries of origin of the materials in collections. The total number of objects in natural history collections worldwide has been estimated at 1,5 to 3 billions [1], with an even less known number of additional observation records. The international GBIF-Portal (www.gbif.org) was already providing access to more than 43 million data records from 82 data providers in October, and the amount of data is constantly increasing. For simultaneous data access, GBIF makes use also of software developed in Germany in the course of the EU-funded BioCASE project (Biological Collection Access Service for Europe). Other European projects such as ENBI (European Network of Biodiversity Information) join forces with European institutions and GBIF nodes to mobilise biodiversity information resources, too.

By signing GBIF's Memorandum of Understanding, the German federal government has not only agreed to provide substantial financial support for the running of the international GBIF Secretariat and the GBIF work programme. Germany has also committed to building a national system providing data to the facility. To foment that national contribution, GBIF-Germany (GBIF-D, www.gbif.de) has been set up as a system of seven nodes, each responsible for a range of taxonomic groups (Tab. 1). This structure was the result of a discussion project within the scientific community. An approach based on existing communication and collaboration structures within the data generating community was thought to be the most effective organisation structure. This has been largely confirmed by the results achieved to-date. The 48 institutes involved look after 66 funded sub-projects and already contributed more than 3,800,000 specimens and observation records to the GBIF network – making Germany currently the fourth-largest GBIF Data Provider.

The node for Prokaryotes & Viruses is currently building its database at the DSMZ in Braunschweig and already contributed 13,000 prokaryotic strains to the GBIF network. The Mycological Node is building its network based on the Diversity Workbench suite of software tools. Data entered reached 32,000 records, more than 5,000 records are accessible via GBIF International. About 50 % of the remaining 27,000 data records will be transferred to GBIF within the next 6 month. The Botanical Node is mainly networking existing collection databases and botanical networks, for example, in September 2004 the German Federal Agency for Nature Conservation connected 2,7 million plant observation records to the GBIF Network. Three of the zoological nodes (Vertebrata, Evertebrata I and

II) are using the *SysTax* system as a common data warehouse and GBIF data node. Input is either by repeated imports, or by *SysTax*'s remote editing features. *SysTax* is based on an Oracle database and now holds 257,000 records that are accessible through GBIF. The Evertebrata II node captured 32,500 records of primary types, about 20-30% more records than expected for the groups tackled. 11,000-12,000 records have been collected by the GBIF-D Vertebrates node and had been transferred to *SysTax* in October 2004. The node Evertebrata III uses the collection management system *SeSam*, with an SQL-server database centrally installed at the Senckenberg Institute in Frankfurt, which can be accessed by external partners through a VPN-based Web-interface. The *SeSam* Server holds more than 25,000 records that will be accessible through the GBIF Portal by the end of 2004.

Tab. 1: GBIF-D - the German system of GBIF nodes

Node	Prokaryotes & Viruses	Mycology	Botany	Evertebrata I	Evertebrata II	Evertebrata III	Vertebrata
sub-projects	5	11	10	10	7	11	5
involved institutes	6	9	11	9	5	7	11
taxonomic groups	prokaryotes viruses cyanobacteria	fungi incl. lichens	vascular plants mosses, algae protista	insecta	mollusca chelicerata myriapoda	marine in-vertebrates cnidaria, crustacea i.e.	fishes amphibians reptiles, birds mammals
co-ordinating institution	DSMZ Deutsche Sammlung von Mikroorganismen u. Zellkulturen GmbH, Braunschweig	BSM Botanische Staatssammlung München	BGBM Botanischer Garten und Botanisches Museum Berlin-Dahlem, FU Berlin	SMNS Staatliches Museum für Naturkunde Stuttgart	ZSM Zoologische Staatssammlung München	FIS Forschungsinstitut Senckenberg Frankfurt a.M.	ZFMK Zoologisches Forschungsinstitut Museum A. Koenig, Bonn
co-ordinator	Erko Stackebrandt	Dagmar Triebel	Walter Berendsohn	Christoph Häuser	Gerhard Haszprunar	Michael Türkay	Renate van den Elzen
contact	erko@dsMZ.de	triebel@bsm.mwn.de	r.jahn@bgbm.org	holstein.smns@naturkundemuseum-bw.de	haszi@zsm.mwn.de	michael.tuerkay@senckenberg.de	r.elzen.zfmk@uni-bonn.de
over-all co-ordination	Speaker of the Co-ordinators Group: Walter Berendsohn, w.berendsohn@bgbm.org Speaker of the IT Committee: Joachim Holstein, holstein.smns@naturkundemuseum-bw.de Co-ordinator of the Informatics Experts Group: Gerhard Rambold, gerhard.rambold@uni-bayreuth.de						

The challenge

By providing an effective access system, GBIF opens new possibilities for the utilisation of existing and new research data. The globally co-ordinated approach provides the organisational and technical framework for a rapid expansion of the network. The broadening pool of data and its universal availability will provide a reliable base for scientists, decision makers, educators and the general public. A rapid expansion of the data network forms the essential base for GBIF's big challenge: turning data into information.

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- [1] The Library, American Museum of Natural History (2003): A Preliminary Worldwide Survey of Systematics Collections Holdings conducted for The Global Biodiversity Information Facility (GBIF).
<http://circa.gbif.net/Public/irc/gbif/digit/library>

Co-ordinating GBIF-Germany (GBIF-D)

Umbrella project: GBIF-D Co-ordination of the German contribution to the Global Biodiversity Information Facility

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Key words: GBIF-D, GBIF-Germany, GBIF national node, interoperability, biodiversity

Abstract

An over-all co-ordination structure has been established in order to ensure communication, interoperability and technology transfer within GBIF-Germany (GBIF-D) as well as between GBIF-International or other organisations and GBIF-D. Tasks include organisational ones such as those associated with workshops and meetings, with preparing, post processing and documenting status seminars and symposia, and with public relation work, including the maintenance of the GBIF-D website. Technology transfer, technical co-ordination, the installation of wrappers on German data providers not included in financed projects, and stimulating data capture are other tasks tackled; some of them in sub-projects bundled with the co-ordination project.

Results

In 2001, Germany has established seven nodes under GBIF-D to fulfil the commitments of the signed Memorandum of Understanding. Each node focuses on a defined part of the taxonomic spectrum and organises the mobilisation of primary biodiversity data in that realm. The co-ordination of GBIF-D is carried out by a committee of Node project co-ordinators providing the overall direction and co-ordination. This committee is supported by a working group of Node delegates and an ad-hoc group of IT specialists (see Rambold & Kehl, this volume). The speakers of these committees are assisted by the overall co-ordination structure organised as an auxiliary project to ensure the exchange of experiences, communication, interoperability and technical harmonisation within the German system, with other Participant Nodes, the GBIF-Secretariat and further international organisations. The co-ordination structure has been set up in the Botanic Garden and Botanical Museum Berlin-Dahlem (BGBM) and focuses on seven basic aspects:

The GBIF-D website: In accordance with the guidelines of GBIF international a World Wide Web portal for the German node system has been established at the BGBM under the domain www.gbif.de. The system's server is currently using the ZOPE public domain software and it provides a common access point to the web domains of the individual nodes within the system. Although organised at 5 separate sites, a uniform user interface and design is maintained. The co-ordination project sustains and continually updates the gbif.de site. The project is also in charge of implementing and integrating tools provided by GBIF-International.

Status seminars and symposia: The co-ordination project supported the Project management organisation (PT-DLR) in the presentation of the funding programmes GBIF-D and BIOLOG-Biodiversity Informatics during the International Symposium „Sustainable Use and Conservation of Biological Diversity“ in Berlin, (1.–4. Dec. 2003), especially with respect of the collection and editing of project summaries and over-all representation of the programmes. The same role is performed for the “Status Seminar” in Bonn (6.–7. Dec. 2004), with additional organisational and documentation tasks such as scheduling lectures, compiling list of posters, etc.

Representation of GBIF-D in GBIF Committees: The project represents GBIF-D in the NODES committee of GBIF-International, normally with two sessions per year. The BGBM's staff also participates actively in the formulation and implementation of the GBIF Work Programme through its

memberships in and contribution to science subcommittees (membership in the science subcommittee for Data Access and Data Interoperability, subcommittee for Digitisation of Natural History Collection Data, and GBIF subcommittee for the Electronic Catalogue of Names of Known Organisms).

Public relation tasks: GBIF is increasingly becoming known as an international scientific endeavour with strong German participation. The co-ordination project answers inquiries of journalists as well as individual scientists, societies and organisations. Press releases have been issued. Presentations of the aims and achievements of the German GBIF system through posters and presentations for various audiences during congresses and meetings are continuous activities.

Supporting the speakers of committees: The node co-ordinators meet twice a year and discuss general progress, prospects and further objectives of GBIF-D, and the Node working group has also met twice already. The co-ordination project supports the scheduling and post processing of meetings (organisation, agenda, minutes). Additional information and news provided by GBIF-International are forwarded to the speakers.

Systematics research metadata: The directory of German research collections prepared within the BIOLOG-ZEFOD project will be carried on and extended by a sub-project focussing on the preparation of a comprehensive information system for biodiversity research.

Technical support: The co-ordination project has now started to provide technical support for German data providers who want to install a wrapper to become connected to the GBIF network. To support that task, GBIF techniques developed in EU projects will be evaluated and further improved.

A sub-project (organisationally associated with the Botanical Node) has successfully tackled data capture in collections. It has adapted a freely available software (*Specify*) developed in the USA for use in German collections (see Sobek, this volume).

To further widen the applicability of the networking techniques developed for GBIF, a sub-project develops security services that can be added to the data provision software (see Tolksdorf & al., this volume).

In 2005, a sub-project will commence work on geographical components of the German GBIF network.

Conclusion

The co-ordination structure set up for GBIF-D has maintained the special character of the German GBIF system as a network of partners representing major parts of the German community of data providers (and potential data providers). The co-ordination project has at the same time supported developments towards coherence within the system, needed to avoid duplication of efforts. Apart from the organisational and administrative role, its main task is to encourage further mobilisation of data resources in Germany and thus to enhance the network building of GBIF-D.

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Sub-project duration: Sept. 2003 – Dec. 2006, lead: W. G. Berendsohn, w.berendsohn@bgbm.org

Supported by the GBIF programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0301, Sept. 2003 – Dec. 2006, lead: Walter G. Berendsohn.

The techniques used in this project were to a large extent developed by the BioCASE project (A biological collection information service for Europe), which is funded by the European Commission under the fifth Framework Programme.

Co-ordination of the IT-Expert Group for GBIF-Germany

Umbrella project: GBIF-D Co-ordination of the German contribution to the Global Biodiversity Information Facility

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Keywords: GBIF-D, GBIF-Germany, biodiversity informatics, documentation, workshops, co-ordination of activities

Abstract

Activities in the co-ordination of the IT-Expert Group in 2004 included the establishment of a website providing information on biodiversity informatics projects and IT-resources in Germany and the organisation and holding of two thematic workshops focussing on collection databases and data flow scenarios.

Objectives

The IT-Expert Group (ITFG) is part of the co-ordination structure of GBIF-Germany. Its major task is to collect and provide technical information of existing software developments and/or database developments, as well as to support programmers and co-ordinate the information flow between software developers active in the area of biodiversity informatics. The following activities are included:

- 1) Documentation of the technical details of the information structure of all biodiversity informatics projects in Germany.
- 2) Organisation of thematic workshops on various topics, e.g.: collection databases and taxonomic name databases (data models, interfaces); databases with other contents (data models, interfaces); data exchange formats: existing imports/export formats; international standards; web services (wrappers, RPCs); analysis of existing services, requirement analysis; different operating systems: specific problems of interoperability; GBIF-D and GBIF-International: integration, interoperability; data transfer security concepts: existing solutions, requirement analyses; presentation of technologies applied in the different projects; identification of overlapping activities; support of joint development of platform-independent usable tools (e.g. Java classes for data transformation) as well as web interfaces.
- 3) Provision of Programme source code released by project owners in a CVS.
- 4) Documentation of ITFG activities and results as a base for the conceptual work by the IT commission and the group of the node co-ordinators.

Results

The project staff started work in January 2004 and the establishment of a website with pages dedicated to the IT-Expert Group was initiated immediately [1]. The pages provide information about results from workshops organised by the ITFG and gives access to a meta-database with technical information on ongoing biodiversity IT projects in Germany within and outside the GBIF context.

For providing continuously updated information, several web forms were created, enabling data entry by programmers and IT-staff of the various institutions [2]. The database content is accessible via a password-protected web page [3]. Up to now, detailed information on 45 projects from 16 institutions were recorded. However, a reliable estimate of the total number of existing ongoing and finalised biodiversity IT projects in Germany is not yet possible. A preliminary analysis of the data will be made available on the home page shortly after the GBIF-D status seminar in Bonn, December 2004.

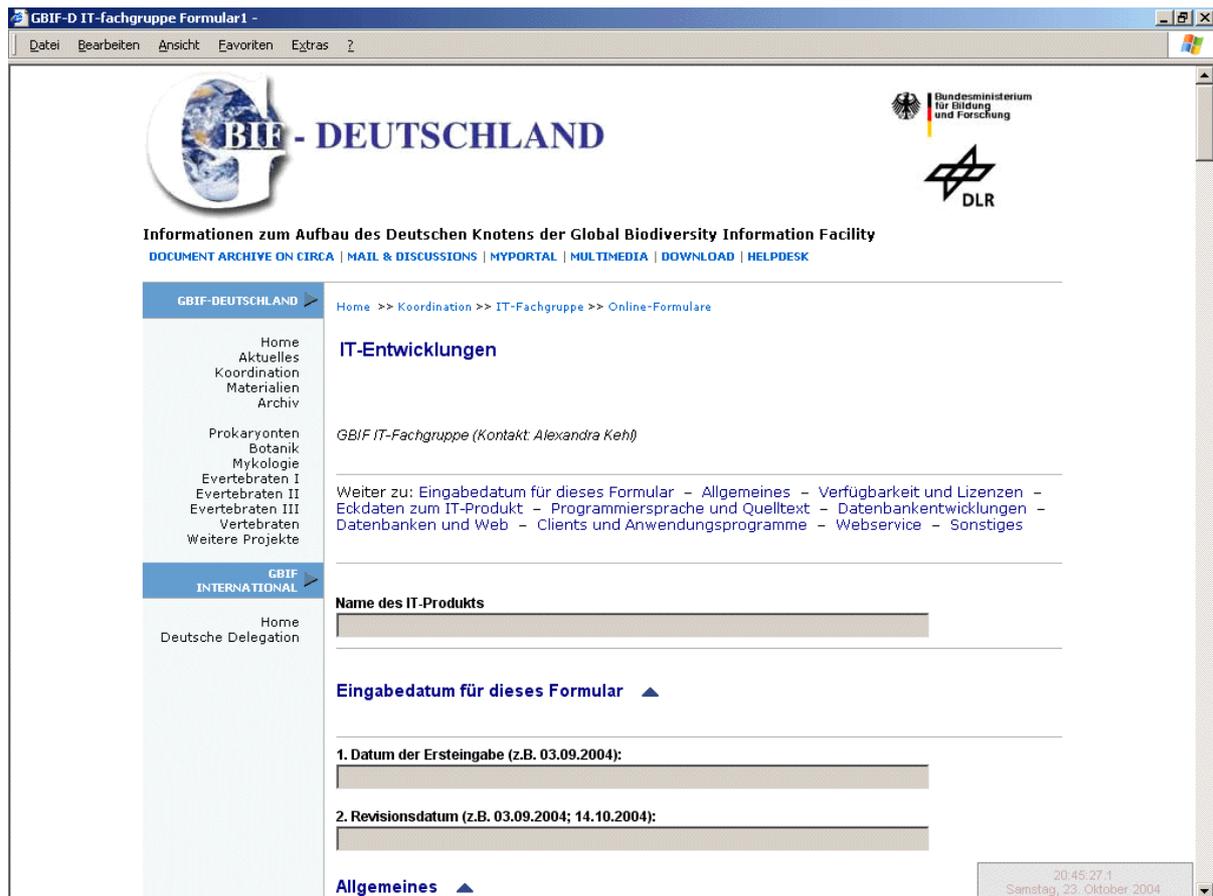


Fig. 1: Website of the IT-Expert Group

A version control system (CVS) for the administration source code of GBIF-D software projects has been installed in co-operation with the GBIF-D Mycology node at the Botanische Staatssammlung München. Installation of a content management system and a mailing list for biodiversity informatics programmers has been delayed until 2005.

The preparation, organisation and documentation of workshops (2–3 per year) for website administrators, software developers, and programmers is a major task in the co-ordination project. In April 23–24th, 2004, a first workshop dedicated to collection database systems (“Sammlungsdatenbanksysteme”) was held at the Botanische Staatssammlung München. Results are summarised in a protocol accessible via the ITFG homepage [4]. A second workshop dedicated to data transfer and future data flow scenarios (“Spezifikationen zum Datentransfer und zukünftige Datenfluss-Szenarien”) took place at October 28–29th, 2004 at the Botanical Garden Berlin. A third workshop focussing on “Combining geo-referenced collection and descriptive data with DNA sequence data” will be held by the end of this year in München, to be announced in November on the ITFG homepage.

References

- [1] http://132.180.63.25/GBIF-ITFG/ITFG_welcome.html
- [2] <http://132.180.63.25/GBIF-ITFG/Fragebogen.html>
- [3] http://132.180.63.25/GBIF-ITFG/Zugang_zu_Formularen/Pwd_seite_03.html
- [4] <http://132.180.63.25/GBIF-ITFG/Workshops.html>

Sub-project duration: Jan. 2004 – Dec. 2006, lead: G. Rambold, gerhard.rambold@uni-bayreuth.de

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XML security services for GBIF-Germany

Umbrella project: GBIF-D Co-ordination of the German contribution to the Global Biodiversity Information Facility

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Keywords: GBIF-D, GBIF-Germany, XML Security, encryption, digital signature, access control, rights management, BioCAsE

Abstract

We are working on the integration of XML based security services into the German biodiversity network GBIF-D. This summary reports on the analysis of user requirements and our concept regarding the establishment of secure communications within GBIF.

Objectives

This project aims to extend the German biodiversity network GBIF-D through XML Security services, ensuring confidentiality, integrity, authenticity and non-repudiation of data and message communication. Second goal is to enhance the GBIF/BioCAsE infrastructure enabling it to define and enforce differentiated access policies for data providers and clients through rights management and access control.

Results

In this summary we report on the requirement analysis regarding the integration of security services in the German network for biodiversity GBIF-D. Our project started in February 2004. In accordance with the project schedule we are finishing at the moment the conceptual phase of the first work package regarding data and message communication security. In the following we summarise our work on user requirement, analyse the results and introduce our concept for the development and integration of XML based security services into the GBIF network.

A requirement analysis was performed to get information concerning the needs and constraints of the biodiversity network system. It was based on a questionnaire given to prospective users. The usage of a questionnaire for analysis has multiple advantages for the purpose of analysis: it saves resources, reaches all project partners, integrates them into the discussion and thus establishes a lasting dialog for the whole development process. In particular the last aspect is of considerable importance for the further development process of security services.

Within the “Framework for European Services in Telemedicine” (FEST) [1] a question set was designed. This set broadly covered all relevant aspects regarding the integration of new components into existing environments in the telemedicine domain. The same question set was taken as a basis for our questionnaire. The questions were adapted to the biodiversity domain and security issues and discussed with a small group of experts and test users from the biodiversity domain. The final version of the questionnaire was then sent by email to 93 partners within the projects GBIF-D, BioCAsE and SYNTHESYS.

The response to the questionnaire reveal very different levels of IT-knowledge and technical equipment on the part of data providers. This observation results in the decision to provide easy to use administration tools for the purpose of configuring and maintaining the security features. The security components will be set up as a part of the BioCAsE software installation process. Further the response

established a lack of additional financial resources for the development of security services. This means that the application of license free and, even better, open source software components is mandatory to save costs and allow future adaptation of software components.

The user requirement analysis shows that data providers are currently supplying only public data to the biodiversity network. The reason lies in the insecure data and message exchange via Internet. In order to make all biodiversity data available to the GBIF network by data providers the main security requirements – data integrity, confidentiality of sensitive data and authenticity of data sources must be guaranteed.

The security components have to be integrated in a pre-existing software architecture developed in the EU-financed BioCASE project (Biological Collection Access Service [for Europe]). Technically the biodiversity data are stored in heterogeneous distributed databases. They are integrated by a wrapper component and the XML based BioCASE protocol. Due to the XML based request/response protocol and data exchange schema we decided to use XML standards to provide security for the communication and development of rights management and access control components. Other important advantages of XML based technologies are high interoperability and platform independence. The following XML security standards have to be considered. The World Wide Web Consortium (W3C) has defined *XML Signature* [2] and *XML Encryption* [3] to provide Digital Signature and encryption within the XML context. The main advantage of these standards is the possibility to sign and respectively encrypt selective parts of the XML document. For example you can encrypt just the sensitive elements or their contents or sign just your part of the document. The *XML Key Management Specification XKMS* [4] defines protocols for public key management services and helps sharing public keys needed for signature verification or decryption of messages.

Our concept for the development of security services will provide integrity of the transmitted data, authenticity of information sources and non-repudiation of messages based on the XML Signature standard. The usage of Digital Signature assures the authenticity of the sender and the integrity of the received information, which is important for trust in the submitted data and image of the data providers. The questionnaire has shown that only a small part of the biodiversity data has to be treated confidential. Thus we decided to provide partial confidentiality for sensitive data according to the XML Encryption standard. It ensures that sensitive information, e.g. locations of protected species, is treated confidentially and is readable only by the intended recipients. For the generation and distribution of public keys needed for the encryption/decryption and signing/verifying operations we intend to use the XKMS standard. In the following step these concepts will be realised using open source Java libraries providing implementations of the security related XML standards. The next phases of our project concern the development of access control and rights management components and their integration into the GBIF network.

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Sub-project duration: Jan. 2004 – Dec. 2006, lead: R. Tolksdorf, tolk@inf.fu-berlin.de

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Specify software implementation for biological collection management and biodiversity information access

Umbrella project: GBIF-D Co-ordination of the German contribution to the Global Biodiversity Information Facility

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Key words: *Specify*, collection management software, biological collections, biodiversity information access, SQL sever database

Abstract

The collection management software *Specify* was implemented and evaluated in several natural history collections in Germany. A German user interface and supporting documentation was compiled and is available free of charge for interested institutions. *Specify* enables collection holders to record and use their data in a fast and efficient way. A BioCASE Wrapper for *Specify* allows institutions to incorporate their holdings into the GBIF network while maintaining full control over their data.

Objectives

To achieve sustainable data provision from natural history collections, the collection holders themselves must be capable of recording, maintaining and providing their data in a way usable for a network system. Using a pre-developed software package like *Specify* ensures high compatibility of the data sources and thus contributes to international interoperability of biological collection data. The project supported the setting up and testing of this system in several collections of different type, provided specialised German user interfaces, translated the documentation, and offers German help-desk functions. The developers at the University of Kansas were assisted in tasks like over-all standardisation of data items, internationalisation, and adaptation of the Programme to complex information structures. As shown by user reports published on the GBIF-D website, the Programme greatly facilitates input and management of natural history collection data and thus contributes to the creation of technical structures allowing sustainable biodiversity information access.

Results

Specify proved to be a flexible database solution for biological collection digitisation and management. The software was developed and tested for more than 15 years at the University of Kansas, USA. It is highly configurable with a wide range of options serving different types of natural history collections. Options include not only basic database tasks like data storage and queries, but also individual form customisation, loan administration and the printing of customised labels and reports. *Specify* is provided free of charge for download via the World Wide Web.

Specify is currently in use in more than 100 biological collections worldwide. The present project was to facilitate the implementation of the software in Germany by means of adaptation and user assistance. Initial tasks included testing *Specify* in the German software environment and bug fixing in close co-operation with the *Specify* Software Project in Kansas. A German user interface was compiled, supporting documentation includes a translated version of the original user manual and new tutorials with special consideration of the conditions in German collections. *Specify* was evaluated in

six German institutions and is currently operating in 9 different subcollections providing data to GBIF (Tab.1).

Tab. 1: Specify users in Germany (data records: November 2004)

Institution	Collection	Records Total	Records Imported	Records Entered
University of Hamburg/Senckenberg Natural History Museum Frankfurt	micro algae	4,600	-	4,600
Alfred Wegener Institute for Polar and Marine Research, Bremerhaven	macro algae	4,000	-	4,000
Botanic Garden and Botanical Museum Berlin-Dahlem (BGBM)	mosses, ferns	4,200	-	4,200
Federal Natural History Museum Stuttgart	seed plants	27,000	19,000	8,000
Zoological State Collection, Munich	insects, invertebrates	12,000	n.a.	n.a.
University of Hamburg, Zoological Museum	mammals, molluscs	24,000	3,500	20,500

The German helpdesk supported participating institutions with regard to form customisation, training of personnel and label/report design. In close collaboration with the partners, user-friendly database interfaces serving different collection types were created. *Specify* proved to allow structured data entry for modern specimens as well as for complex historical material, which often bears several determinations and type designations [1, 2]. The average time to digitise a herbarium sheet with *Specify* is four to five minutes (without imaging), but strongly depends on the extent and structure of label information and on quality checks conducted during input.

Specify enables collection holders to efficiently record and maintain their data. Moreover, it also serves as a platform to make use of this data by providing access to international networks. A BioCAsE (Biological Collection Access Service) wrapper was configured for *Specify*, which allows collection holders to participate in online networks, while maintaining full control over their data. Data portals providing access to the data currently include the GBIF Secretariat's in Copenhagen, the German virtual Herbarium, and the BioCAsE portal for European collection data.

In October 2004, a "hands-on"-workshop was arranged offering information and advice to further interested institutions throughout Germany. The reports of the test phases at several institutes are available on-line [3]. Further workshops will be organised in 2005. All documentation, tutorials, and current versions of database interfaces in German language are available free of charge on the World Wide Web [4].

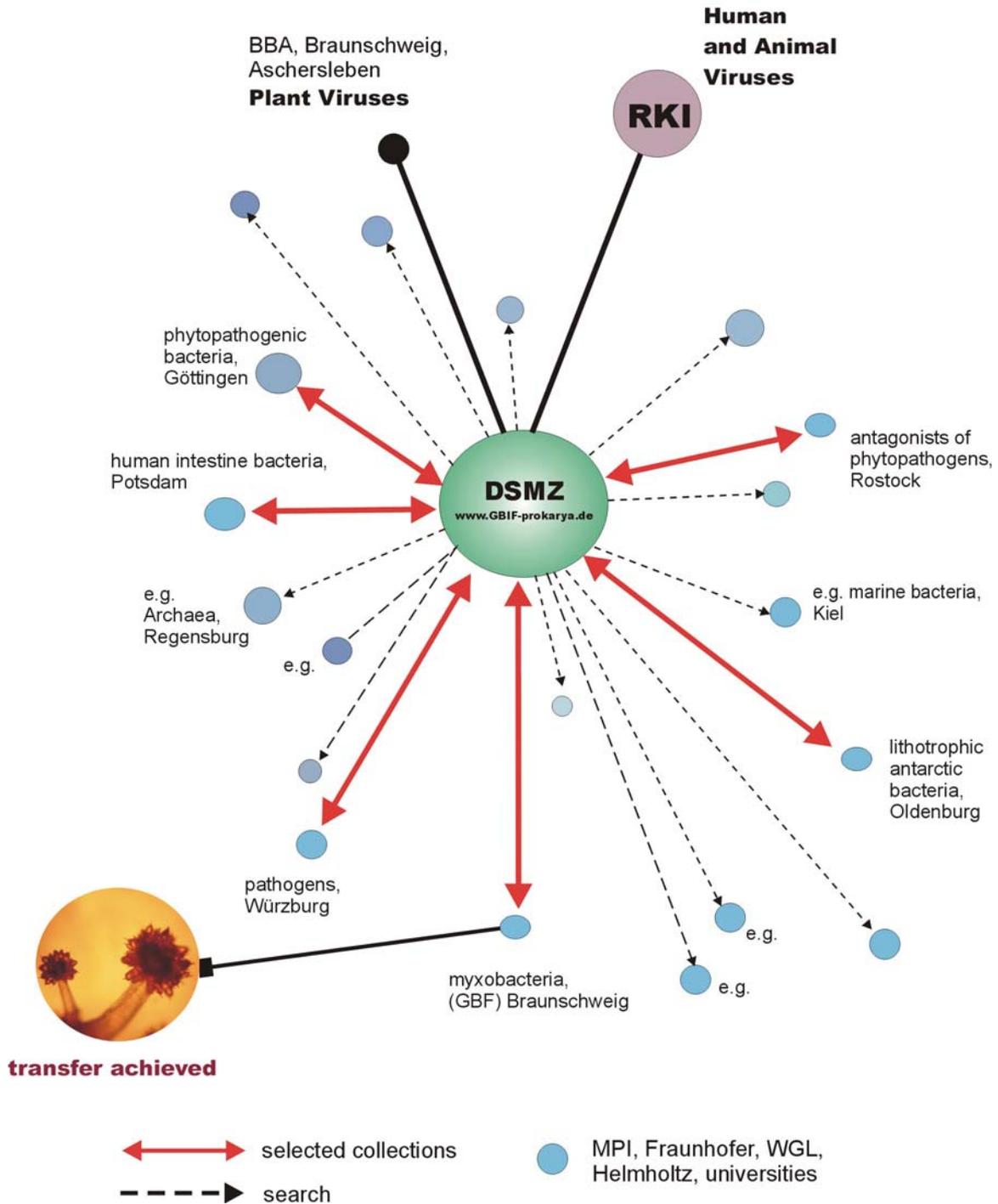
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Sub-project duration: Jan. 2003 – Jan. 2005, lead: W. Berendsohn, contact: w.berendsohn@bgbm.org

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GBIF-D Prokaryotes and Viruses



GBIF Node for Prokaryotes and Viruses

GBIF-Germany: Prokaryotes and Viruses

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Keywords: GBIF-D, GBIF-Germany, Prokarya , Virus, Access databases, MySQL Server

Abstract

Using the CABRI minimal dataset a total of 13,000 strains have been made available to GBIF International. In addition, information on several thousand strains from specialised collections (Rostock, Würzburg, Göttingen) has been transferred to Access databases to a varying degree of completeness. The DSMZ-own database is in the process of being transformed from static to dynamic web pages by transferring the data from DataPerfect to Access, which will run on a MySQL server. Specialised DSMZ databases, such as those for Actinomycetes, Plant Viruses and Plant Cell Cultures are now available on Access. The Plant cell Culture database has been linked to the Botanical node of GBIF-D.

Objectives

Information on strains of prokarya, available in the DSMZ and scattered in various German academic institutes in varying completeness, quality and availability will be assessed and harmonised under the same quality standard. These data will be made available through a common gateway, the DSMZ portal. The biological material will remain at the decentralised locations. It is the goal to provide potential users with a broader spectrum of resources than available at the national collection, and to train taxonomist by raising their awareness about the importance of databases and strain-related information. In a first workshop the range of biological material was assessed and specific collection selected in a second workshop. A third workshop will be organised in 2005 to discuss strength and weakness of the strategy applied.

Background

One of the fundamental differences between the Prokaryotes & Virus node and the other nodes in the German node structure is laid down in its role as a provider of resources. Culture collections of microorganisms conserve the microbiological heritage and provide a genetically stable world resource to scientists in the public, industrial and academic environment. The tasks of collections of biological resources concentrate not only on the preservation and maintenance **but also on the distribution** of microorganisms, viruses and cell cultures as well as their genomic material to academia and chemical and pharmaceutical industry, serving a broad range of clients in various disciplines. Recent political issues place an increasing importance on quality management which will transform traditional collections into "Biological Resource Centres", necessary to match the demands of research, industry and services for authenticated material; associated topics are the needs for accredited quality standards, reduction of redundancy, linkage of material and information and on the development of harmonised guidelines for import, export and shipping of biological material. This OECD initiative runs in parallel with the GBIF initiative, though with a delay of several years. The OECD, and possible later UNESCO, will begin a pilot phase in which collections working under different quality management structures will harmonise their efforts towards a common quality standard. The DSMZ has received certification under ISO EN 9001-2000 in May 2004 which will also influence data processing and quality of data provided internally and externally. At the end of this development, it is envisaged to create a Global Biological Resource Centre with its own secretariat, which needs to be linked closely to the GBIF secretariat and its mandate.

Earlier than collections of botanical and zoological content, collections of microorganisms have provided information on species and strains to the public by means of electronic catalogues; for example, various West European collections have formed a network of catalogues and expertise [1, 2] that facilitates comparability and interoperability, thus providing an improved service to the end user. The CABRI guidelines are internationally widely accepted, serving collections well on their way to internationally accepted quality standards. The Global Biodiversity Information Facility (GBIF) now provides a framework of linking information of all biological material through a common gateway, the GBIF secretariat's portal, thus proving a virtual catalogue of biological material [3].

Results

Transfer of a BBA/DSMZ database for plant virus diagnosis from the F&A Management System to a Microsoft Access MDE-database (Dr. Dorothea Gleim and Dr. S. Winter in cooperation with Dr. Dietrich-Eckhardt Lesemann, Institute for Plant Virology, Microbiology and Biosafety, Federal Biological Research Centre for Agriculture and Forestry – BBA, Braunschweig).

The F&A-database established by Dr. D.-E. Lesemann and Prof. Günter Adam for BBA electron microscopy laboratory was imported to MS Access and connected with viruses and antisera of the existing MS Access Database. The Database now can be used also as a diagnostic database which can be searched by plant name (scientific or vernacular), plant genus and plant family. Pages that have been designed will provide information about the plant viruses which might infect the plant(s) of a selected taxon, the recommended antiserum for routine analysis and advice on diagnostic investigations. Nearly 400 plants, most of them of agricultural or horticultural importance, are searchable by more than 650 names.

Sammlung antagonistischer Bakterien gegen phytopathogene Pilze
 Universität Rostock, Fachbereich Biowissenschaften
 Institut für Molekulare Physiologie und Biotechnologie

Berichte

Antagonistische Bakterienstämme

- ▶ nach Spezies
[Gesamtbericht](#) [Teilbericht für ausgewählte Spezies](#)
- ▶ nach Krankheitserregern an Pflanzen
[Gesamtbericht](#) [Teilbericht für ausgewähltes Pathogen](#)
- ▶ nach Metaboliten
[Gesamtbericht](#) [Teilbericht für ausgewählten Metabolit](#)
- ▶ nach Enzymen
[Gesamtbericht](#) [Teilbericht für ausgewähltes Enzym](#)

Suchen

▶ [Spezies](#) ▶ [Stamm](#)

Neuanlage oder Korrektur von Datensätzen

- ▶ [Neue Spezies](#)
- ▶ [Neuer Stamm](#)
- ▶ [Neue Literaturangabe](#)
- ▶ [Neuer Autor](#)
- ▶ [Neue Substanz \(neuer Metabolit\)](#)
- ▶ [Neue Pflanze](#)
- ▶ [Neues Mikrohabitat](#)

[MS Access beenden](#) [Zu den Tabellen](#)

DSMZ - der Knoten Prokaryonten und Viren von GBIF-Deutschland

Fig. 1: Example of a webpage of one of the external DSMZ node partners, here University Rostock

Development of a MS Access MDE-database for bacteria that are antagonists to plant pathogens (Dr. Dorothea Gleim) in the framework of GBIF – Global Biodiversity Information Facility (Dr. Manfred Kracht, Andrejs Naumovs, Dr. Dagmar Fritze, Dr. Erko Stackebrandt)

Development of the database for the Institute for Molecular Physiology and Biotechnology of the University of Rostock, workgroup Gabriele Berg, has been nearly completed. It consists of 19 foreign-key connected tables and comprises 79 fields (keys and other administrative fields excluded). All data compiled by Dr. Berg and her co-workers within the framework of the GBIF Project have been imported into the database. By now, the database keeps information on more than 2,500 strains of bacteria; most of them show antagonistic activity against phytopathogenic fungi. Similarly the Access database of the Würzburg group has been nearly completed, consisting of about 1,000 strains. The database of plant pathogens, University of Göttingen, will contain about 3,000 strains.

New Structure and Website

In connection with new challenges by quality management and IT security, major changes in the DSMZ computer department have to be realised. The current heterogeneous structure (2 different network operating systems: Novell NetWare and Microsoft Windows NT, client operating systems: Microsoft Windows 95/98/Me/NT/2000/XP, Unix/Linux, and MacOS) has to be standardised as much as possible. One of the favourite options is a closer integration into the GBF network (network operating system: Windows 2003, client operating system: mainly Windows XP).

The DSMZ website will be managed by a CMS (Content Management System), i.e. a SQL database will be the tool to administrate the contents of the dsmz.de website [4]. The system has been established.

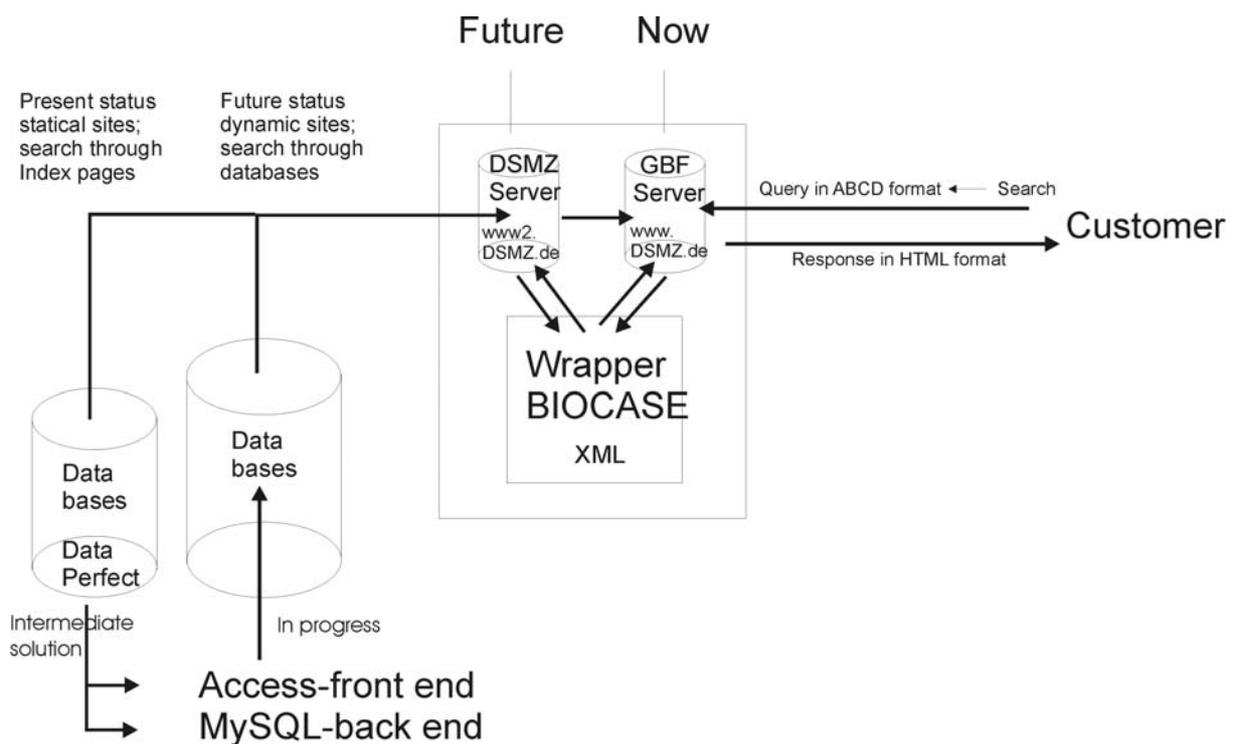


Fig. 2: Hard- and software development strategy of the DSMZ, to cope with user demands

Database of the DSMZ Collection of Microorganisms

Development of the database of the DSMZ Collection of Actinomycetales, which was already transferred to MS Access, was carried on. The database contains especially morphological, physiological and biochemical characteristics of strains and is used for identification purposes. Forms and reports for internal and external use were developed. Later on, the database will be connected to the main database of microorganisms (with Dr. Reiner M. Kroppenstedt)

Development of a MS Access MDE-database in the framework of GBIF

A MS Access database for the 'Institut für Molekulare Infektionsbiologie' at the University of Würzburg was developed. The data compiled by Dr. Ölschläger and his co-workers were restructured and imported into the database. At now, the database contains information about more than 1,000 strains. The database was presented to Dr. Ölschläger and his group and they were instructed to use it. Suggestions to improve the database are realised just now.

The GBIF Node was presented to the scientific community during several conferences, e.g. [5, 6, 7].

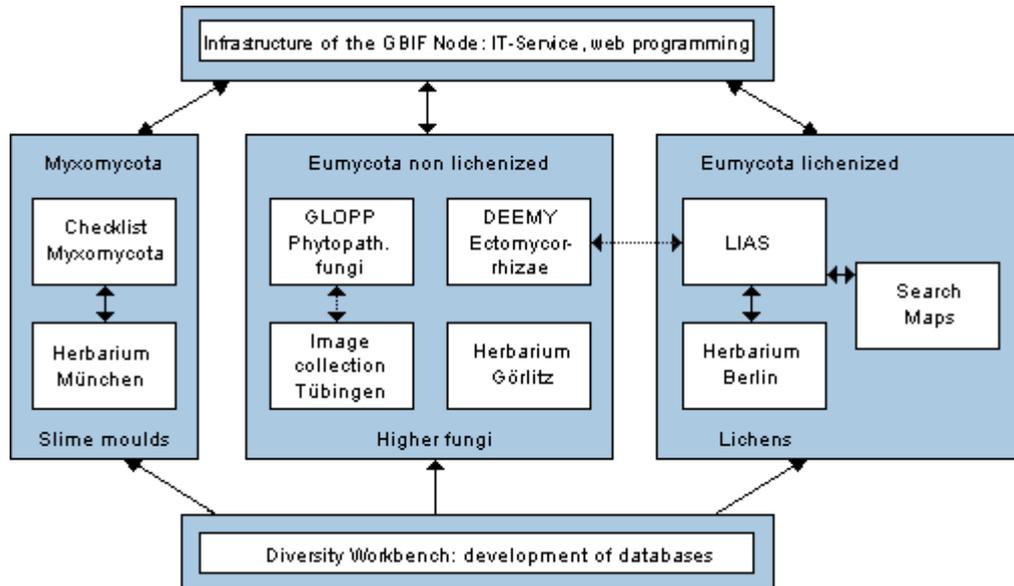
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GBIF-D Mycology

Fungi & Lichens



Structure of the Mycological Node project

Developing the infrastructure of the German GBIF Node for Mycology

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, data node, server network, web-programming, sustainable infrastructure

Abstract

The German GBIF Node for Mycology was installed as service centre for mycological and lichenological biodiversity data in Germany. Starting in October 2002, the node project administrates a server network, gives technical as well as scientific advice to the individual sub-projects, transferred data from proprietary databases into database components of the *Diversity Workbench*, developed special web interfaces with search function, and is building a sustainable infrastructure that guarantees long-term maintenance of the GBIF-D node.

Objectives

The GBIF-D Node for Mycology is providing online access to biodiversity data of fungi including the Myxomycetes and lichens. The actual activities focus on geo-referenced specimen data and structured descriptive data at species level. Furthermore, two lists of scientific names are technically improved and offered as joint efforts together with international projects: the Index of Myxomycete Names "NomenMyx" in collaboration with the National Herbarium Madrid and the "LIAS Lichen Names" in co-operation with Species 2000 europa. GBIF-D Mycology acts as combined participant and multiple data node within GBIF and will offer data to this international framework via the BioCASE-wrapper technology using the ABCD data definition. It supports German data providers with technical as well as scientific advice and builds up an infrastructure that gives supporting node institutions a perspective for long-term maintenance of the GBIF infrastructure. The shared access to locally independent databases with a common architecture (*Diversity Workbench* modules) and therewith the connection of dispersed database content with mycological data will be realised by JAVA client *DiversityNavigator*® extensions. Validation and analyses of data are planned in co-operation with the partner projects.

Results

The German mycological network started with 9 partner institutions and 11 sub-projects, 9 of which are collecting and providing biodiversity data. The general concept is to collect and present on-line a large amount of high quality data especially from ecologically and commercially important organisms. 5 projects focus on the optimisation and extension of already existing initiatives and information systems with data of high value for applied research (e.g. identification tools of DEEMY (www.deemy.de) and LIAS (www.lias.net)). 4 projects are housed at major herbaria and devoted to the databasing of specimen data (Berlin, Görlitz, München, Tübingen). The database structure is based on the *Diversity Workbench* database suite, being partly based on developments accomplished during the GLOPP project (BMBF BIOLOG Biodiversity Informatics programme). A special *Diversity Workbench* sub-project is devoted to the GBIF relevant design of database applications (see Fig. 1).

The GBIF-D Node for Mycology was set up on a centralised cluster of servers with combined Linux and Microsoft platforms. IT-structures for data storage, access, and database interoperability, a project management system for special organisational requirements of the node (*DiversityProjects*) and special web interfaces with search function were designed and built up. A tool for the content transfer from MS Access to corresponding PostgreSQL databases was developed making possible XML export and ODBC-directed transfer. The MS Access database application *DiversityDocumenter* was established to generate SQL listings for the rapid establishment of corresponding PostgreSQL database structures. For the development of web interfaces JSP and ColdFusion MX were used. To support the software developer of the umbrella project a CVS (Concurrent Versions System) was installed on a Linux server. Web services with tailored information were offered to GBIF International. The BioCAsE wrapper software was adopted and registered at the GBIF data portal. One *DiversityCollection* database has already been indexed by GBIF International and several others are going to be registered. As a result, about 32,000 data records will be searchable via GBIF International within the next few months. A bilingual Internet portal for user access and service information was established under www.gbif-mykologie.de and www.gbif-mycology.de. In co-operation with Mycology.Net (www.mycology.net), the GBIF-D Mycology portal now provides web pages with links to mycological biodiversity data located on German web servers and gives direct access to the Mycology.Net email directory.

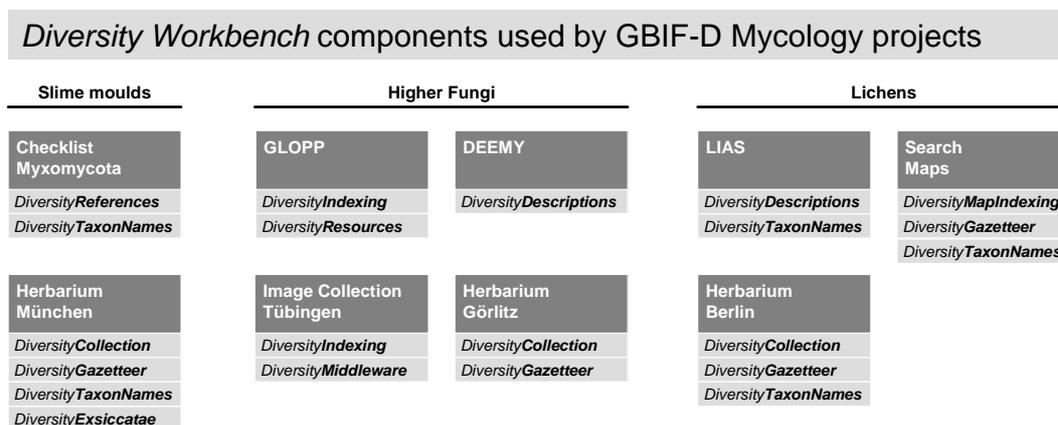


Fig. 1: Building the GBIF-D Node for Mycology using Diversity Workbench modules

In 2003 and 2004, several meetings with project partners from Bayreuth, Berlin, Greifswald, München and Tübingen were held to evaluate the compatibility of their databases and develop concepts to convert their data into the shared database structure (see Fig. 1). *DiversityCollection* 2.0 was presented on the Biodiversity Information Technologies Conference of the Taxonomic Databases Working Group in Christchurch, New Zealand. The data of several databases with relatively “flat” design were re-organised and converted into *Diversity Workbench* modules, e.g. the MS-DOS-based database of the myxomycete collection of M. Schnittler into *DiversityCollection* Ver. 1.0, the MS Access database “NomenMyx” into *DiversityNames_myxomycetes* and the MS Access database “Search Maps of Lichens” into *DiversityMapIndexing*. Ver. 1 of *DiversityCollection* was installed at the BGBM, Berlin with a pick list of lichen names. Web interfaces were developed or expanded for four sub-projects: LIAS, DEEMY, GLOPP-Doppelbaur and Index of Lichen Distribution Maps.

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References (including all publications referring to the umbrella project) see www.gbif-mycology.de/Publications.html.

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Design and optimisation of the node specific database infrastructure (*Diversity Workbench* components and compatible modules)

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, *Diversity Workbench* modules, databases, Internet presentation, middleware

Abstract

Several *Diversity Workbench* modules were upgraded and adapted to the demands of the GBIF-D Node for Mycology. The components were partly transferred on a server based database system. To enable the extension of the modular approach of the *Diversity Workbench* to Unix databases and to ensure the interoperability with other GBIF projects, a middleware is under development.

Objectives

Three workpackages are envisaged to optimise the existing components of the '*Diversity Workbench*', an integrated component framework for biodiversity information in mycology. The components will be adapted to the specific requests of the GBIF-D Node for Mycology and expanded with respect to the specific demands of the data collecting sub-projects. Most components will be ported to a server-based database system.

Results

Workpackage 1 (lead: G. Hagedorn, Berlin): The *Diversity Workbench* component *Diversity-Descriptions* was improved to fulfil special requests of the sub-projects DEEMY and LIAS [1]. To achieve better coexistence of *DiversityDescriptions* with external databases and web interfaces, additional immutable IDs were introduced for character headings, characters, character states and items (= taxa). It is now possible to define hierarchically organised headings in the form of tree structures. Further, new tables were added to enable concurrent multilingual usage. The table RSC (Resources) to link in images was extended and provides options to define multiple quality levels for images (icon, selector, definition). Various information models were published [2-5]. In collaboration with Workpackage 2, the *DiversityModelDocumenter* was enhanced. This is a database documentation tool for the representation of the data model in HTML ("data dictionary") and for the generation of SQL data definition language-commands for the creation of database structures on MS SQL Server and PostgreSQL from MS Access *Diversity Workbench* components. *DiversityResources* (image administration) and *DiversityUsers* (user administration) were ported to SQL-server. Problems resulting from the integration of an independent and portable user administration with an approved system for account administration could be solved. The establishment of web interfaces for remotely editing the data of both components was started.

Workpackage 2 (lead: G. Rambold, Bayreuth): Focus of workpackage 2 has been the further development of the *Diversity Workbench* component *DiversityCollection* and associated components as *DiversityExsiccatae* and *DiversityGazetteer* and the establishment of *DiversityProjects*, a component for the administration (workflow and database version management) of the *Diversity Workbench* projects. A number of bugs detected by beta-testers in the MS Access version of the

database *DiversityCollection* (ver. 1) were fixed and various new features implemented. For multi-user usage via Intranet, *DiversityCollection* was ported as ver. 2.x to MS SQL Server. The database model was extended with options for mapping collecting event hierarchies and – as an interim solution (until the completion of the module *DiversityCharacters*) – with options for the direct storage of analysis data. For version 2.x, a completely new client was written in C#, with a wide range of new features. For example, a routine for the recognition of bar codes will replace the obsolete Programme LabelScan (a module of *DiversityCollection* ver. 1.x), and version 2 features automatic generation of SQL query code, allowing complex filtering of database records by users without SQL-knowledge. *DiversityMapIndexing* was developed as an MS Access and PostgreSQL module in conformity to the *Diversity Workbench* for the demands of the sub-project “Search Maps”. For the storage of image data, the databases *DiversityImage* was reconstructed for later integration into *DiversityResources*. The database *DiversityNames_Lichens* was reconstructed on MS SQL Server and expanded with options for handling different taxonomic concepts. All available records of taxonomic names from LIAS main, LIAS light, and various checklists were transferred to that database. Similarly, the database *DiversityNames_Myxomycetes* was reconstructed on MS SQL server as a *Diversity Workbench* conformant database, further developed and filled with all taxonomic name records from “NomenMyx”. For the connection via BioCASE-wrapper to GBIF international, parts of the newly developed SQL-server databases, i.e. *DiversityNames_Lichens* and *DiversityMapIndexing*, were mirrored as PostgreSQL databases under Linux.

Workpackage 3 (lead: D. Begerow, Tübingen): Seminal co-ordination and preliminary work have been completed, and experience with the improved prototypes was gathered. The image database has been made available for internal testing through the middleware-framework. Experience from testing was used to gather clues for current and future work. A primary aspect has been the further refinement of the infrastructure and its readjustment with respect to the other sub-projects. Major efforts have been made to continue improving the middleware-components regarding performance, stability and especially scalability and extensibility; great portions of the code have been further parallelised. Mechanisms to allow for arbitrary computations and data processing have been introduced. Hooks to allow for fine-granular authorisation have also been added. Interaction with the system is possible at various levels, ranging from low-level interfaces (a proprietary TCP-based protocol), via HTML to SOAP. Access using .NET is currently undergoing evaluation, as the connection to the *Diversity Workbench* system is currently being developed. The fundamentals for a common user authentication system have been elaborated in co-operation with the other workpackages. A prototype is currently being tested.

Recent versions of data models, databases, and clients developed in the frame of these workpackages can be downloaded via anonymous FTP (<ftp://132.180.63.21/>).

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Sub-project duration: Jan. 2003 – Dec. 2005, lead: G. Rambold, gerhard.rambold@uni-bayreuth.de, G. Hagedorn, D. Begerow

Supported by the GBIF programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0202, Oct. 2002 – Dec. 2005, lead: D. Triebel, triebel@bsm.mwn.de.

Web-presentation of data on distribution and ecology of myxomycetes in Germany

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, Database-generated checklists, literature database, *DiversityReferences*, *DiversityIndexing*, *DiversityNames_Myxomycetes*

Abstract

The project will make published checklist data of myxomycetes in Germany available on the Internet. In addition, a database with keyworded references on approx. 3,500 published papers on taxonomy, distribution and ecology of myxomycetes will be presented. The databases will use the JAVA client *DiversityNavigator* and *Diversity Workbench* modules, namely *DiversityReferences*, *DiversityIndexing* and *DiversityNames_Myxomycetes*.

Objectives

As typical for many groups of cryptogams groups, information on taxonomy, distribution and ecology of myxomycetes (plasmodial slime moulds) is widely scattered in a plethora of small journals. It is thus mostly not accessible via established information systems like ISI Web of Science or ISI Current Contents. This project aims to compile a checklist of German myxomycetes (workpackage 1), and to make an already existing literature database of approx. 3,500 references available via the Internet (workpackage 2). The full reference of a paper together with a interface allowing also searches via species' names and keywords will be provided. For this purpose the database has to be optimised and transferred to *DiversityReferences*.

Workpackage 1: Annotated checklist of German Myxomycetes:

The annotated checklist published with the Red List of German vascular plants (Schnittler et al. 1996) was converted into a database to allow for publishing it as a searchable entity on the Internet. Within the next months, this database will be related to the NomenMyx taxonomic standard (Lado 2001). Further, the checklist will be updated with all records published since 1996, and all people working with myxomycetes in Germany will be asked for further contributions. The database will use the JAVA based graphic user interface *DiversityNavigator* with underlying PostgreSQL developed within the BIOTA S04 project, which at the moment works for the LIAS Checklists project (see www.checklists.lias.net).

Workpackage 2: Literature on myxomycete taxonomy and distribution:

The literature database has been converted to Reference Manager V10.0, now comprising about 3,700 entries. All entries have now keywords. As the next step, an annotated list of keywords has to be compiled, and the database will be published on the Internet.

The database-generated checklist and the literature database will be maintained and expanded by the author after the end of the project. Together with the collection information of another project under the same umbrella (see Triebel, Schnittler & Novozhilov, this volume), access to these digital resources will create a focal point for the widely scattered international community of specialists for myxomycetes and thus contribute to the information infrastructure needed for the implementation of the Global Biodiversity Information Facility.

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Sub-project duration: Jan. 2005– June 2005, lead: M. Schnittler, martin.schnittler@uni-greifswald.de

Supported by the GBIF Programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0202, Oct. 2002 – Dec. 2005, lead: D. Triebel, triebel@bsm.mwn.de.

Compiling a web-accessible database of the myxomycete herbarium of the Botanische Staatssammlung München, including the private collection of M. Schnittler

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, slime moulds, data capture, DiversityCollection, DiversityGazetteer, DiversityExsiccatae, DiversityNames_Myxomycetes

Abstract

The goal of this project is to make specimen data of myxomycetes (plasmodial slime moulds) accessible via the Internet. By uniting a collection of 2,500 specimens already existing at Munich with the collection of M. Schnittler (approx. 10,000 specimens), one of the largest myxomycete collections of Europe will be created, comprising records especially from Europe, Russia and Central Asia, and the Neotropics. The data being recorded within this project will on the one hand be used to compile the first world distribution maps of this group of organisms within a project funded by the US National Science Foundation. On the other hand, they represent the German contribution to a recently funded project within the GBIF – DIGIT Seed Money Programme.

Objectives

The main purpose is the compilation of a database for the myxomycete herbarium at the Botanische Staatssammlung München (2,500 specimens, among them many historic records; all material revised by Dr. H. Neubert, Bühl) and the accession of the private collection of M. Schnittler (approx. 10,000 specimens). All records of the joint collection will be referred to geographic co-ordinates; and all data will be made available via the Internet. The project is of dual scientific importance: First, it will provide biodiversity information about a group of organisms with a very poor taxonomic record. From the approx. 1,000 species described, almost a quarter is known from less than 10 localities worldwide, and many descriptions are based on a single record only. Second, the collection data will be a major contribution for two international projects: (i) the compilation of the first maps of global distribution for myxomycetes, a project being funded by the US National Science Foundation and (ii) “Linking local databases for collections of plasmodial slime moulds (Myxomycetes) to create a global web-based herbarium”, a project founded by the GBIF – DIGIT programme 2004.

Results

The project comprises two workpackages: The data capture of the myxomycete collection originally held in M (workpackage 1) and the physical and virtual accession of the private collection of M. Schnittler (workpackage 2).

Workpackage 1: By early October 2004, the bar coding of the regular collection of approx. 2,500 myxomycete specimens at the Botanische Staatssammlung München (M) and the scanning process for the labels using LabelScan was finished. Currently, data entry is effected using the database application *DiversityCollection* 1.0. Most of the locality data, habitat data, collector names and dates as documented on the labels were already transcribed and the exsiccatal series were linked with the ExsiccataeID of the IndExs database (online version see [1]; with underlying *Diversity Workbench* module *DiversityExsiccatae*). Currently the data are submitted to a quality check. Some figures describing the profile of this myxomycete collection are already available: the collection comprises 291 taxa of myxomycetes, mainly from Germany, Austria, the Czech Republic, Hungary and other central European countries. The number of accessioned specimens is 2,923 (that means 400 more than previously estimated); 628 specimens are belonging to exsiccatal series. The oldest specimen was collected in 1830 by H. Wilms, the majority in the period between 1850 and 1960. The collection includes material from 343 collectors.

Workpackage 2: The myxomycete collection of M. Schnittler (approx. 10,000 specimens) will be integrated in the herbarium M. In parallel, the data in the existing dBase database for that collection will be transferred to *DiversityCollection*. Work on the following tasks is in progress or already finished:

1. The dBase database has been converted to *DiversityCollection* 1.0. The current version includes 7,192 data records for specimens. A conversion Programme has been written, allowing the inclusion of further data from surveys still under work.
2. Some 3,260 specimens of the collection M. Schnittler were already accessioned in M (which means that these specimens are labelled, bar coded, and sorted according to taxonomic names) and integrated in the main collection, using a customised system of drawers that allows to see labels of all boxes in a drawer at once.
3. About 1,500 additional specimens have been determined and labelled at Greifswald over the past six months, these will be transferred to M by the end of 2004. These are collections from myxomycete surveys carried out in southern Russia (Volgograd region), Costa Rica and Ecuador. Currently, two more surveys from Mongolia and again Costa Rica with altogether 300 specimens, are being accessioned.

In a further step (for both workpackages), all data records will be linked with a NamesID offered by the nomenclator database "NomenMyx" compiled by C. Lado (Royal Botanical Garden Madrid). The NomenMyx database is currently being optimised as a *Diversity Workbench* module "*DiversityNames_Myxomycetes*" in co-operation with C. Lado. All data records will be linked with the GettyThesaurusID (by using *DiversityGazetteer*) of a geographic location, a precondition for compiling distribution maps for these organisms. The whole collection with about 12,500 specimens will be presented on-line as searchable database.

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[1] <http://141.84.65.132/BSM-Mycology/Exsiccatae/ExsiccataeFind.cfm>

Sub-project duration: Jan. 2004 – Dec. 2004, lead: D. Triebel, triebel@bsm.mwn.de, M. Schnittler, martin.schnittler@uni-greifswald.de

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Extension of the GLOPP information system through integration of the data collection of Hans & Hanna Doppelbaur

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, plant pathogens, fungi, host range, observations, collection, *DiversityIndexing*

Abstract

The data collection by Hans and Hanna Doppelbaur contains more than 21,000 observations about the occurrence of phytopathogenic fungi mainly in Southern Germany. The collection has the form of dual-use machine- and human-readable punch cards. About a fourth of these observations is documented by vouchers housed at the herbarium of the Botanische Staatssammlung München. All punch cards were digitised. The information was integrated into the main GLOPP database and is also separately searchable by a web interface titled "Phytopathogenic Fungi Observed by Hans and Hanna Doppelbaur". Integration into the GBIF network and thus data provision for the GBIF International data portal is planned for the near future.

Objectives

The aim of the project is the expansion of the "Global Information System for the Biodiversity of Plant Pathogenic Fungi" GLOPP [1] through integration of the data collection of Hans and Hanna Doppelbaur and the presentation of the data as an online database.

Results

The 3,153 dual-use machine- and human-readable punch cards of the data collection by Hans & Hanna Doppelbaur were digitised both as images (Fig. 1) and as a structured database. Most punch cards include multiple observations, resulting in a total of 21,348 observations.

The information comprises the period between 1950 and 1970. Nearly all observations (20,244 = 95%) are from Germany, with a main focus on Bavaria (15,692 = 74%). The observations include about 1,400 taxa of obligately phytopathogenic fungi. One of the strengths of the punch card collection is that many observations are vouchered by herbarium specimens (4,992 vouchers, 921 taxa). They are part of the herbarium H. & H. Doppelbaur, which is now housed at the Botanische Staatssammlung München. The data capture (*DiversityIndexing*, *DiversityResources*) and quality check was finished in December 2003. The data were integrated in the main GLOPP database [1]. In parallel, the "Phytopathogenic Fungi Observed by Hans and Hanna Doppelbaur" are accessible on-line [2]. Extant biographical data about Hans & Hanna Doppelbaur as scientists and collectors are also presented on the World Wide Web [3].

The data will be integrated into the GBIF network in the near future via the BioCASE wrapper installed at the Botanische Staatssammlung München using the ABCD data definition. It will thus soon become accessible through the GBIF International data portal.

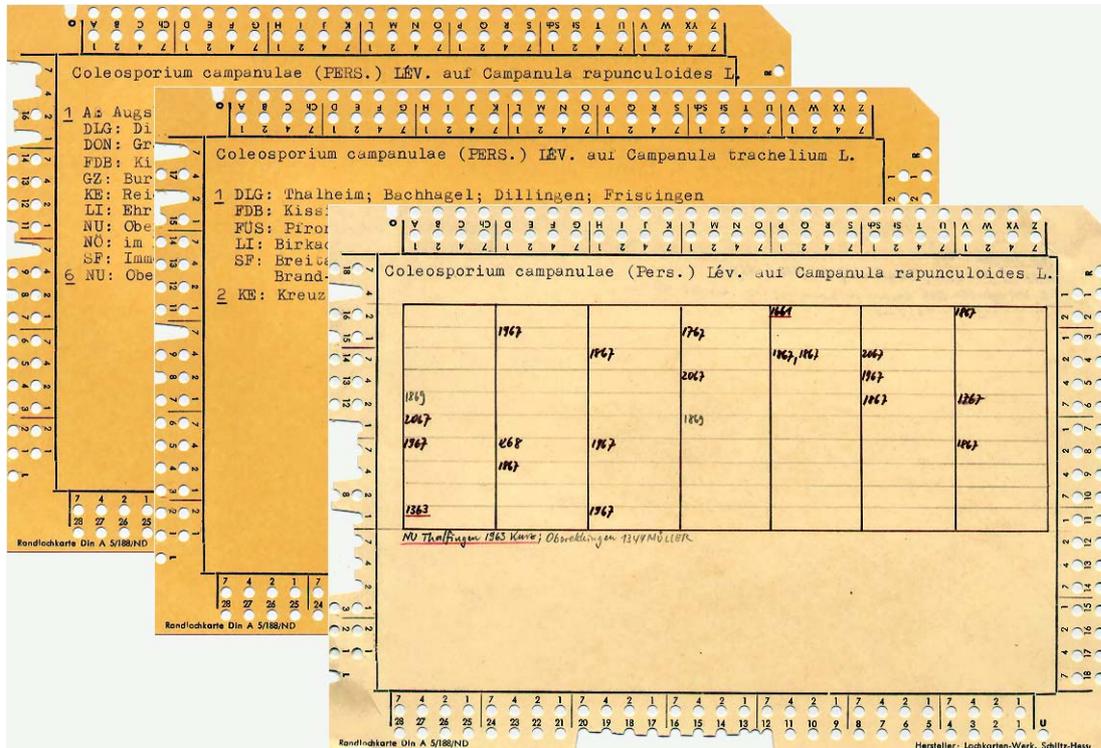


Fig. 1: Exemplary punch cards

References

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Sub-project duration: Apr. 2003 – Dec. 2003, lead: G. Hagedorn, G.Hagedorn@bba.de, G. Deml, D. Triebel

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Structural optimisation and web-connection of DEEMY, an information system for DEtermination and characterisation of EctoMYcorrhizae

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, mycorrhiza, anatomical and morphological data, Internet presentation, DiversityDescriptions

Abstract

DEEMY was initiated as a DELTA-based information system in 1996 [1]. It is a data collection, gathering descriptive data on ectomycorrhizae, including a glossary of definitions of external phenotypic characters that is illustrated with original line-drawings and photographs. It was initially published on CD-Rom and commercially distributed in 1998 [2] and is now available on-line [3]. All information can be queried using elaborate interactive identification tools. DEEMY has recently been considerably expanded, now comprising nearly 320 types of ectomycorrhizae characterised by 420 different characters and nearly 850 descriptive drawings and photographs. The aim of the project soon shifted towards the integration into a freely accessible web-based database using *Diversity Workbench* modules.

Objectives

Ectomycorrhizae show a wide anatomical and phenotypic diversity, possibly intricately involved with and adapted to the nutrition and ecology of their host trees. These descriptive data generally allow rapid identification and, at the same time, provide ecologically important information about assumed functions in facilitating nutrient-supply of the host trees. The main goal of DEEMY is to make this information freely accessible. The use of modern information technologies and an interactive user-interface with intuitive navigation tools provides users with easy access to this group of exciting organisms. Images and drawings are directly accessible on-line. They provide excellent tools to explain the terminology employed and thus considerably improve the user experience.

Results

As a first part of our project, a list of morphological, anatomical and ecological characters (=descriptors) in DEEMY has been reviewed and was expanded by approx. 60 new entries. The descriptive data were transferred from DELTA-standard encoding to the *Diversity Workbench* database module *DiversityDescriptions*. In accordance with descriptors used by LIAS, characters follow a strict naming convention of structure-property-state, first proposed by Diederich et al. [4]. In addition, characters were re-organised according to a hierarchical and logical order. Image data were edited, optimised for web-display, naming conventions were developed, and the data were indexed as part of the online database.

In co-operation with the web-programmer of the GBIF Node for Mycology and a graphic designer, the website www.deemy.de was developed. As part of the functional web-interface, the database tool *Navikey* allows rapid and efficient web-based identification of ectomycorrhizae. In addition, the database client *DiversityNavigator* will be used to edit the descriptive data and images in a convenient way. Thus, data can easily be modified, as soon as more detailed information becomes available as a

result of new research. In the future, descriptive data of additional taxa of ectomycorrhizae can rapidly be added to the system. New data, including new images, are easily entered using a structured, organised step by step approach.

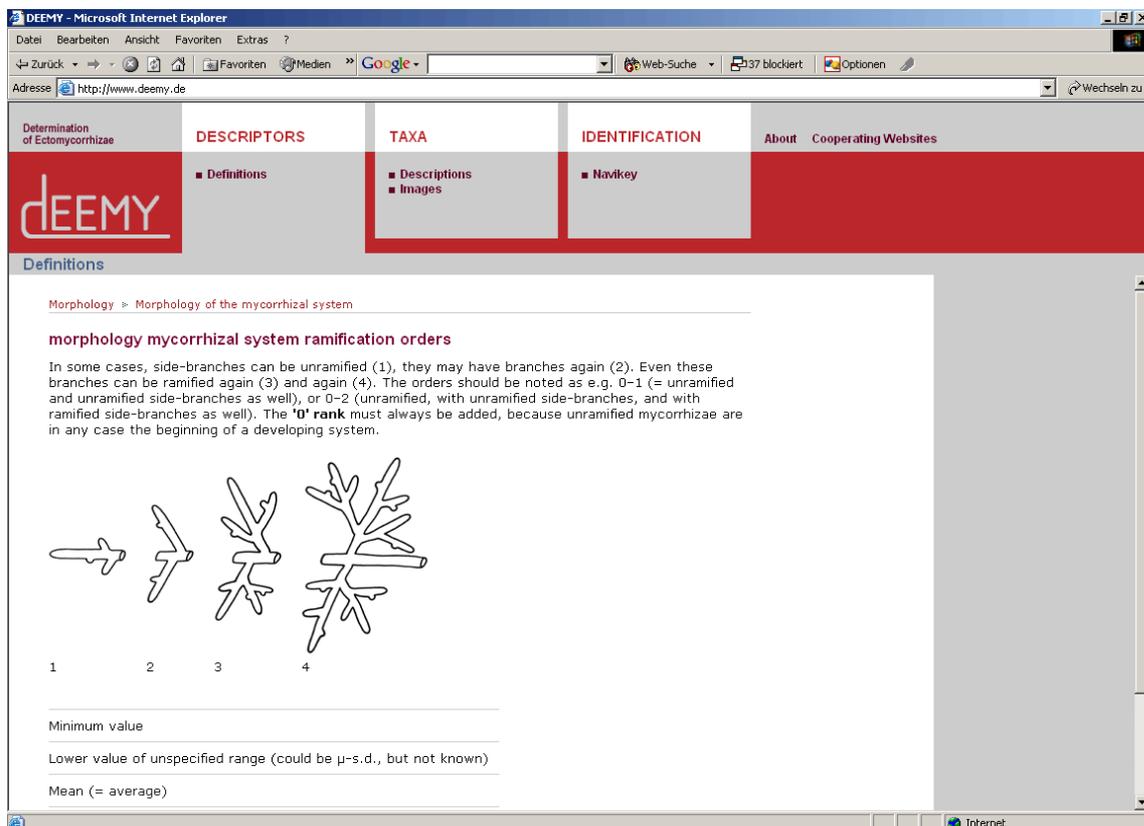


Fig. 1: Website of the DEEMY project

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A web-based database for fungal illustrations, kept at the University of Tübingen

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, hand drawings, TEM photographs, ultrastructure, basidiomycetes, *Diversity Workbench*

Abstract

After establishing the database framework we digitised illustrations from morphological and ultrastructural studies of fungi. The *Diversity Workbench* compatible PostgreSQL database comprises about 2,500 illustrations. The database is realised with a PHP front end and is linked to the German GBIF Mycology Node.

Objectives

A special collection of approx. 3,000 illustrations including TEM photographs from ultrastructural studies and high quality hand drawings from microscopic examinations are to be digitised, the data will be incorporated in a *Diversity Workbench* compatible database and presented on the Internet.

Results

Based on the “Digital Exsiccate of fungi” we developed a web-based database compatible with and connected to the *Diversity Workbench* modules. At the present stage we have included 1,800 drawings and 1,000 TEM photographs. The pictures are presented in various qualities including high resolution



Fig 1: Screenshots of the Fungal Illustration Database: a) The taxonomy browser gives an easy access to the illustrations; b) The illustrations are presented in different sizes with short figure captions; c) Input of data and digitised illustrations

for further scientific use. At the moment around 80% of the digitised pictures are already on-line [1]. The data are organised following the systematic of the fungalweb project (see Fig. 1a) and are kept in a PostgreSQL database. The web interface is realised in PHP (see Fig. 2). The staff involved in the

digitisation process provided massive input for further versions of the software tools. Major advances cover the input of serial pictures and illustrations linked to each other in some way. The input is realised in a password restricted area. The database is also used by colleagues for their collections. At the moment we are trying to obtain funding for the digitisation of the complete set of approx. 80,000 TEM photographs, to make them available to the scientific community. In Fig. 1 we present screenshots of various parts of the in- and output.

The pages are quite functional and not yet thoroughly designed for easy and convenient use, as this will be part of the *Diversity Workbench* project (Fig. 2). In workpackage 3 of the *Diversity Workbench* project (Rambold, Hagedorn & Begerow, this volume) we connect this database of fungal illustrations to *Diversity Workbench* modules. The main goal is the presentation of the illustrations together with morphological descriptions and reference data (see *Diversity Workbench* sub-project for details). The initial release will start with approx. 3,000 digitised illustrations.

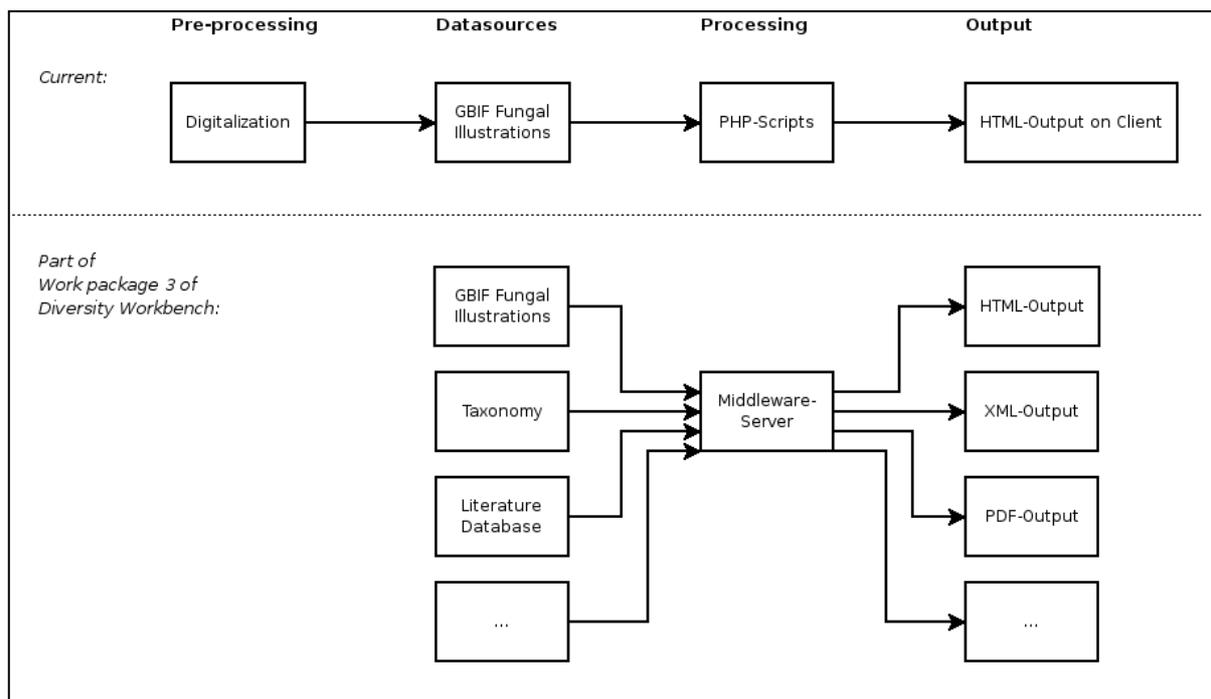


Fig. 2: Scheme showing the current workflow, which is realised for input and basic output. The lower part shows the combination with the database realised in workpackage 3 of the *Diversity Workbench* sub-project (Rambold, Hagedorn & Begerow, this volume).

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Complete electronic database coverage of the mycological collections in the herbarium Görlitz (GLM) and presentation of the data on the Internet

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, fungal diversity, collection database, *DiversityCollection*

Abstract

The mycological herbarium in Görlitz has at present approx. 55,000 vouchers representing nearly 4,400 taxa of Eumycota (excluding lichens) covered in a locally situated database. The collections are mainly of East German geographic origin, ranging from the 2nd half of the 20th century to present. These data are to be transferred to the *Diversity Workbench* module *DiversityCollection* and will be presented on-line within the next months.

Objectives

An important segment of the mycological herbarium in Görlitz' collections consists of poroid and corticioid wood-inhabiting fungi, which were the main focus of the collection from 1968 to 1995 [1, 2]. Within the last decade the taxonomical and geographical scope of the herbarium has been continually expanding. Currently, molecular studies in the basidiomycete genus *Hebeloma* (Fr.) P. Kumm. (Boyle et al., submitted) have led to intensive collection activities regarding this genus. Furthermore, considerable external collections have significantly augmented the scope of the Görlitz herbarium, most recently the geographically and taxonomically extensive collections of phytopathogenic fungi from Dr. H. Jage, Kemberg.

As use of herbarium material for classical, molecular and related studies is on the increase, there is a growing tendency worldwide for herbaria to present a catalogue of their collections on the Internet, rendering biological material more readily available for researchers of all relevant disciplines. This has the additional effect of providing an insight into currently existing voucher-documented biodiversity.

The objectives of this sub-project designed to implement the above are:

- a) to complete the digitisation of the collection data of the mycological herbarium at GLM,
- b) to augment the data by geo-referencing and
- c) to convert the data into *Diversity Workbench* database components for online presentation, also in the context of the Global Biodiversity Information Facility.

Results

Since the beginning of the sub-project in July 2003 the remaining approx. 6,000 collections that had not been digitised by that time were entered into the herbarium database (MSAccess 2000). As a result, the digitisation of the herbarium inventory is now complete, presently comprising over 55,000 data records.

In the course of data entry of the 6,000 older vouchers, they were geo-referenced as far as possible, depending upon the exactness of the data given on the labels. Additionally, in the course of the project approx. 16,000 voucher records were amended by geographic coordinates. Further collection records that were localised to a one-sixteenth subdivision grid of 1:25 000-scale ordnance maps (but without sufficient geographic details for determination of coordinates) were enhanced by the addition of coordinates delimiting the subdivision. For the determination of the geographical coordinates, digital maps of the “TOP-50” ordnance survey series were used on the geodetic basis Potsdam datum (Bessel ellipsoid). The geodetic system WGS 84 was used for material originating from outside Central Europe.

The data will be converted into *DiversityCollection* Ver. 2 within the next months and will thus be accessible via Internet, both by a local web interface and through the GBIF network and data portal.

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Sub-project duration: July 2003 – Dec. 2004, lead: H. Boyle, Herbert.Boyle@smng.smwk.sachsen.de

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Structural optimisation of the global information system LIAS by establishing a LIAS names server and expanding the Descriptors Workbench

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, ascomycetes, LIAS lichen names, terminology, descriptive data, glossary, *DiversityDescriptions*, *DiversityCharacterDocumentation*

Abstract

The structural optimisation of the Global Information System on Lichenized and Non-Lichenized Ascomycetes (LIAS) includes two major aspects: The LIAS names server is established as taxonomic reference database and a LIAS glossary considerably expands the LIAS Descriptors Workbench, integrating definitions and illustrations as part of the *Diversity Workbench* module *DiversityCharacterDocumentation*. This optimisation process includes a general review of LIAS revising more than 700 descriptors to facilitate future data entry. Data accumulated for both, names and glossary, are available to support lichen projects within the German GBIF Node for Mycology. Access to content data is facilitated in the context of the EU project Species 2000 europa.

Objectives

LIAS, the Global Information System for Lichenized and Non-Lichenized Ascomycetes, collects descriptive and taxonomic information for all ascomycetes. Several modules have been established organising a variety of data sets as part of this large information system. The system is currently revised to optimise two major aspects: (1) the names subsystem is established as taxonomic reference database of standardised lichen names and their synonymy. The database is an essential pre-requisite to assure that each record of descriptive data can unambiguously be attributed to a single taxon only. As part of the German GBIF Node for Mycology, a standardised list of lichen names will facilitate access to descriptive data for all lichen projects in the context of the EU project Species 2000 europa. (2) The glossary subsystem is established, thus considerably expanding the LIAS Descriptor Workbench, now including detailed definitions for more than 700 descriptors (characters). These definitions will be integrated in the *Diversity Workbench* module *DiversityCharacterDocumentation*. This database module provides crucial information on descriptive terminology employed by LIAS. It is anticipated that online access to the glossary will significantly contribute to more consistent data entry and therefore considerably improve the quality of descriptive data in the near future.

Results

The functionality of the web-interface was considerably enhanced in co-operation with a web-designer. Direct access is now available via frame-based webpages. This new design replaces a previous site first adopted in 1995. The user is now presented with a more consistent interface and interactive help. The webpages for all sub-projects have been re-designed [1].

All databases were reviewed and their functionality improved. To achieve additional flexibility a parallel PostgreSQL database running on Linux has been developed as an alternative to the original MS Access platform. XML data are automatically exchanged across these platforms. Preparations to implement a data wrapper providing names and synonyms are completed. LIAS is currently evaluated by the Species2000europa project as Global Species Database for Lichens.

More than 60,000 name entries were originally stored separately in LIAS main and LIAS light as well as regional LIAS checklists. In addition, P. Scholz kindly supplied an electronic version of the German lichen checklist. All names have been compiled into a single data set. The majority of 20,000 names now stored in this set are validly published and currently accepted. Author names follow standard abbreviations and accurate spelling of taxon names has been checked. The list supports all lichen projects sponsored by GBIF-D Mycology. It is used to populate a drop-down menu for data entry of specimen information into *DiversityCollection*. In co-operation with the *Diversity Workbench* sub-project a concept for a new core module *DiversityNames_Lichens* has been suggested. The list of names will be part of this central module. Data will be administered with this module and integrate directly with the LIAS main, checklists, and LIAS light subsystems. For the following aspects direct access is established using PostgreSQL:

- 1) An online search of accepted names and their synonyms via SOAP.
- 2) A Synonymy-Editor programmed in ColdFusion for efficient data editing and maintenance [2].
- 3) A Classification-Editor for regular updates of changes in ascomycete classification; developed in co-ordination with O. Eriksson (Umeå, Sweden), editor of MYCONET (remote access via the Internet is currently developed).

To provide more tangible support for direct data entry into LIAS main, a glossary subsystem has been established. This general reference system provides background information on consistent use of terminology for all 700+ descriptors of LIAS main as well as the subset of 70 descriptors in LIAS light. The glossary is the first attempt to explain in detail how to use descriptive characters for data entry. It provides a common standard to gather data in computer accessible form. As part of the process, 700+ descriptors of LIAS main will have been reviewed by the end of this year. The language adopted follows a hierarchical structure of “structure-property-state”. For example, the descriptor no. 120 refers to the position of cilia along the margin of thallus lobes. The category of this particular descriptor is “Upper Surface Structures”, the relevant structure are the “Cilia”, the property is the “Position” along the lobes and a possible character state is “basal”. LIAS main collects this information as “Upper Surface Structures – Cilia – Position – basal”. In the future, while entering data, contributors will have direct access the following general definition:

CILIUM [*pl.* CILIA] – long-acute, multicellular hair-like outgrowth with the appearance of an “eyelash”, generally originating from the margin or upper surface (but close to the margin) of a thallus lobe or along the margin of apothecia; consisting of a compact strand of agglutinated hyphae; generally visible with the naked eye and similar in shape to simple rhizines (therefore sometimes called MARGINAL RHIZINES), however, never located on the lower thallus side and not functioning as attachment organs.

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Compiling a web-accessible database "Index of Lichen Distribution Maps"

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, lichenised fungi, distribution maps, biogeography, bibliography, *DiversityMapIndexing*, *DiversityGazetteer*, *DiversityNames_Lichens*

Abstract

An existing database of published distribution maps of lichenised, lichenicolous and related fungi was optimised with respect to content and database technology and made accessible by a searchable web interface.

Objectives

Bibliographic indices for vascular plants, bryophytes and fungi (excl. lichens) had been published in the past and are continued for vascular plants until now (e.g. Lundquist & Jäger [1]). The main objective of the "Index of Lichen Distribution Maps" is to fill the existing gap for lichens by a web-accessible database which allows to search for and retrieve bibliographic references of all published maps for a given lichen taxon.

Results

The "Index of Lichen Distribution Maps" was developed as a worldwide database of distribution maps for lichens, lichenicolous fungi and other related ascomycetes. The project was initiated in the 1990ies. Since then scientific publications from all parts of the world had been scanned systematically for distribution maps by Peter Scholz. Within the GBIF project period, the database was expanded from 33,500 records to more than 40,000 records. The records were obtained from nearly 2,000 literature sources published over the past 150 years. Each record refers to a distribution map of a single taxon. By now, information for more than 8,000 taxa has been recorded, covering genus and species as well as taxa of infrageneric and infraspecific rank. Information for every single map (1 to 150 per taxon) constitutes map category (i.e., dot maps, grit maps, area maps and district maps), references to the geographical area covered by each map and a link to the original literature source. If available, additional information was recorded on ecological preferences, habitats, bioindication and the distribution of chemical races. Within the GBIF project period, each literature reference was cross-referenced with the online database "Recent Literature on Lichens and Mattick's literature index" [2]. In co-operation with the LIAS names project all information will ultimately be linked directly to a unique taxon identifier based on a standardised list of lichen names and their synonymy (*DiversityNames_Lichens*).

The former local database of distribution maps was imported into the *Diversity Workbench* module *DiversityMapIndexing*, a MS Access database application developed by Markus Weiss and Gregor Hagedorn. At the same time, geographical data were integrated with the module *DiversityGazetteer* and a ColdFusion web interface was programmed by Wiltrud Spiesberger [3].

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Databasing of the epiphytic Schwarzwald lichens collected by G. Lettau and kept in the Botanical Museum Berlin-Dahlem (B), and providing Internet access to the data

Umbrella project: Establishing the German GBIF Node for Mycology

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Keywords: GBIF-D, GBIF-Germany, fungi, lichens, Black Forest, epiphytes, DiversityCollection

Abstract

The label information of selected lichen specimens in the herbarium of the Botanic Garden and Botanical Museum Berlin-Dahlem is being databased using the *DiversityCollection* module of the *Diversity Workbench* and will be made available on the Internet. Specimens selected are the epiphytic lichens collected by G. Lettau in the early 20th century in the Schwarzwald area, Germany. Their distribution will be compared with the current distribution as presented by Wirth [1].

Objectives

Natural History collections worldwide store huge numbers of objects. The object itself presents valuable information on morphological variation; past and present distribution and ecology of the taxon is provided as written text on labels that go with the specimens. The storage is at considerable costs, and to have maximum profit of this investment it is important to have the information readily available. In herbaria availability of morphological variation is achieved by storing the material in taxonomical order. However, in this way the information on past and present distribution and ecology is not readily available. Databasing of label information has the potential to improve this situation. In addition, it enables us to keep track of specimens which have been moved following re-identification.

The lichen herbarium at the Botanical Museum Berlin-Dahlem contains many specimens of interest, worth-while and in need of databasing. In order to meet financial restrictions, a limited group of specimens was selected which allows a demonstration of the potential of databases with respect to the comparison between past distribution as extracted from herbarium labels and present-day distribution of the taxa.

For this purpose epiphytic lichens collected by G. Lettau in a specific area were chosen. The collection is the result of intensive floristic investigations during a restricted period of time in the early 20th century in the Schwarzwald area in SW Germany. During that time Lettau was the leading specialist for German lichens and the herbarium material presents probably the best documentation of a lichen flora available for any comparable part of the world at that time. Fortunately the same area is included in recent distribution maps published by Wirth [1].

Lettau never published a summary of his observations in the Schwarzwald. His only floristic publication from the region is a paper on the Feldberg area [2]. Otherwise much information was scattered throughout his series "Flechten aus Mitteleuropa" (final issue [3]). The database of his herbarium material will therefore provide a survey which has never been available before.

The databasing of these specimens can be considered as a hard test case, because there are several complicating factors. Since Lettau suffered from strong financial constraints during the years of inflation, he had to pack his collections very compactly and often put specimens from different localities together, occasionally up to 8! Other, more common complications are: the labels are hand-written; the locality indications are sometimes restricted to minor locations, and follow in part outdated political boundaries; often accompanying specimens are listed on the packets, which are to be included in the database.

Preliminary results

Currently (early October 2004, at about half time in the project) about 85 percent of the herbarium has been sighted and the labels of the found specimens were scanned. This resulted in approx. 2900 label scans and from these approx. 3,300 datasets have been entered into *DiversityCollection* 1.0, covering about 60% of all expected specimens. The progress in the databasing is thus in accordance with the time schedule. However, it has become apparent that the number of actually present specimens is lower than originally expected, and the geographical scope has been widened to include material less evidently belonging to the target area.

Some changes from the original concept had to be made. The most important one concerns the imaging of the label information. Since the packets often contain much written information, on several pieces of paper and on the packets themselves, large areas had to be scanned, and sometimes two images were necessary, in particular when information was present on both sides of labels. This made the image files very large and time-consuming and slowed down the database in an impracticable way. Therefore scanning was done at lower resolution. This made the barcode pictures unreadable for the LabelScan Programme, and a hand scanner had to be used for barcode input instead.

It also became evident that the goal of preparing distribution maps is in serious conflict with the goal of efficient databasing of herbarium specimens. The selection of the specimens is very time-consuming, and an exact estimate of the number of specimens to be treated is difficult to make.

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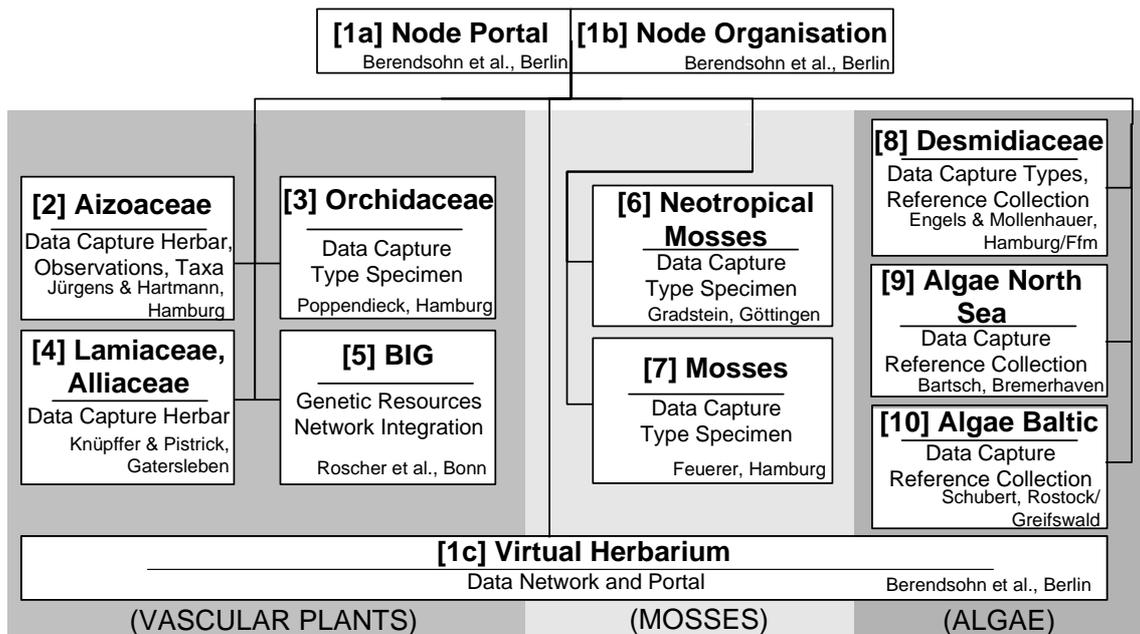
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GBIF-D Botany

Vascular plants, mosses, algae and protista



Projects in the GBIF-D Node for Botany

Virtual Herbarium, portal and organisation of the Botanical Node within GBIF-D

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Key words: GBIF-D, GBIF-Germany, biodiversity data, Virtual Herbarium, remote annotation, ABDC schema, Botany, BioCASE

Abstract

The construction of the Botanical Node of the German GBIF Network started in 2002 with a three-year initial project phase. It covers eleven sub-projects and is organised and co-ordinated at the Botanic Garden and Botanical Museum Berlin-Dahlem. By now, eleven databases of seven institutions are available via a data query prototype, all of them also connected to both GBIF's international network and portal and to the European BioCASE. The requirements for design and implementation of a remote annotation mechanism as a future part of the Virtual Herbarium portal have been subject of a workshop in early 2004 and will be published. With the connection of FloraWeb to the Botanical Node, GBIF-D became the fourth largest data provider within GBIF International.

Objectives

The objectives of the GBIF-D Botanical Node are: Foster the digitisation of herbarium collection data and their joint presentation in a "Virtual Herbarium" portal; integrate existing databases and networks that deal with botanical specimen data or catalogues of names; create cross-discipline virtual collections, combining living collections, observation data and herbaria; set up a portal for botanical collections and databases in Germany; maintain close collaboration with the other German nodes, with other National Nodes, with GBIF International and other international organisations.

Results

The organisational structure of the Node and the website [1] have been established. The German Botanical Node permits central access to the distributed collection databases via an Internet-based network (see Fig. 1). The development of this network is based on BioCASE software, including the BioCASE data transmission protocol, and on the data definition schema ABCD (Access to Biological Collection Data, [2]). This is in accordance with recognised GBIF standards [3].

The development of the Botanical Node focuses on the connection of existing databases, and on data capture and database development of botanical collections. Eleven databases are already connected; their data can be retrieved via the GBIF-D Botany data query prototype. With the registration of 2.75 million observational data from the FloraWeb Portal [4] of the German Federal Agency for Nature Conservation (BfN) in September 2004, GBIF-D became the fourth largest GBIF provider. In addition to the connection of object and observation data, the BfN's concept-oriented taxon database on ferns and higher plants of the German flora is being used by the access system to automatically expand user queries for taxon names to include synonyms.

Eight sub-projects provide the basic data of the German Virtual Herbarium portal, a specialised portal within GBIF-D Botany that will provide access to Herbaria, including specimen images and pictures. A remote annotation mechanism will be integrated into the Virtual Herbarium portal. The important topics of how to design an appropriate mechanism to enable a remote annotation of digital specimens

Tab. 1: Collection databases connected to the Botanical Node (as of Oct. 2004)

Institution	Database	Unit records
Bundesamt für Naturschutz (BfN)	FloraWeb	2,743,016
Georg August Universität Göttingen	Bryophyta Herbarium	16,993
IPK, Gatersleben	Genbank Accession	109,711
<i>SysTax</i> , Universität Ulm	<i>SysTax</i> botanical Data	208,799
Staatliches Museum für Naturkunde Stuttgart	Vascular Plants (<i>Specify</i>)	19,771
Botanischer Garten und Botanisches Museum Berlin-Dahlem	BGBM Databases	39,304
Fachhochschule Weihenstephan	Süddeutsche Bergwälder	263,572
		3,401,166

and how to economically handle the need for updating the physical as well as the virtual collection were discussed at a workshop in early 2004. A discussion paper was handed out to participants in preparation for this workshop. It will be published together with the workshop results.

The projects of GBIF-D Botany were presented in of 28 publications, posters and presentations [5].

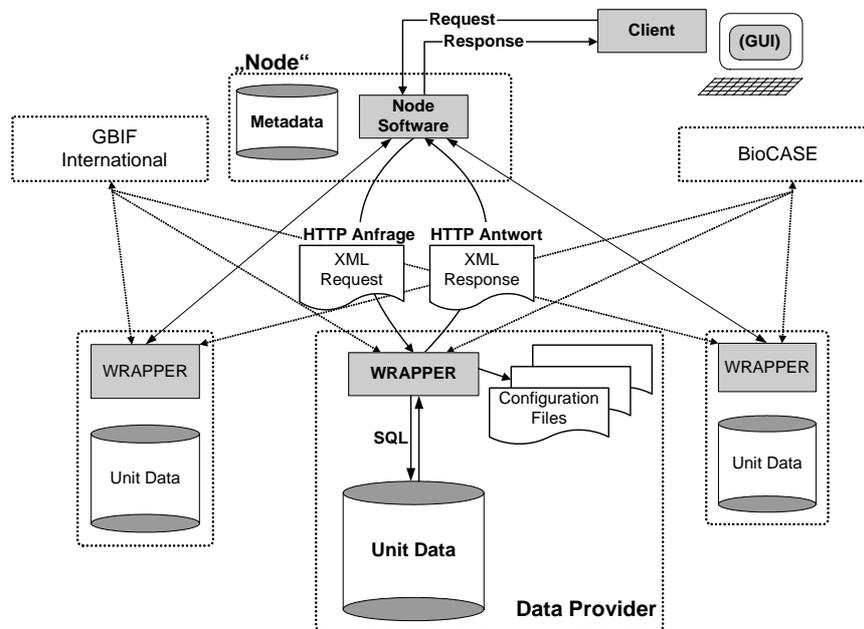


Fig. 1: Simplified overview of the GBIF-D Botanical Node network architecture. Unit data (specimen or observation data) are held by data providers and can be accessed by a variety of portals, including those of the GBIF secretariat, BioCASE, and that of GBIF-D Botany.

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The GBIF-project Aizoaceae in Hamburg

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, Aizoaceae, collection, Herbarium Hamburgense, sensitive data, Internet publication

Abstract

The databases of the collections of Aizoaceae have been transformed and partly published on the Internet, specimen data have been approved to a large extent. A visit to South African Herbaria in September 2004 has been successful in terms of co-operation, data security agreements and plant identifications.

Objectives

Presentation on the Internet of the types and other collections of the family Aizoaceae within the Herbarium Hamburgense, the life collection of the Botanical Garden and other collections within the Systematics Department of the Biocentre of the University of Hamburg.

Results

The Herbarium Hamburgense is one of the largest Herbaria in Germany, with over 1,600,000 specimens of 25,000 species of about 3,000 genera of spermatophyta. The collection of Aizoaceae in Hamburg is the largest worldwide, concerning specimens in the Herbarium Hamburgense and life material in the Botanical Garden collected over the past 40 years. Furthermore, old collections were incorporated, such as the collections of Dinter and Schwantes, which date back into the 1920ies. This extraordinary historical background and the existing large collections of Aizoaceae explain the choice of Hamburg for the GBIF-project Aizoaceae.

Progress: Large parts of the collections were examined and put on the Internet in a trial version as approved data. By the end of 2004, about 15,000 specimens shall be published, yet not all of those as approved data.

Internet publication: The databases have been transformed into a MySQL database and are ready to be published. Part of the data is published via a provisional URL [1]. Some details of database transformation however still have to be investigated, particularly in terms of the connection to GBIF-wrappers.

Location data: After discussion with colleagues from South Africa (Prof. Gideon Smith of the South African National Botanical Institute – SANBI - in Pretoria, Wendy Foden, co-ordinator of the Threatened Species Programme) it was agreed not to publish detailed location data on the Internet, or even include these data in the databases used for the publication in the GBIF-Network. The recent cases of theft of two cycad species (*Encephalartos brevifoliola* and *E. nubimontanus*) in South Africa which led to their extinction in the wild within the last few months show the vulnerability of species of interest for collectors, to which many species of the Aizoaceae belong.

Synonymy: Due to legal obstacles, the existing synonymy as compiled by Hartmann [2] could not yet be incorporated into the database.

A visit to Herbaria in South Africa and Namibia (September/October 2004) was successful in establishing a close research relationship and agreements of co-operation. Furthermore, some problems in the identification of several species were solved.



Fig. 1: A herbarium specimen of *Ruschia scabra*, Aizoaceae, Herbarium Hamburg

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Digitising essential parts of the Gatersleben Herbarium (GAT)

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, herbarium, crop plants, Lamiaceae, Alliaceae, digitisation

Abstract

The project aims at digitising parts of the IPK herbarium (GAT) with emphasis on Lamiaceae, type specimens, and Alliaceae. Approximately 6,000 specimens will be scanned during the project period, partly with several detail scans, using an A3 scanner. Label information will be documented in GBIS, IPK's Genebank Information System under development. Thus, essential data for linking up the IPK herbarium with GBIF will be computerised.

Objectives

Essential parts of the IPK Herbarium in Gatersleben (GAT) will be registered and made accessible on-line to GBIF-D via a database. GAT is one of the largest herbaria focussing on crop plants and their wild relatives, comprising 378,000 sheets. Preferably specimens of the Lamiaceae and type specimens will be registered. The registration of the Alliaceae collection will be started. It is planned to integrate the IPK herbarium database with other relevant databases at IPK, such as the IPK Genebank accessions (approx. 140,000), and the Mansfeld Database (taxonomic data on 6,100 cultivated species worldwide).

Results

The technical equipment consists of a Windows 2000 PC with CD-burner, A3 scanner, Adobe Photoshop, Visual FoxPro and standard software. The scanner is in normal position, so that any sheet is processed face down.

For every specimen, the whole sheet is scanned with 300 dpi. Details of important plant parts are picked and scanned separately with up to 1200 dpi. The uncompressed image files (TIFF) can have a size of up to 50 MB. Those are used as backups and as templates for further compression suitable to Internet presentation. During that process (Photoshop), each image is provided in three different levels of reduction, a "thumbnail" (approx. 2 KB) for preview purpose, a "normal view" (approx. 30-50 KB), and a "high resolution" (approx. 300-500 KB) for detailed study. Copyright information and a scale are added. All images are stored in an image database connected with the name entity of "Mansfeld World Database of Agricultural and Horticultural Crops" [1]. The image database contains information about image type, motif, resolution, scale, typus, scientific names, and backup location.

The original scan images are achieved uncompressed both on CD-ROM and a backup file server.

Tab. 1: Number of processed images (October 2004)

	Scans	Specimens	Overview	Details	Taxa
Total	4,000	2,300	2,300	1,700	534
Lamiaceae					260
Compositae					50
Legumes					35
Alliaceae					15
Other					174

By the end of the project processing of another 2,000 specimens is expected.

Label data of the herbarium will be linked with GBIS, the Genebank Information System of IPK under development. Before end of the project, label data will be registered for all herbarium sheets scanned so far.

Two posters on the project have been presented up to now [2, 3].

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Federal Information System Genetic Resources (BIG) – Current state and outlook

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, biodiversity, genetic resources, in situ, ex situ, wild flora, cultivated plants, botanical gardens, gene bank, GBIF

Abstract

The Federal Information System Genetic Resources (BIG) provides information on wild and cultivated plants in Germany. BIG comprises comprehensive information on plant genetic resources about: plant names (scientific/common), biology and ecology, geographical distribution and location of collecting sites, holding institutions (botanical gardens/gene banks), characteristics and traits, utilisation and breeding, endangerment and protection status, access and availability, photographs and drawings and literature.

Objectives

The four BIG-partners make their databases accessible for the GBIF-network and share their experience of running the distributed information system on genetic resources with the GBIF-D Botany Node.

Results

Genetic resources are an essential part of the biological diversity. Comprehensive and nationally important information on genetic resources is available in different institutions. BIG integrates a wide range of taxonomic, genetic, biological, ecological, economic and geographical data in a portal that focuses on plant genetic resources on the national level.

Utilisation and target user groups of BIG are identified as follows: 1) research (public and private research institutes and organisations) 2) economy (plant breeding, horticulture) 3) policy and administration 4) nature protection 5) collection holders (botanical gardens, gene banks, herbaria) 6) international technical and scientific co-operation

Partners and Databases: 1) Federal Agency for Nature Conservation (BfN): databases on the native wild flora (*in situ*), species distribution and ecology (FLORAWEB), on literature documentation of source references (LITFAS) as well as databases on status and trade of species, that are protected according to national and international legislation (WISIA); 2) Institute of Plant Genetics and Crop Plant Research (IPK): database of the accessions of cultivated plants of the gene bank (*ex situ*) (ACCESSION), and the taxonomic database for agricultural and horticultural crop species (MANSFELD); 3) Department of Special Botany and the Botanical Garden of the Ruhr University Bochum (RUB) on behalf of the Association of Botanical Gardens in Germany: database on the Collections of botanical gardens in Germany (*SysTax*); 4) Information Centre for Biological Diversity (IBV) of the German Centre for Documentation and Information in Agriculture (ZADI): central

databases of plant and forest genetic resources (PGRDEU and FGRDEU) as well as evaluation data of selected crops (EVA).

All BIG-Partners implemented the BioCASE-wrapper and mapped successfully their local concepts to those of the ABCD-schema. As a result FloraWeb, IPK-Accessions, PGRDEU and *SysTax* are already GBIF-data providers. The following figures give a brief overview of the data items, that are accessible within the GBIF-network (November 2004):

Database **SysTax**

<i>Accessions in Botanical Gardens</i>	173,000
Number of taxa	48,000
Taxonomical data (scientific name, higher taxonomy, synonyms, common names etc.)	160,000
Literature citations	30,000
Distribution data	20,000
Images	4,000

Database **FloraWeb**

<i>Occurrence of flowering plants and ferns</i>	
Grid Name and Identifier	3,002 Grids covering Germany
Taxonomical data (Scientific names, German name, etc.)	4,500 taxa of ferns and flowering plants of the wild flora (approx. 3,600 native plant species (incl. sub-species, apomicts, hybrids) and introduced species)
Unit Identifier (Literatures, Voucher, ...), Naturalisation Status, ...	In total 2,743,016 records are delivered

Database **IPK-ACCESSIONS**

<i>Accessions gene bank IPK Gatersleben</i>	110,000
Taxa (species & infraspecific)	4,400
Genus	630
Countries of Origin	160

Database **PGRDEU**

<i>Accessions in gene banks (other than IPK)</i>	23,839
Taxa (Scientific names, common names)	88
Accession number, Holding Institution, Country of Origin, Gathering Site, ...	

Database **MANSFELD**

Number of taxa	10,300 (accepted) plus 26,000 (synonyms)
Number of Species	6,100
Common names (in >110 languages)	30,000
Literature references	7,700
Images	500

Outlook

The number of data items that are delivered by means of the wrapper will be extended by all partners. Foreseen are for example the differentiation of species observation data in the grid by time period, addition of references for identification like images of fruit varieties and literature, and forest stands (*ex-situ* and *in-situ*). Also the addition of ornamental plants is presently being investigated.

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Supported by the GBIF Programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0203, Oct. 2002 – Dec. 2005, lead: Walter G. Berendsohn.

Internet presentation of the type specimens in the Theodor Herzog (1880-1961) bryophyte collection in Jena

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, mosses, hepatics, bryophytes, Herzog, herbarium, type specimens

Abstract

A survey of the Theodor Herzog bryophyte collection situated in the Herbarium Haussknecht in Jena (JE) yielded an amount of about 2,000 type specimens. Collection and herbarium data of each type specimens were recorded and entered into the *SysTax* database.

Objectives

The project aims at gathering specimen as well as publication data of all type specimen in the Theodor Herzog bryophyte collection in JE and making the information freely available on the Internet.

Results

The Theodor Herzog bryophyte collection is the core of the bryophyte division in JE, in which it is the most important collection concerning type specimens. In his lifetime, Herzog published circa 1,300 new bryophyte species. Furthermore, his collection contains many isotypes, specimens of species collected by Herzog and described by others, or type specimens he received from colleagues. Altogether, the Herzog collection contains about 2,000 type specimens.

For the project, a list of species described by Herzog was prepared. We thank Robert Magill at Missouri Botanical Garden, who sent us the list of mosses from the TROPICOS database. The hepatics list was built from Herzog's 150 bryological publications. The type specimens were then localised in the collection in JE. The herbarium data (determination and revisions) and collection data of each type specimen were recorded and entered into the *SysTax* database. The *SysTax* database is situated in Ulm (Germany) and can be accessed on-line. It is also a GBIF provider.

The information available for each type specimen comprises taxon name at first publication, place and date of first publication, date of collection, country of collection, original label text, further determinations with date and author, and the currently accepted taxon name.

Because a systematic survey of the entire collection was not possible, type specimens of taxa not described by Herzog could be considered only sporadically. Mosses described by Herzog are nearly completely registered with only 5% missing. Of Herzogs hepatic type specimen, about 20% have not been found. A few were lost due to bomb damage in World War II. Most of the missing type specimens are probably only represented as microscopic preparations. The revision of the collection of Herzogs microscopic preparations, however, was not within the scope of this project. It is in a bad state and needs to be curated, which, together with data capture, could be assigned to another project.

Sub-project duration: July 2003 – Dec. 2004, lead: H.-J. Zündorf, h.j.zuendorf@uni-jena.de

Supported by the GBIF Programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0203, Oct. 2002 – Dec. 2005, lead: Walter G. Berendsohn.

Internet presentation of the types and tropical bryophytes of the Herbarium of the University of Göttingen (GOET)

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, bryophytes, herbarium, online database, type specimens

Abstract

The Herbarium of the University of Göttingen (GOET) has large holdings of type specimens and tropical bryophytes. Online databases [1] using Oracle designer were created to present these holdings on the Internet. To date, the type specimen database includes approx. 7,500 entries, the bryophyte database approx. 17,000 entries.

Objectives

Internet databases are created allowing online access to the holdings of type specimens and tropical bryophytes of the Herbarium of the University of Göttingen (GOET).

Results

An online database [1] was created using Oracle designer 6i to present the tropical bryophyte holdings of GOET, especially those of Central and South America, on the Internet [2,3]. The search function allows for searching of taxa (family, genus, species), collectors, and regions (continent, country, state). To date about 17,000 entries are available. Only few European herbaria hold comprehensive recent collections of bryophytes from the Tropics. These bryophyte accessions are a most valuable resource for biological research, both in the fields of taxonomy and floristics as well as in molecular-phylogenetics, biogeography, ecology, and other types of investigations. The database is already connected to GBIF-D and GBIF International [4]. In addition, an online version of the type specimen database of GOET was created using Oracle designer 6i [2,3]. The database is one of the largest of its kind in Germany and currently holds about 7,500 entries, representing more than half of the total type holdings of the Herbarium (approx. 14,000 specimens). The database allows for the search of taxa (family, genus, species), country of origin, and collector. Search by combination of criteria and spelling variants (e.g., “Müller” or “Mueller”) is possible. Interactive photographs of type specimens (plant habit, plant detail, original label) are also provided.

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Sub-project duration: Jan. 2003 – Dec. 2005, lead: S. Robbert Gradstein, sgradst@gwdg.de

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Catalogus novus et amplificatus speciminum exsiccatorum et viventium algarum Desmidiacearum (New and extended catalogue of Desmid specimens in Germany, collected in herbaria and culture collections)

Umbrella Project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, Algae, desmids, herbarium material, living specimens, *Specify*, GBIF

Abstract

Desmids are unicellular algae forming part of the Charophycean line of evolution. In inland waterbodies only the taxonomic diversity of diatoms surpasses that of desmids. They proved to be sensitive indicators of oligotroph habitats with soft water, low pH and a low level of mineral and organic nutrients - habitats that are endangered worldwide. For nearly 200 years the Central European region is a focus of investigations about these organisms, resulting in the accumulation of a high amount of documents and rather rich research material. This result of an impressive history of research, however, is widely dispersed, distributed in many institutions, and catalogues do not exist, so that most of them cannot be used by the scientific community. The database *Specify* is an ideal tool not only to assemble all this information but also to present the data in the GBIF framework on the Internet.

Objectives

- 1) To record reference material of desmids in Germany within GBIF-D Botany, using the *Specify* software, starting with the reference material in herbaria and with living strains in culture collections, with a special focus on type specimens.
- 2) To summarise and digitise the data and figures of these taxa. The references are complemented by scans of micrographs from preparations for light- and scanning electron microscopes.
- 3) To make the digitised data freely and universally available to the scientific world by the Internet.

Results

In co-operation with Stephanie Sobek from GBIF-D at the BGBM Berlin-Dahlem (FU Berlin) a data entry form for the databank *Specify* was developed, made up of the following 6 main parts: 1) Catalogue data, 2) Details about preparation and digital images, 3) Specimen determination, including references concerning the type- and the taxon citation, 4) Collecting data, including habitat type and/or habitat description, 5) References and Exsiccata Collections and 6) General notes, summarizing for example all desmids occurring in the same sample with the specimen or referring to special stages of the life cycle in the sample, like zygospores etc. The label was scanned in those cases, where the handwritten remarks on the label were illegible or showed figures concerning the specimen.

This comprehensive presentation was chosen to give the opportunity to solve as many problems as possible just by accessing the *Specify*-data bank, without the need to borrow the specimen itself from a

herbarium or a culture collection. With utmost care the references concerning the type- and taxon citations were checked according to the rules of the International Code of Botanical Nomenclature [1]; many specialists, especially in the developing countries, rarely have access to complete libraries to make these investigations themselves. Consequently, a nomenclatural reference list is in work. The comparison of habitat type and habitat description (Part 4: collecting data) with the combination of species in a single sample (Part 5: general notes) provides an impression of the special requirements of a desmid community and the situation of a special location in the time the sample was collected. On the other hand, changing species composition of desmid communities in a given site over time may indicate disturbance of the biotope. In such cases the *Specify* data bank is a useful tool for biomonitoring and bioindication. Desmids are algae mainly living in wetlands, sources and small water bodies. These components of the biosphere are rather neglected by the usual procedures of biomonitoring in water-management in the EU. Taking desmids into consideration during this biomonitoring work means supplementing the set of average bioindicators with an important additional control, thus contributing to security for environmental resources.

By now, specimens of 5 Collections have been prepared (living cells) and digitised (Tab. 1) The specimens in the culture collections SVCK and SAG and the exsiccata of Rabenhorst [2] have been treated completely. In the Herbarium Hamburgense 85% and in the Förster-Collection about 20% of the material has been completed. Connection of the data bank to the GBIF network is under way.

Tab. 1: No. of digitised data of specimens of herbaria and culture collections in Germany (Oct. 2004)

Collection/ Herbarium	Number of Specimens	Figures			
		Label Scans	Light-Micr.Scans	SEM- Scans	Line-Drawing-Scans
SVCK ¹	468		670	102	
SAG ²	112				
HBG ³	3,464	750			
Rabenhorst ⁴	207	207			
Förster ⁵					1,496

¹ Sammlung von Conjugatenkulturen, Hamburg. ² Sammlung von Algenkulturen, Göttingen. ³ Herbarium Hamburgense. ⁴ Rabenhorst 1856-1867, exsiccata. ⁵ Collection of all scientific material left by Kurt Förster (1918-1983), kept by Dieter Mollenhauer [3].

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Sub-project duration: Jan. 2003 – Dec. 2005, lead: M. Engels, engels@botanik.uni-hamburg.de

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New electronic database for the reference collection 'Macroalgae of the southern North Sea'

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, electronic database, GBIF, macroalgae, southern North Sea, Helgoland, herbarium

Abstract

The AWI hosts the collection of marine macroalgae from the island of Helgoland, southern North Sea, and guarantees the sustainable use of the herbarium and its electronic database for training, coastal information and research. After the establishment of the collection database *Specify* at the institute, more than 50% of the herbarium collection (approx. 3,500 sheets) was incorporated into the database within 6 months. All annotations were transferred to the database, mostly consisting of taxon name, collector, date and location, sometimes with additional information on reproductive structures or ecology. The database now allows a detailed search for many attributes. A connection between database and GBIF portal and online access is in preparation.

Objectives

The aim of the project is the establishment of an electronic database for the approx. 6500 sheets of the 130 years old reference herbarium 'Macroalgae of the southern North Sea' located at the marine station of the Foundation Alfred-Wegener Institute for Polar- and Marine Research (AWI) on the island of Helgoland (North Sea). In addition to the transcription of the herbarium annotations into the database, digitised images of selected specimens, e.g. type material and/or rare or probably extinct species, will be included. Internet access to the database will be established via the connection to the GBIF network.

Results

At the beginning of the project the old herbarium was registered at the Index Herbariorum [1] under the code BRM in order to use the code for the barcodes and to internationalise the existence of the herbarium. In a second step the collection software *Specify* [2] was configured for the demands of the macroalgal herbarium. Since then 3,500 herbarium sheets comprising most of the more recent herbarium specimens dating 1952 and later were entered. This took approx. 600 working hours, resulting in a speed of data entry of approx. 5 sheets per hour. It became clear that the speed is considerably reduced if the herbarium is in disorder and/or several persons have to work on one dataset. One responsible person is needed to standardise and correct the database continuously.

By now, 106 genera and approx. 120 species of North Sea macroalgae have been entered into the database. Additionally many species (73) are only registered with their old and invalid names and still need a virtual nomenclatural tracing. This is not possible yet because the management of synonyms of the software *Specify* still needs development. The remaining old part of the herbarium will add many more sheets but only few more genera and species are expected.

Although most of the conspicuous macroalgal species are present in the herbarium, evaluation of the database shows that only 45% of the species and 60% of the genera recorded for Helgoland are represented by a specimen in the herbarium (Tab. 1). In order to create a scientifically valuable reference herbarium, these gaps have to be filled in future. The Internet connection of the Microsoft SQL database is in preparation and a test version will be available soon.

Tab. 1: Status report of electronical database 'Macroalgae of Helgoland', 6 Oct. 2004

	Electronical database	Records for Helgoland [3]
No. of genera	106	175
No. of species	188	274
No. of species with valid names	111	
No. of species with invalid old names	77	
Catalogue numbers	2,580	
Herbarium sheets	Approx. 3,500	

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Development of an electronical reference collection of macro algae of the southern Baltic Sea

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, macro algae, Baltic Sea, Schleswig-Holstein, Mecklenburg-Vorpommern, herbar studies

Abstract

In the project specimens of macro algae from the southern Baltic Sea are investigated. Most of them are preserved in unexplored herbaria of the universities of Greifswald (GFW) and Rostock (ROST). In order to make the data accessible for interested persons and organisations a *Specify*-Database was implemented.

Objectives

The specimens of macro algae from the southern part of the Baltic Sea, which are preserved in the unexplored herbaria of the universities of Greifswald (GFW) and Rostock (ROST) were to be investigated.

Based upon the herbarium studies the distribution of the macro algae in the Southern Baltic sea was to be discussed as recently done for charophytes and submersed macrophytes by Blümel et al. [1]. A further aim was the recovery of type material, since it was shown before for charophytes that type material seemingly lost during World War II was found in the herbarium GFW.

Finally a database was to be created to enable access to the evaluated data for interested people and organisations. For this, *Specify* database software was used. The database will be accessible on-line through the GBIF network portals (GBIF-D Botany: [2] and GBIF International: [3]).

Results

Both herbaria contain together approx. 13,000 specimens. Especially the collection in ROST is in a very bad state of preservation. The storage of the specimens should be improved and safeguarding of particularly important ones (type material) must be guaranteed.

In a precursor project Blümel et al. [1] had shown that it is possible to re-construct the historical distribution of charophytes and their community structure by evaluation of unexplored herbaria [1], and that many type specimens believed lost during World War II were present in the GFW herbarium. The size of the investigated charophyte collections is similar to that of the collections of the other algal groups. Both collections were not catalogued before. It was supposed that an investigation of the macro algal collections would provide similar results, with respect to hidden types as well as with respect to data about the distribution and community structure of the species of macro algae occurring in the southern part of the Baltic Sea.

Unfortunately this expectation was not fulfilled, because contrary to charophyte collections most specimens of macro algae were gathered outside of Europe. With respect to the initial aims, the macro algal collection of GFW is the important one. It contains 422 specimens from the western Pomeranian part of Mecklenburg-Vorpommern. Because of the low salinity in this area of the Baltic Sea the

species richness is very low. Especially in estuaries and isolated coastal lagoons several freshwater species were observed.

Similar to the GFW collection the macro algal collection of ROST contains mostly extra-European specimens. 308 specimens from sampling locations of the southern part of the Baltic Sea were found. Due to the higher salinity of the western part of the southern Baltic Sea the species richness is higher than in the western Pomeranian part. The specimens in ROST are mainly from two focal points. Half of the specimens were received in specimen exchanges and have been gathered by Reinke and Reinbold in Kiel and surroundings. Because most specimens of Reinke and Reinbold contains data about depth distribution they become particularly important for the historical depth distribution of related species. The other half of the specimens represent macro algal occurrences in Mecklenburg-Vorpommern. Several specimens from the Salzhaff (Wismar Bay) could not attributed to any collector. The rest of the specimens was gathered in Warnemünde (Rostock) on the beach. So it is not clear if the species occur at the coast or drifted to this location. In a lot of cases information on sampling area and time are lacking.

All records of macro algae from the southern part of the Baltic Sea were fed into a *Specify* database. A taxonomic reference list is the base of such a database and should contain the current species names and the corresponding synonyms. Because no such reference list for the investigated area existed, much time was spend on creating one. Especially the generation of the set of synonyms was difficult and time-consuming. The taxonomic reference list of the database was compiled according to AlgaeBase [4]. The database is accessible on-line via the GBIF homepage [3].

Before data input the specimens were revised where possible. A major problem consisted in the insufficiently known taxonomy and nomenclature of marine macro algae. In most cases microscopical examinations or knowledge about the life cycle of the species are necessary. Therefore only few specimens could be revised in this project.

Another important problem is the lack of scientific staff of the investigated collections. It was often observed that some specimens of a species are stored under the current name and another part stored under one ore more synonyms.

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Data collection and Internet presentation of moss types in the Herbarium Hamburgense

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, Mosses, Bryophytes, Types, GBIF

Abstract

Collection of label information including scanning and barcoding of 1,200 types of bryophytes in the Herbarium Hamburgense and their presentation on the Internet.

Objectives

Label data of all types of Bryophytes in the Herbarium Hamburgense will be entered into a database including scans of the mostly hand written labels and finally be made accessible on the Internet via the German botanical GBIF Node.

Results

It was possible to include not only the 1,200 estimated and planned type samples but also additional type material. Data sets of about 2,000 samples could thus be included in an Excel file. High resolution scans of about 1,500 samples were captured as well. Bar-code-labels have been attached to all samples treated. The missing samples are mostly on loan to other herbaria and not available for scanning presently. Scans and label data will be handed to the co-operation project *SysTax* (University of Ulm, Germany) for inclusion in the database and presentation on the Internet at the end of the year. The higher number of included samples resulted from the personal activities of the applicant. The originally planned co-operation with Diversity Workbench modules was substituted by the alternative use of *SysTax*, providing a highly effective Internet presentation of collection data. The available set of data will be continuously enlarged by volunteers using the hardware devices made available by this project.

Sub-project duration: Oct. 2003 – Dec. 2004, lead: T. Feuerer; feuerer@botanik.uni-hamburg.de

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A type specimen register of phanerogams in the Hamburg herbarium (HBG) with a focus on Orchidaceae

Umbrella project: GBIF-D Botany – German national node for Botany (Plants and Protists)

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Keywords: GBIF-D, GBIF-Germany, phanerogams, Orchidaceae, type register, iconography

Abstract

The sub-project concentrates on databasing the type specimens of the phanerogam collection of the Herbarium Hamburgense with an emphasis on Orchidaceae, where an iconography will be produced using detailed drawings of dissected flowers.

Objectives

The ultimate aim is databasing all type specimens of the phanerogam collection at HBG in order to make them internationally available. The present project represents a first step towards this goal. The Herbarium Hamburgense (HBG) is rich in type specimens especially from tropical areas, e.g. Brazil (Ule), Borneo (Winkler), India (Brandis) Australia (A. Dietrich, Preiss) and from the former German colonies in Africa and the Pacific Area [1]. The Orchidaceae were chosen as a starting point because they are already well documented [2] and because some 1,500 drawings have been made from the collection by Prof. Dr. D. Szlachetko, showing the floral structures of the delicate flowers in great detail. This material will be scanned in order to produce an iconography of the Hamburg orchid collection.

Results

The Hamburg orchid project is one of four GBIF projects located at the Biozentrum Klein-Flottbek. At present, a common platform for these projects is being developed. The main part of the orchid project will start in January 2005 when this platform will be available. At present, preliminary work at the phanerogam herbarium has resulted in databasing some 28,000 data sets, including 464 orchid specimens and 140 orchid types.

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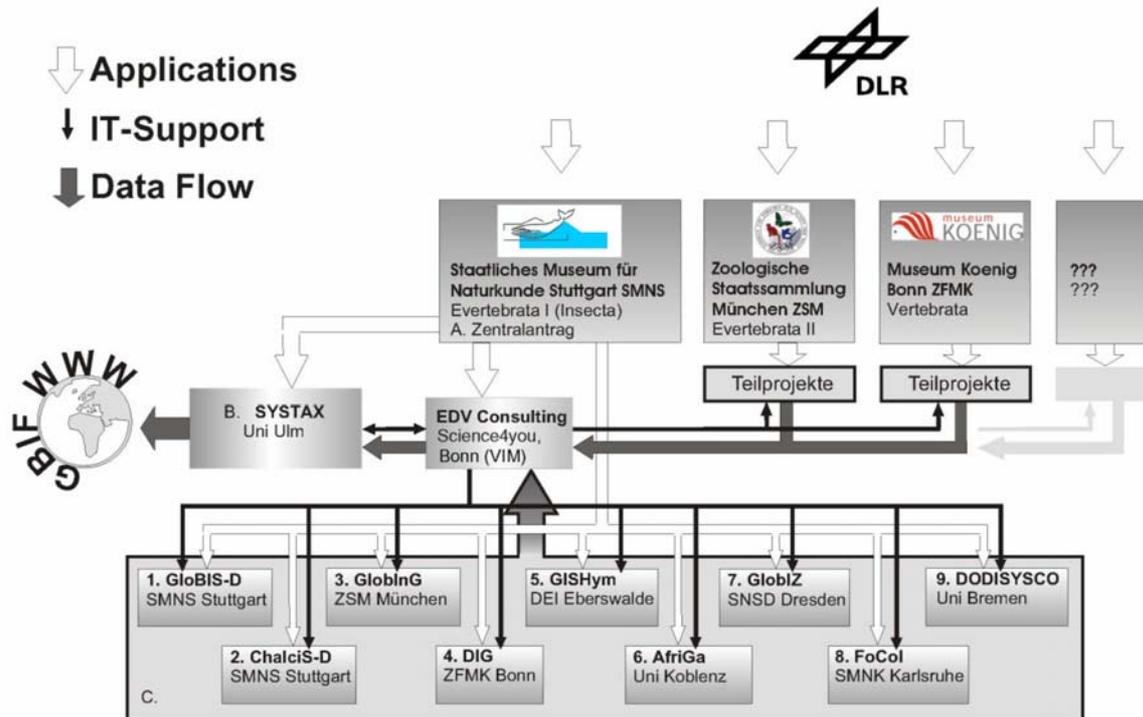
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Sub-project duration: Dec. 2002 – Dec. 2005, lead: H.-H. Poppendieck, Poppendieck@botanik.uni-hamburg.de

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GBIF-D Evertebrata I

Insecta



Sub-projects in the GBIF-D Entomology node (below) and data flow and management structure of the SysTax data portal within GBIF-D

GBIF-D Entomology – German national GBIF Node Evertebrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, biodiversity informatics, taxonomic databases, insects, museum collections, type specimens, world checklists, species identification

Summary

As part of the national implementation strategy for the Global Biodiversity Information Facility (GBIF), the German GBIF Node "Evertebrata I" is responsible for the co-ordination and mobilisation of scientific databases and other digital information sources for all insect groups to be inter-linked with the international GBIF network. With financial support from the German Federal Ministry of Education and Research (BMBF), currently nine separate databases are established for different insect groups by participating institutions which all are made available via the *SysTax* Internet portal at the University of Ulm. The node will seek linkages to additional projects in the future. For the implementation of the national strategy, GBIF-D Entomology interacts closely with the other six German thematic nodes which together form the distributed national GBIF node [1].

GBIF-D Entomology is a project network jointly undertaken by a number of leading natural history museums and university institutions in Germany, which is co-ordinated and administrated by the State Museum of Natural History, Stuttgart.

With support from the German Federal Ministry of Education and Research (BMBF), the following projects currently participate in the network:

- Chalcidoidea Information System – Germany (Hymenoptera) (ChalCIS-D: Staatl. Museum für Naturkunde, Stuttgart, and Zoologische Staatssammlung, München)
- Global Butterfly Information System – Germany (Lepidoptera) (GloBIS-D: Staatl. Museum für Naturkunde, Stuttgart)
- Global Information System Geometridae (Lepidoptera) (GlobInG: Zoologische Staatssammlung, München)
- Digitisation of key Insect Groups at ZFMK, Bonn (DIG: Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn)
- Global Information System Hymenoptera (GISHym: Deutsches Entomologisches Institut, Zentrum für Agrar- und Landschaftsforschung -ZALF, formerly Eberswalde, now Müncheberg)
- Compilation of an electronic catalogue on Afrotropical Galerucinae (Chrysomelidae, Coleoptera) (AfriGa: Institut für Integrierte Naturwissenschaften, Universität Koblenz-Landau)
- Global Information System of Pyraloidea (Lepidoptera) (GlobIZ: Staatl. Museum für Naturkunde, Museum für Tierkunde, Dresden)
- Digital Information on German Ant Collections and their Types (Hymenoptera) (FoCol: Staatl. Museum für Naturkunde, Karlsruhe)
- Documentation, Digitising and Systematics of Collection Inventory of Collembola (DODISYSCO: Universität Bremen - UFT, Abt. 10 - Ökologie, Bremen)

Separate presentations for all projects are included in this volume, which are implemented independently by the respective partner institutions. Common Internet access to all data generated and provided for GBIF-D Entomology is established in close co-operation with the Department of Systematic Botany and Ecology at the University of Ulm by making use of their *SysTax* Internet database system [2], and with additional support from a specialised IT-media company (Verlag für Interaktive Medien – V.I.M: [3]). The *SysTax* portal also provides access to all insect data from GBIF-D Entomology, as well as data from two other thematic GBIF-D nodes (Evertebrata II, and Vertebrata), to the global GBIF network.

It is anticipated that further projects will join the node in the future, and GBIF-D Entomology is expected to be established as an open-ended network providing the infrastructure to potentially inter-link all nationally existing databases and other information sources for insect data relevant to GBIF. The system architecture developed for the node and within the *SysTax* database system will certainly allow to incorporate and interlink with additional collection based information datasets, and interested parties are invited to contact the node co-ordinator.

In summary, the overarching GBIF-D Entomology tasks comprise:

- Co-ordination and administration of the projects participating in the network
- Representation of GBIF-D Entomology partners and other entomological information projects at the national GBIF co-ordination panel
- Providing and maintaining links with GBIF at international level
- Establishing Internet access to all data from GBIF-D Entomology
- Implementing and co-ordinating Internet connectivity for data from the national GBIF nodes Evertebrata II (Mollusca, Myriapoda, Chelicerata) and Vertebrata.

References

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- [2] <http://www.biologie.uni-ulm.de/systax/>
- [3] <http://www.vim.de>

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Global Butterfly Information System – Germany (GloBIS-D) GBIF-D Entomology

Umbrella project: GBIF-D Entomology – German national node Evertibrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, biodiversity information system; species distribution; common names; global species checklist; taxonomic database; type specimens; museum collection; Lepidoptera: Papilionoidea: Papilionidae, Pieridae, Lycaenidae

Abstract

GloBIS-D is a prototype of a comprehensive information module for butterflies as a megadiverse group of organisms, based on extensive taxonomic databases (GART – Global Species Register of Butterflies). The web-based system currently provides access to global species checklists for two butterfly families (Papilionidae, Pieridae) as well as bibliographic information about all taxa included and their type specimens. In addition, it will deliver information about species distribution, general characteristics, common names, and conservation aspects. The system is designed as a long term resource allowing multi-author access for continuous expansion and updating of information content.

Objectives

GloBIS-D is developed as a prototype for a comprehensive, web-based information system for butterflies, which will allow access to general species information such as distribution, morphology, ecological characteristics, and conservation aspects, on the basis of global synonymic checklists as a taxonomic backbone. The project will incorporate results of the BIOLOG project „Globales Artregister Tagfalter - GART“ [1] and thereby contribute to maintenance and update for that project. The portal developed by GloBIS-D will provide answers to questions such as:

- which butterfly species occur in which country?
- how can the species be identified and distinguished from other species?
- what is the ecological importance of a particular species?
- which species are endangered and protected in which country?
- what information is contained in the species' original description?
- where is the type material located and what is its condition?
- which museums and collections in Germany hold material of the species?

Results

For GloBIS-D as a comprehensive information system, a prototype portal has been established [2]. Data generated by GloBIS-D are also made available on the Internet via *SysTax* [3], a joint database application for the German GBIF-D node Evertibrata I (Insecta).

Taxonomic database: The taxonomic database currently holds records for 4,500 named butterfly taxa. For each nominal taxon, the standard bibliographic information, historic and actual data about the type material and its depository, as well as subsequent interpretations of its taxonomic status are included. The interlinked literature database contains 32,000 records.

Global species checklists: Worldwide checklists have been developed in co-operation with international experts. The checklist for the family Papilionidae comprises 552 species [4], that for the Pieridae 1,064 species. The Lycaenidae checklist (Old World) is in preparation. Species checklists are supplemented with data about distribution and common names.

Type specimens: Primary type specimens of butterflies present in the major museum collections in Germany (Berlin, Bonn, Dresden, Frankfurt, Karlsruhe, Munich, Stuttgart) are being documented. So far close to 2,000 types have been identified and digitally photographed (upper side, underside, and labels of each specimen). In addition, more than 1,000 images of other specimens have been taken to be used for identification purposes.

Web-based information system: The prototype portal allows access to comprehensive taxonomic data for the family Papilionidae. The families Lycaenidae [old-world] and Pieridae are being prepared for inclusion. At present, data from the taxonomic database are shown as “taxon sheets”, supplemented by photographs of type specimens mostly from collections in Germany. For the general user there are “species sheets” offering basic information such as species’ distribution, habitats, larval host-plants, phenology, and vernacular names. The portal design allows active participation by multiple authors, which will help to involve a broader community of experts to supplement, validate, and update the information content in the future.

The GloBIS-D project (Global Butterfly Information System – Germany) is expected to provide a significant contribution to two GBIF work programs, 'Catalogue of Names of Known Organisms (ECAT)' and 'Digitisation of Natural History Collections (DIGIT)'. At the same time it can be regarded as a prototype for GBIF's 'Species Bank' programme planned for future implementation. GloBIS-D is a nationally funded effort to contribute to a truly "Global Butterfly Information System - GloBIS", which will be implemented jointly with the Natural History Museum, London, the National Museum of Natural History, Smithsonian Institution, Washington, D.C., the National Museum for Natural History – Naturalis, Leiden, and the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima [5].

References

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- [3] *SysTax*: www.biologie.uni-ulm.de/systax/
- [4] www.insects-online.de/frames/papilio.htm
- [5] www.ento.csiro.au/globis/

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For digitisation of type specimen data, the project is further supported by the "European Network for Biodiversity Information" (ENBI), work package 6 ("Co-operation of pan-European databases on biological collections and specimens"), as funded by the European Commission under the fifth Framework Programme (EVK2-CT-2002-20020), which is also gratefully acknowledged.

ChalcIS-D: Informationssystem Chalcidoidea Deutschlands (Hymenoptera)

Umbrella project: GBIF-D Entomology – German national node Evertabrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, chalcid wasps, primary types, database, taxonomy

Abstract

The ChalcIS-D project provides detailed taxonomic information of all primary types of Chalcidoidea deposited in German institutions and makes these data accessible as part of GBIF-D. Depositories of primary types of Chalcidoidea in Germany are clarified and a digital catalogue of primary type specimens with relevant type information is compiled. Currently 780 primary type specimens belonging to 486 species have been recorded and relevant type data from the original literature have been databased. Co-operating German institutions are: Deutsches Entomologisches Institut, Müncheberg; Museum für Tierkunde Dresden; Museum Senckenberg, Frankfurt; Institut für Forstzoologie der Universität Göttingen; Zoologisches Museum der Universität Hamburg.

Objectives

Purpose of ChalcIS-D is to provide taxonomic information, in particular type information about Chalcidoidea, a group of microhymenoptera which is one of the most diverse, species rich, and economically important groups of parasitic wasps of the order Hymenoptera. Chalcidoidea are ecologically and economically the most important insects for the control of other insect populations [1, 2]. However, only a minor percentage of species diversity in this group has been made accessible through identification keys and taxonomic revisions. It is estimated that less than 5% of the species of chalcid wasps can be named without comparison to the type specimen [3]. This observation alone demonstrates the utmost importance of accessible type information, which in this group is probably more important than in any other group of insects. ChalcIS-D makes available the necessary taxonomic, nomenclatorial, and type information on primary type deposited in Germany which will facilitate further taxonomic and other research on this group of micro-hymenoptera.

Results

The search for type specimens at museums and natural history collections in Germany revealed the presence of 780 primary types of 486 species of Chalcidoidea. Major depositories of primary types of Chalcidoidea in Germany are the Zoologisches Museum der Humboldt Universität, Berlin (409 specimens), Deutsches Entomologisches Institut, Müncheberg (237 specimens), Zoologische Staatssammlung München (46 specimens), Institut für Forstzoologie der Universität Göttingen (25 specimens), and Museum Senckenberg, Frankfurt (8 specimens).

A database of primary type specimens created during the project includes relevant information about the type specimen and additionally a photographic image of the label data of each specimen. If there were more than a single primary type (syntypes) each specimen was included into the database. A label was attached to each type specimen with a unique GBIF-identifier. An associated taxonomic database contains relevant type information taken from the original literature. The data are made available through and will be maintained as part of the *SysTax* database system at the University of Ulm.

During the project a checklist was compiled based on literature information which currently contains 1,889 valid species. The whole database including all synonyms and combinations comprises 12,629 records. The taxonomic data associated with the species included in the checklist is based on literature information that was extracted from a total of 2,057 references. The bibliographic data are stored in a separate literature database which is linked to the species file so that the data provided with each taxon file can be traced to the original source of information.

Based on our current knowledge and comparison with the Chalcidoidea fauna of other European countries with better known fauna of chalcid wasps it is estimated that the number of species occurring in Germany will be at least twice as large, i.e. approximately 4,000 species. The taxonomic and type information provided by ChalcIS-D will constitute an important basis for further studies on Chalcidoidea in Germany and elsewhere.

The high importance of type information in this group of insects (see above) makes it highly desirable to provide digital images of the type specimens. This would allow an immediate, though preliminary estimation of the taxonomic value of the type specimen of interest. Together with the text recognition (OCR) of label data, the acquisition of digital images of type specimens would be primary task for a possible extension of the project.

References

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GlobInG: Global Information System Geometridae

Umbrella project: GBIF-D Entomology – German national node Evertabrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, Geometridae, type specimens, taxonomy, moths, online information system

Abstract

The GlobInG project improves accessibility to data on the moth family Geometridae, which is an economically important group of insects (with 351 pest species [1]), perfectly suitable as bioindicators [2, 3] and extraordinarily diverse (approx. 21,000 species). Co-operating German institutions are: Staatliches Museum für Naturkunde Karlsruhe; Zoologisches Forschungsinstitut und Museum Alexander Koenig Bonn; Museum für Naturkunde der Humboldt-Universität zu Berlin.

Objectives

- 1) Improve access to collections by (a) an inventory of primary type specimens of Geometridae stored in German museums (total of approx. 5,000); (b) inventorying, IT-harmonisation and online-publication of existing digital information on types; (c) digital photography of primary type specimens of Geometridae stored in German museums with inventory of accompanying scientific data (examined primary data); (d) testing provision of digital metadata in a pilot project, e.g. species catalogues with box numbers
- 2) Improve access to relevant literature data with scientific control of taxonomic status and nomenclatural availability (possibly with digital facsimile of origin description)
- 3) Improve access to taxonomic data by provision of a taxonomy database, by converting and actualising data from the electronic name catalogue of described species

Results

(a) Taxonomic catalogue of all described species, subspecies and synonyms

During the project a catalogue was compiled including 32,843 records of primary names of Geometridae based on Scoble [4]. In addition, the catalogue contains the names of the accompanying authors (of the original description), genera and subfamilies. All this information was complemented into a database, of which the user interface was worked out in the GART project on butterflies and which serves as an interoperable basis for further data input.

(b) Primary type data

Until today 800 object data sets of primary types, mainly from the Herbulot collection at the ZSM, are documented with photographs and data. This covers a total set of 2,000 pictures of dorsal and ventral views of the specimens and of the labels.

By now, 200 object data sets are processed in detail and are integrated into the existing database according to the standards of the GART/GloBIS project. For this the respective original descriptions were evaluated and all relevant taxonomic information was included into the database. These data sets contain the citation of the original description, information about the locus typicus, a listing of the type material, and, additionally, the digital photographs of each specimen as mentioned above. So far the database contains 500 image data sets of primary types, 50 accompanying literature records, and 400 image data sets of the facsimile of the original descriptions. The data are made available through the *SysTax* database system at University of Ulm. Sustainability is guaranteed by continuous maintenance through ZSM.

Since Geometridae types are inventoried also in other countries in the framework of the Forum Herbulot initiative at the ZSM [5], great international impact is expected, and Geometridae as model group will get established for various kinds of further research, see e.g. [6].

References

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The DIG project (Digitisation of key Insect Groups at ZFMK)

Umbrella project: GBIF-D Entomology – German national node Evertebrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, Digitisation of key Insect Groups, ZFMK, BIODAT database

Abstract

The DIG project at ZFMK intends to digitise specimens of representative insect orders (Diptera, Orthoptera, Heteroptera, Homoptera) of museum collections in Germany in order to make them available via the Internet and to develop techniques for data capture in large collections. Specimen data are entered into the BIODAT database and linked with information on systematics, localities, and collectors. All specimen data are on-line and searchable via the BioCASE and GBIF portals.

Objectives

The aim of DIG is to computerise museum collections by digitising specimens of representative insect orders (Diptera, Orthoptera, Heteroptera and Homoptera) and entering the associated label data into a database that can be used on-site and on the World Wide Web. The specimen based information units are captured with and stored in BIODAT, a database developed at the Zoologisches Forschungsinstitut und Museum Alexander Koenig (ZFMK). BIODAT is connected to both the BioCASE and GBIF portals since spring 2004. Digitisation of mass collections, such as insects, at the specimen level is not normally integrated in the daily work of museum staff. The development of ‘best practice’ was thus a key element of the DIG project. Objectives in detail:

- Creating a complete catalogue of all taxa of Hemiptera s.l., Orthopteroidea, and Diptera-Tipuloidea held at the Museum Koenig Bonn (ZFMK).
- Validity check of the taxonomic information of the specimens concerned.
- Digitising the locality data (gathering sites) of all type specimens of the selected key groups and of all specimens of Orthoptera at ZFMK. Geo-referencing of the locality data (gathering sites).
- Taking digital images of all primary types including label information of the key groups Hemipteroidea, Orthoptera, and Diptera: Tipuloidea.
- Linking of the specimen information with information on systematics, localities, collectors, etc.
- Adaptation of the BIODAT database to the requirements of the DIG project.
- Adaptation of the BIODAT database to the transmission protocol of GBIF-Germany.

Results

More than 6,000 taxon names (of them >1,500 Orthoptera and >4,000 Diptera) have been entered into the BIODAT database, together with about 2,000 geo-referenced locality data. Taxa and localities were included in the systematic or geographic catalogue of the ZFMK, respectively. In addition, about 2,000 type specimens of Diptera and more than 20,000 specimens of Orthoptera were recorded (Tab. 1). Moreover, we extended digitisation to the type specimens of lice (Phthiraptera) and fleas (Siphonaptera), which were usually mounted on slides. Publications are forthcoming [1, 2].

Roughly three-quarters of the specimens of the selected key groups are already digitised together with verified taxonomic information and referenced locality data. The specimen data are linked with information on systematics, localities, and collectors. All specimen data are already on-line and searchable via the BioCASE and GBIF portals. A BIODAT search engine, which will be available by December 2004 will provide faster access to BIODAT’s specimen data and images on the Web.

The “best practice” for data input [3] starts with data capture for species, which leads to a systematic catalogue. This is followed by data capture of localities (gathering sites), leading to a geographic catalogue. Finally the specimens are recorded. As compared to the traditional specimen-by-specimen procedure, this reduced the time needed for data entry from 9 min/specimen to 1.5 min/specimen.

More than 4,000 digital images of specimens and labels have been compiled. Initial tests served to develop a time-saving routine for digital imaging. Two types of image capture have been tested: (1) taking between 5 and 9 shots per specimen; (2) in-depth photography of specimens with automount software. Both take about 10 minutes per set of images including processing, which is similar to the amount of time needed at the ‘New Zealand Arthropod Collections’ (NZAC) in Auckland with automontage software. We selected the first type as a routine for image capture as it allows the user to view details of different parts and sides of the specimens. The second type may be used as an addition for holotypes only. Ideally 3D-images would be preferred, allowing navigation around the specimen in a single image. However, due to the financial restrictions this is currently beyond reach but may be a prospect for the future.

Tab. 1: Number of BIODAT’s information units (digitised until September 2004)

Taxonomic Catalogue (Level 3)	Diptera	Heteroptera	Homoptera s.l.	Hymenoptera	Odonata	Orthopteroidea	Phthiraptera	Siphonaptera
taxa	4524	1808	1811	8520	1213	1905	201	29
synonyms	275	457	381	2886	-	432	30	2
genera	727	343	401	1181	219	436	41	4
species	3517	1164	1168	6641	896	1160	144	9
Geographic Catalogue (Level 6)								
named areas	1403	4835	4835	4835	1	4835	4835	4835
Collection Catalogue (Level 7)								
specimens	2124	4	8242	5460	-	20288	453	28
localities	461	3	416	442	-	1147	136	9
primary types	194	4	86	51	-	72	6	1
secondary types	1962	-	408	756		154	437	27
images (types)	-	20	1001	603	-	1309	1068	62

References

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GISHym: Global Information System on Hymenoptera

Umbrella project: GBIF-D Entomology – German national node Evertabrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, Hymenoptera, primary types, checklist, DEI collection

Abstract

The GISHym project will provide detailed information on collection material of Symphyta, Ichneumonidae and other Hymenoptera groups. We submit 11,300 records on the Symphyta fauna of Germany, 10,000 datasets of the collection stock of the DEI, and 2,500 datasets on the Symphyta species described by German authors and their proper taxonomic placement. The data will be made available on the Internet via *SysTax*.

Objectives

The GBIF-D Project GISHym aims to provide a sizeable data stock on the Hymenoptera housed in German collections. Particularly data on Symphyta and part of the Ichneumonidae are being databased. Both are economically important groups: Symphyta comprise serious agricultural, forest and horticultural pests and beneficial biological control agents; Ichneumonidae occur as antagonists of many arthropod pest organisms. The primary focus of GISHym is on taxonomic information about the primary types of these groups. In addition, we present data on the Hymenoptera collection stock of the DEI and a checklist of the Symphyta occurring in Germany. Thus GISHym will help to reduce the taxonomic impediment and facilitate taxonomic research in these groups by giving access to important primary and secondary data.

Results

Checklist of the Symphyta of Germany

During the past years intensive efforts have been made to present a checklist of the Symphyta occurring in Germany and in the German federal states (Bundesländer). In the past, reports on the occurrence of particular species were uncritically repeated through many publications without re-examination of original material. We have included only verified records in the checklist or single records of unmistakable species. Some species of doubtful presence have now been verified to occur in Germany [1]. In a subsequent step we have examined 77 publications for additional records and databased the resulting evaluated data. The checklist now contains 732 valid species. This is based on 5,370 species records for the Bundesländer and 11,300 individual records. We estimate that the total species number will increase only slightly after the investigation of deficiently studied regions and species groups. This checklist is an information pool on the current state of knowledge and will help to eliminate taxonomic and faunistic deficiencies.

Hymenoptera collection of Deutsches Entomologisches Institut (DEI)

The DEI preserves one of the most important Hymenoptera collections in Germany. It comprises approx. 200,000 specimens, which belong to about 15,000 species of 58 families. Among this material there are approx. 1,950 primary type specimens. GISHym provides approx. 10,000 datasets on the Hymenoptera collection of the DEI. The single datasets for conventional (non-type) collection

material contain species-related information on the amount of material (estimated for larger series), on the origin of the material (zoogeographic region), and on the physical position of the material. This “rough data capture” has been performed for the Ampulicidae, Apidae s.l., Crabronidae, Pompilidae, Sphecidae, Symphyta and for part of the Ichneumonidae (approx. 7,850 datasets). For type material we additionally provide referenced information on the original name, type status, subsequent nomenclatural actions, and the composition of the type series (approx. 2,150 datasets). The current taxonomic placement of the names has been checked against the latest name catalogues and taxonomic databases (Taeger & Blank 2004). These data provide essential curatorial information on the DEI Hymenoptera collection for external users.

Primary type data

Due to the lack of modern catalogues for Symphyta GISHym has continued to prepare the database “Electronic World Catalog of the Symphyta” [2]. This forms the sound basis for the association of primary types with valid names according to literature. Particularly important steps to augment the catalogue have been the inclusion of data from the Zoological Record (1977-2004) and of three sizeable printed catalogues. The latter three works have been scanned, and the content has been captured with the OCR software Abbyy FineReader 7.0 and databased. An additional 900 works have been processed with OCR and saved as PDF, which allows a quick search for keywords (e.g. species names) across these documents. All this was a necessary preparation for data capture of the primary types in the various collections. This will include the capture of basic type information like presence / absence, state of conservation, sex, a photo of the labelling, and the addition of an id-number for better recognition. At present we provide a database, which comprises the species-group names described by German authors and associates these with valid names (2,500 datasets). GISHym will finally provide a database for all primary types of Symphyta housed in German collections.

Due to the recent publication of a catalogue for the Ichneumonidae [3] the association of these primary types with valid names is much easier compared to the situation found in Symphyta. The primary types of Ichneumonidae at the DEI and in the collection of G. Heinrich at the ZSM are going to be databased. The data for the Symphyta and part of the Ichneumonidae in German collections are made available through and will be maintained as part of the *SysTax* database system at the University of Ulm.

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AfriGa: Compilation of an electronic catalogue on Afrotropical Galerucinae (Chrysomelidae, Coleoptera)

Umbrella project: GBIF-D Entomology – German national node Evertebrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, Coleoptera, Africa, Madagascar, type catalogue, type photos, identification

Abstract

A new catalogue on all 1,750 nominal species of Galerucinae described from Africa and Madagascar is compiled. It includes photos of the primary types and their original labels, detailed information on the bibliography, and, for recently revised taxa, also figures of external and genital characters, and distribution maps. Data are made available through the *SysTax* system.

Objectives:

The Galerucinae are one of most species-rich beetle groups with about 6,700 described species. 1,750 species names have been published from tropical Africa and Madagascar. Most species have been described between 1870 and 1950. More than 95 % of museum material, in particular type specimens, are housed in European collections. Next to the natural history museums in London, Paris, Genova, Brussels and Tervuren, type material of about 320 species are deposited in German collection, mainly in Berlin and Hamburg.

Recent studies on the taxonomy, biogeography and phylogeny on the most species rich galerucine genus *Monolepta* and related groups, showed many taxonomic inconsistencies. Particularly, studies on genital structures allow now a much better identification of species and delimitation of genera. Our recent studies have led to many taxonomic changes including identification of many synonyms, and recognition of numerous undescribed species, e.g. [1, 2, 3].

A detailed knowledge on depositories and the identity of the primary types are basic data for any taxonomic study. Photos of type material can give valuable information on species identity, which will reduce time consuming museum visits and loan transactions.

Results

Aim of this project is to establish an online available catalogue on the Afrotropical Galerucinae. It includes photos of the holo-, lecto- or one syntype with its original labels, and detailed information on the bibliography including data of the original description for each species. For recently revised taxa, figures of external and genital characters, and distribution maps are also provided. By December 2004, 1,730 nominal species (99 %) have been identified and all data sheets have been compiled. This is based on collection and literature data of 192 literature sources which are all recorded. 990 (57 %) of the primary types are photographed (Fig. 1).



AfriGa - Entry Screen - Species Group Taxa ID 117			
Valid Genus	Cerochroa	Author	Gerstaecker, 1855
Cited Genus		Author	
Taxon Name	ruficeps	Author	Gerstaecker
		Year	1855
		Date	
Valid Species		Author	
Ref - ID	27	Description Image	
		Pic. ID	479
Page (Name)	637	Image	figure in lit. 28
Pages (Description)	637	Species distribution map	
Type Loc. / Coll. (Quote)	Mossambique / Sena und Tette		
Type Locality (Additions)			
Type Locality (Country)	Mozambique		
Type Material (Quote)	ruficeps Gerst.* Sena Tette Peters / 30570		
Type Material (Additions)			
Type Status	<input type="checkbox"/> Holotype <input checked="" type="checkbox"/> Syntype <input type="checkbox"/> Lectotype <input type="checkbox"/> Neotype		
Type Material (akt.)	4 Syntypes MNHU		
Depository primary type	MNHU, Berlin		Help <input checked="" type="checkbox"/> old record <input type="checkbox"/> revised
Name not available	<input type="checkbox"/>	reason	
objective Invalidity	<input type="checkbox"/>	reason	
subjective Validity			
Taxonomy			
Remarks	Cerochroa ruficeps var. picea: 2 Syntypes MNHN		
Created by	Levermann	Modified by	
Date	14.05.2003	Date	24.10.2004

Fig. 1: Syntype of *Cerochroa ruficeps* Gerstaecker, 1855 with original labels, detail, and corresponding data sheet

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Global Information System of Pyraloidea – Globales Informationssystem Zünslerfalter

Umbrella project: GBIF-D Entomology – German national node Evertabrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, Lepidoptera, Pyraloidea, nomenclature, literature

Abstract

The Global Information System of Pyraloidea (GlobIZ) has been made available via the Internet for multi-user editing of data by collaborating specialists and provides taxonomically important data for users via its website [1]. Queries can be made for taxa and references. The taxon-report includes the actual taxonomic status of Pyraloidea names including complete references for all information provided (Fig. 1). 12,875 records have already been entered. The remaining period of the project will focus on the completion of species group names and the export of data to *SysTax*.

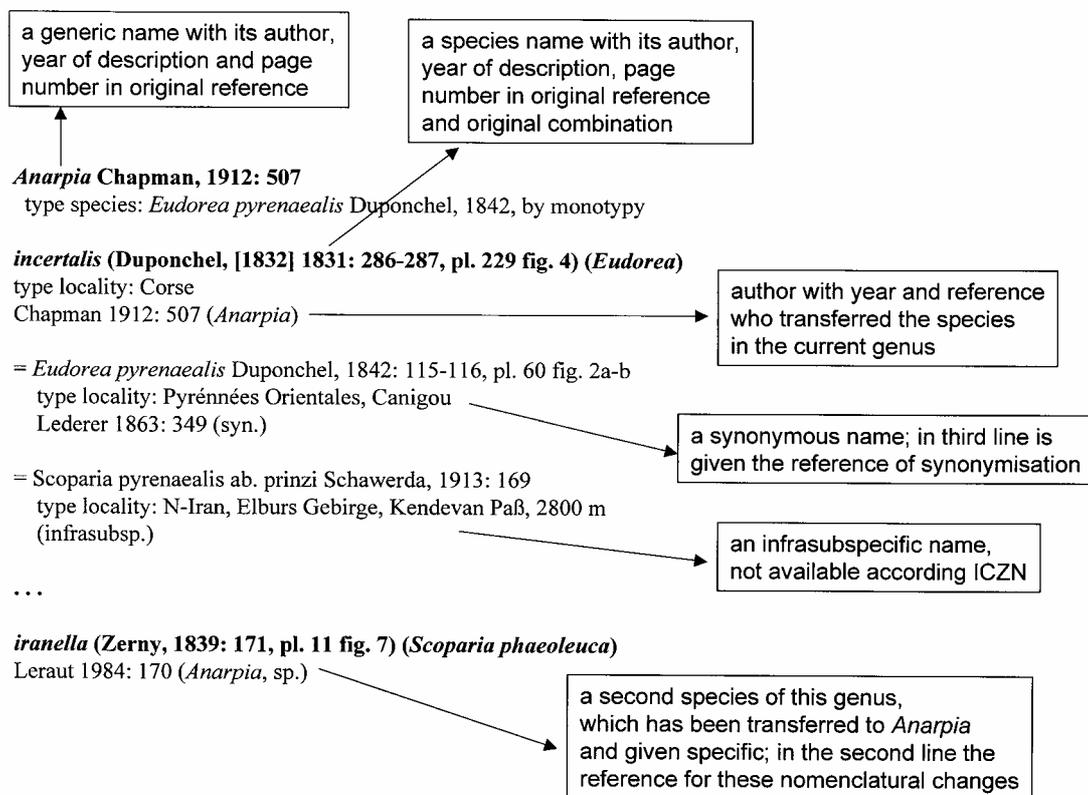


Fig. 1: The design of the taxon-report of GlobIZ [1]

Introduction

Pyraloidea (Insecta: Lepidoptera) have a wide variety of ecological adaptations, ranging from desert to aquatic species. In terms of species numbers, they are one of the four largest groups of Lepidoptera, comprising about 16,000 described species so far. Hence, Pyraloidea became an ideal model-group for biodiversity studies [2, 3, 4]. However, research on this group is still severely hampered by a lack of a comprehensive information system which provides complete data on the described taxa, their current nomenclatural status and the relevant references.

Objectives

- 1) establishment of a comprehensive catalogue of all species-, genus-, and family-group-names of Pyraloidea, including synonymic names and current combinations, based on the International Code on Zoological Nomenclature
- 2) editing of data strictly according to published information, and linked with it
- 3) establishment of a bibliographic catalogue of systematic literature on Pyraloidea
- 4) establishment of an Internet-based platform allowing simultaneously editing of data by several specialists, and providing validated data for any user.

Results

The database has been ported from MS Access to MS SQL Server. ASP-templates have been programmed using c-sharp. The multi-user editing is operational, and up to now, 12,875 records have been included (Tab. 1).

Tab. 1: Data already edited

	No. of records
Family group names	91
Genus group names	3,261
Species group names	6,158
Generic transfers	511
Changes of status	424
References	2,430

Perspectives

During the remaining project period, species-group-names will be completed and the data exported to *SysTax*.

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Digital information on ant collections in Germany and their types (FoCol)

Umbrella project: GBIF-D Entomology – German national node Evertebrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, Formicidae, ant collections, type specimen, digital images, Germany

Abstract

The FoCol-project as part of the GBIF-D Insecta node concentrates on ant collections and their type specimens in German collections. Information is provided on the principal taxonomic and geographical focus of the collections and on the names of the most important collectors. Information about type specimens includes high resolution digital photos with enhanced focus by the AutoMontage® software and will be available in the Internet database *SysTax*.

Objectives

Ants hold ecological key positions in most terrestrial ecosystems and belong to the most investigated insect groups especially under ecological, physiological, behavioural and applied aspects. Annually 800 – 1,000 scientific papers about ants are published worldwide. Keys for all genera and a complete species list have already been published [1, 2]. Today, more than 11,000 ant species have been described and the species registry is steadily updated on the Internet [3]. However, many investigations are still hampered by the unclear taxonomy of many species, the lack of identification keys for species, and by lack of easy access to well documented and researchable collections including their type specimens.

German natural history museums do not hold ant collections of highest international rank but a number of medium-sized collections of importance (i.e. coll. ROGER, STITZ, SEIFERT, VIEHMEYER, part of FOREL etc.). Only incomplete information about ant collections in Germany exists [4, 5], and only few type catalogues of ants have been published so far [6].

In this context, the FoCol-project as part of the insect node within the GBIF-D programme aims to register all institutional ant collections in Germany and characterise them with regard to following aspects:

- size of the collection and number of types
- taxonomic and geographical focus, important collectors
- state of conservation and responsible curator

Some important private collections will be included, too.

A principal objective of the project is the registration of the primary type material held in German collections, including important paratypes, for example of castes that differ from the holotype. All types are characterised in detail in the following way:

- original name, author and year of description; citation
- currently recognised taxonomical status

- type locality with modern GIS interpretation, if possible; collection date and collector with scans of original labels and descriptions
- high resolution digital photos in frontal, lateral and dorsal view

For the digital photos a high-resolution camera and the software package AutoMontage® [7] will be used to produce a series of in-focus images from which a single image with extended focus will be calculated. The result outclasses simple digital photos in sharpness and details depicted and consumes only a fraction of time necessary to produce the same quality manually from serial focus images with conventional graphical software. AutoMontage® is increasingly used by myrmecologists to depict their objects and to build up image databases on the Internet [8]. The result will not only be a catalogue of type specimens in German collections but all data including the photos will be available in the Internet database *SysTax* with free public access [9]. This allows a rapid type examination that makes travelling to museums or mailing of types in many cases unnecessary, thus helping to reduce the budget and time requirements for taxonomic investigations. By reducing physical handling, it also will help to conserve the types for the future.

Results

Due to a change in the scientific staff, work in FoCol started but in the second half of 2004. At this time we made a complete list of all German institutions and private collections where ant material is possibly deposited. Furthermore we performed a detailed literature search for ant taxa which should be deposited in these collections. At the same time we checked the status of each taxon and the availability of the original descriptions in the copy material at the SMNK or on the Internet. Synonyms of the taxa were listed and revisionary literature noted. At this point we count about 1,000 holotypes deposited in German collections. The growing data set has been adapted for the several interfaces of the *SysTax* databank to facilitate and accelerate the implementation of the FoCol data in the GBIF-project. In parallel a routine procedure for ant photographing with the AutoMontage® software has been established during the digitisation of ant species deposited in the SMNK collection that started simultaneously.

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Documentation, Digitising and Systematics of Collection Inventory of Collembola (Arthropoda, Hexapoda) (DODISYSCO)

Umbrella project: GBIF-D Entomology – German national node Evertebrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, Collembola, Insecta, Germany, Scientific Collection, Museum, Digital Images

Abstract

A list of Collembola occurring in Germany or in German collections was compiled and supplemented by data on their habitats, dispersal and systematics. Habit and morphological characters of a representative part of the German Collembola fauna (118 genera, 160 species) were photographed and complemented by the corresponding meta data.

Objectives

Collembola are universally distributed in almost all terrestrial habitats and represent the most abundant order of insects in the world [1]. At present, more than 7,500 species are described, whereof the German list »Nomina Collembola Germanica« covers about 420 species [2]. Collembola are considered as a key group of soil organisms and therefore they mark an important research object in numerous investigations of soil ecosystems [1]. Knowledge of taxonomy and determination of Collembola has developed remarkably in recent years [3]. Nevertheless in many cases it is still indicated to consult comparative collections. Up to now in Germany only scarce information is available about the inventory of Collembola in scientific collections which are situated predominantly in museums of natural history. The main objective of the project DODISYSCO is to provide a digital base of collection data and digital photographs of German Collembola species which is accessible via the World Wide Web.

Results

Collections in Germany

In the beginning of the project 18 potential locations for collections were contacted. 10 public Collembola collections are existing, which are differing in size and maintenance. The most important collections are located at the following institutions:

- Natural History Museum Görlitz (about 1,000,000 determined specimens and 545 species, with 31 type specimens). About 90% of the collection are species naturally existing in Germany.
- Zoological Institute and Museum Hamburg (4,000 specimens, about 300 species with 100 type specimens. About 50% of the collection's species are naturally occurring in Germany.
- Scientific Institute Senckenberg, Frankfurt (database with 417 sampling locations with 30 genera and 45 species. Apart from the 26 type specimens and typoids, partly coming from Germany most of the collection material was sampled in Peru.

- Natural History Museum Karlsruhe (2,110 specimens, 88 species sampled in Germany, moreover 7 species from Brazil, with 5 paratypes).

Other small, not catalogued collections are located in Berlin, Bonn, Munich and Stuttgart. Moreover two private collections exist in Germany that are not accessible. The collections in Görlitz and Hamburg were surveyed and the data are present in digital form. Moreover a taxon list was established, based on the *Nomina Collembola Germanica* [2]. This list was formatted compatible to *SysTax*, supplemented by additional species occurring in Germany or in German collections, and completed with synonyms and data on occurrence in co-operation with Dr. Arne Fjellberg [4, 5].

Photographic Documentation

After the photographic documentation of about 120 species from the collection in Görlitz, about 30 more species from the private collection of Dr. Fjellberg were photographed. The total number in our documentation is 118 out of the 121 genera and 160 out of 416 species listed in the *Nomina Collembola Germanica* [2]. For every species the habit and the characters important for species determination were photographed resulting in a total number of 586 pictures. The meta-information on the photographs like species, sampling location, body part, magnification and filters was documented in an Excel file.

Each photo contains a scale and was composed of up to eight single pictures from different image planes. Particles or other optical perturbations in the background of the object often were deleted by an image processing software (Corel Photo Paint 10.410).

Presentation of the Project

A poster summarising the results of the photographic documentation [6] was presented on the Biolog-GBIF-D-Workshop (Dec 2003, Berlin) and on the International Colloquium on Apterygota (Sept 2004, Rouen, France)

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SysTax-GBIF: The systematic and taxonomic database system *SysTax* as node software for the German GBIF nodes Evertebrata I, Evertebrata II, and Vertebrata

Umbrella project: GBIF-D Entomology – German national node Evertebrata I (Insecta)

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Keywords: GBIF-D, GBIF-Germany, *SysTax*, ORACLE DBMS, biodiversity data, botanical systematics, zoological systematics, botanical garden, herbarium management, multimedia data, biological database system

Abstract

The *SysTax* database at the University of Ulm has been chosen by the three German GBIF nodes Evertebrata I, Evertebrata II, and Vertebrata to serve as their common central database and GBIF data provider. Additionally, the botanical data of the “Botanical Garden Information System *SysTax*“ of the BIG project (German Federal Information System Genetic Resources) and the herbarium accessions of the herbaria of Ulm and Jena are stored in *SysTax* and made available to GBIF-International and the GBIF-D Node for Botany. The data are either keyed in from the *SysTax* client software or imported from other local database systems or simple spreadsheet files. The number of collection data sets will reach about 300,000 by the end of 2004.

Results

The system which is based on the ORACLE database management system has from the very beginning been implemented not only as a multi-user system but also as a "multi-institutional" system. Several scientific institutions can store e.g. their collection data separately but the data of all institutions and collections can be queried for an overall evaluation. Because of this feature the system can be used for installing comprehensive information systems on the Web. A "security system" hides sensible data from being read by the public thus avoiding an abuse of data to the greatest possible extent.

Furthermore, *SysTax* has been developed as a “concept based” system thus allowing the storage of multiple “opinions” of a name regarding its circumscription (taxa below its own rank and its synonyms) and its belonging to a taxon of higher rank. Every single “taxon” of a concept is called a “potential taxon” [1] or, according to the zoological code, a “taxonomical taxon”.

Because of its being a “multi-user” system, “multi-institutional”, and “concept-based” system *SysTax* can also be used for building up comprehensive information systems on the Web. The first of these information systems was a “Botanical garden information system” which later contributed its data to the BIG project (German Federal Information System of Genetic Resources, see Roscher et al., this volume).

Within the BIOLOG Project *SysTax* has been used as central data repository for the “Entomological Data Information System - EDIS“. In collaboration with EDIS detailed data exchange format definitions have been developed which could then be used also for data import of GBIF data.

Based on the development mentioned and the experiences with data import from different local database systems as well as normal data entry via the *SysTax* client software, the *SysTax* database at the University of Ulm can be used as data warehouse and provider software for GBIF nodes. Three of the German GBIF nodes (Evertebrata I, Evertebrata II, and Vertebrata) decided to use *SysTax*. Additionally, the botanical data of the “Botanical Garden Information System *SysTax*“ of the BIG project (German Federal Information System Genetic Resources) and the herbarium accessions of the herbaria of Ulm and Jena are stored in *SysTax*.

Based on the BioCAsE wrapper software and using the ABCD XML schema, the data stored in *SysTax* can be queried from the portal of GBIF-International via three separate wrappers for zoological, botanical, and garden data. The *SysTax* database can of course also be queried from the *SysTax* web pages and the web pages of the three nodes mentioned.

The *SysTax* system has been developed at the University of Ulm and the Ruhr-University of Bochum since 1989 with the support of the DFG (Deutsche Forschungsgemeinschaft), the GTZ (Gesellschaft für Technische Zusammenarbeit), the University of Ulm, and the BMBF (“Federal Information System Genetic Resources – BIG”, Th. Stützel, Ruhr-University of Bochum and BIOLOG, J.R. Hoppe, University of Ulm).

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SysTax – Task Profile



Botanical and zoological systematics and taxonomy

Concept based storage of names and (potential) taxa; flexible synonymy; linkage of taxa with literature and specimens

Literature

Storage and administration of references; cross referencing literature data and taxa; storage of literature scans

Botanical Gardens

Storage and administration of garden accession data; label printing; retrieval of accession lists

Creation of seed catalogues; mailing lists for seed catalogues and seed material

Herbaria and zoological collections

Storage and administration of accession data; administration of loans;

Output: labels, revision labels, specimen lists, letters for loan, reminders, exchange, and returns

Vernacular names

Addresses

Information on Taxa (IOT)

Storage and retrieval of information on taxa, represented by names and/or collection items: texts, pictures, movies, sound, and OLE-objects;

World Wide Web outputs

queries and taxon-browser

Import definitions and routines

SysTax-light

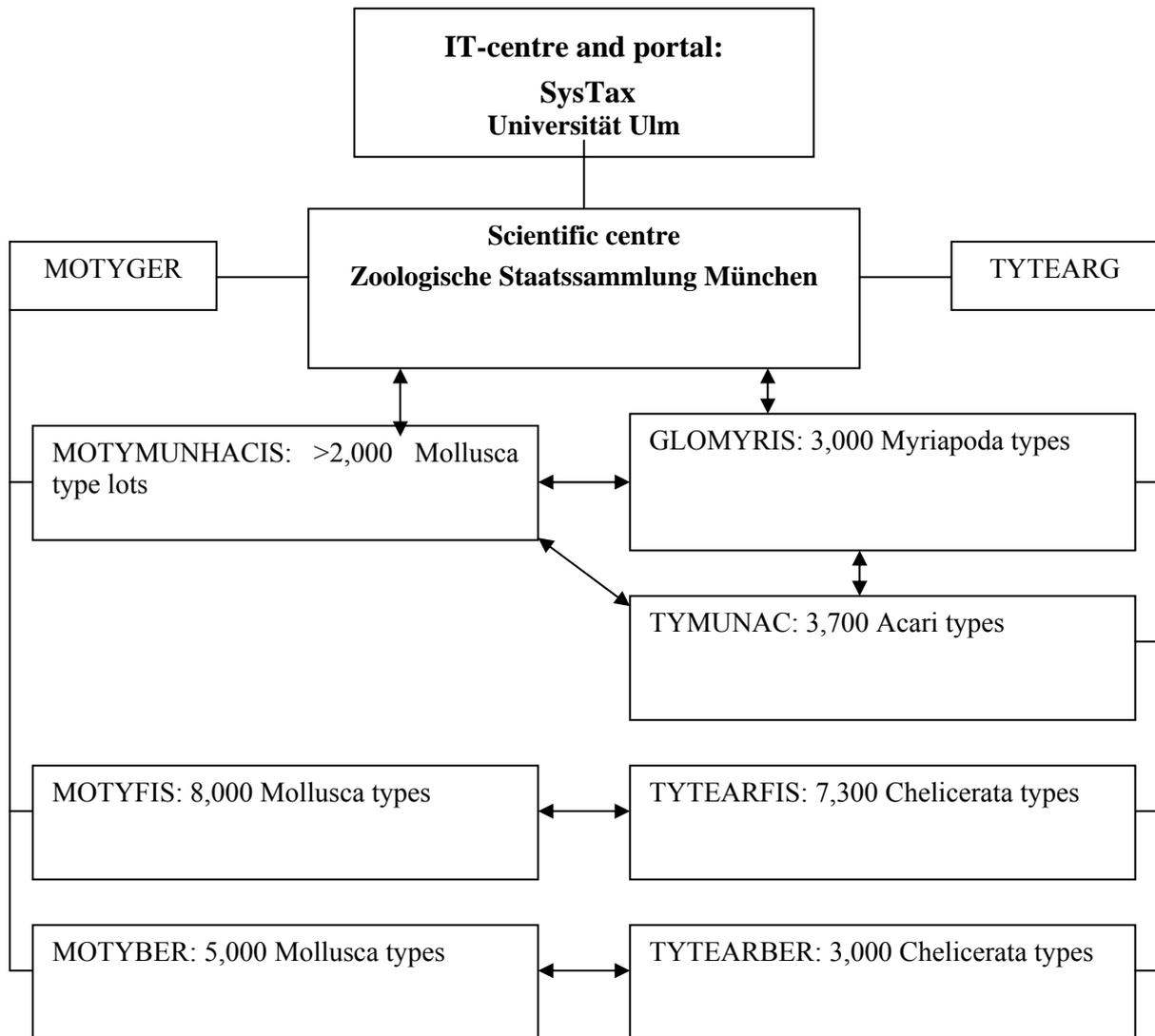
Database system for entering collection data off-line and for a simple botanical garden management.

GBIF data provider facilities

Three BioCase (ABCD-schema) “wrappers” for botanical collections, zoological collections, and garden accessions.

GBIF-D Evertebrata II

Mollusca, Myriapoda & Chelicerata type database



Projects in the GBIF-D Evertebrata II Node

Taxonomic types in the Third Millennium – A major perspective of GBIF-D

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Keywords: GBIF-D, GBIF-Germany, types, taxonomy, collections, GBIF

Abstract

All biological data on species are correlated by names. However, the latter are an interpretation of the evolutionary process depending on the actual state of knowledge and are therefore not static but dynamic. To ensure stability of names, type specimens are necessary. Because Germany is among the world's leading nations with regard to deposits of types, several nodes in GBIF-D have set a priority on the digitising of type specimens housed in German collections. The Internet provides a perfect technology to facilitate type searches significantly, but the transmitted data cannot replace the type itself.

The basic problem

All investigations on organisms are done on individuals or clones. Extrapolation of these results to the species and higher levels of evolution as well as correlation of biological data of all kinds are done via the name of the (sub-)species under investigation. In fact, this is done since the origin of mankind, and in a truly scientific way since Linnaeus. However, species names are always a probabilistic expression of the current state of knowledge depending on both, the actual data set and the philosophy of interpretation (e.g., “lumpers” versus “splitters”). Therefore species names are a dynamic matter rather than an iron fundament of the biological data-world.

The basic solution

Since the early days of scientific systematics, taxonomy has developed a double-strategy in order to ensure maximal stability of the principal dynamic matter of species names. (1) Highly sophisticated legislatives (the “Codes”) provide clear (though often complicated) rules to clear up priorities and usage of formal names. (2) Each name, which has been proposed for an (multicellular) organism new to science, should be based on type specimens. By that original and uniquely historical specimens are designated (if several specimens are available, the author usually designates a single individual as “holotype”). Thus, type specimens are the “urmeter” of the respective species name. Regardless whether the original proposal (“this represents a new species”) is later followed or not – and often this decision changes repeatedly over time – the type specimen(s) provide(s) the unequivocal and thus stable basis of the original proposal of the name. Indeed, the types are the fundament of all correlations and extrapolations of all kinds of biological data. Because of that importance, biological collections globally take particular care of their “types” and have published specific “type-catalogues” in order to provide the scientific community with the knowledge about the presence, location, and actual conditions of type specimens. Regardless of the particular taxon, checks and loans of types hold the majority of all usages of biological collections by scientists.

Objectives of GBIF-D

Together with the USA, Great Britain and France, Germany is among the world leading nations in having type specimens from all over the world. Germany research collections house many tens of thousands of types throughout the organismic kingdoms. Because of that the German institutions have a high responsibility to curate this cultural and scientific world heritage over decades and centuries,

and to make it available to the global scientific community. Nowadays, the Internet provides a perfect instrument to enhance and facilitate fast checking of types, if the relevant information (presence, location, condition, label data, etc.) are provided by the holder. However, the overwhelming majority of German types are not digitised and a high number is “cryptic”, i.e. the holding institution or the respective curator does not know about its existence due to historical reasons and (compared with the size of the collections) very limited manpower. It is the declared aim of several nodes of GBIF-D to digitise all (known) types of German collections in their respective taxonomic field. Details of digitisation are provided by the reports of the various projects.

Results – the current state of the art

Throughout the taxa and the various nodes the overall framework is virtually the same: (1) The coordinative network of each node and the overall activities of GBIF-D have led to a standardisation of type-digitisation in the respective supergroup. This standardisation will already enhance and facilitate future type searches in German collections significantly. (2) Nodes concerning smaller systematic entities (e.g. Vertebrata; currently about 100,000 species names) and sub-projects concerning smaller collections (e.g. Mollusca in Munich) will reach the original objective to place all type specimens in the given time frame of the current supporting phase in the World Wide Web. (3) Nodes with much larger entities (particularly the Insecta with currently about 2 million species names, i.e. 20 times the vertebrates) or sub-projects concerning larger type-collections (e.g. the zoological collections in Berlin-Humboldt) cannot reach this aim because of the given limitations of man-power, although substantial progress has been made. (4) Because of the GBIF-D activities a high number of cryptic (i.e. not clearly designated or labelled) or seemingly lost or destroyed types have already been detected in nearly all large German collections. Indeed, the estimated number of type-specimens has increased between 10 and 20, sometimes even to 30 percent. This will result in a substantial progress concerning the stability of the respective names (see above).

Prospects

There is no doubt that GBIF-D should finish the major aim to provide all German types via the World Wide Web. In particular the Insecta, but also other large invertebrate taxa have to continue the started activities in order to fulfil German responsibilities for this kind of world heritage. However, it has also become clear, that regardless of the quality of web-data on a type specimen, these data will never replace the types themselves.

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Inventory of molluscan types at the Zoologische Staatssammlung München (ZSM), the Zoologisches Museum der Universität Hamburg (ZMH), and the Haus der Natur, Cismar

Umbrella project: GBIF-Germany, Evertebrata II (Mollusca, Chelicerata, Myriapoda)

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Key words: GBIF-D, GBIF-Germany, Mollusca, type material, database, biodiversity

Abstract

The molluscan collections of the ZSM, ZMH, and of the Haus der Natur, Cismar were searched for potential primary types. So far, 782 lots with primary types have been discovered. 1,551 lots of molluscan types including those with primary types have been catalogued in electronic databases during the MOTYMUNHACIS sub-project in the framework of GBIF-Germany. Species names and museum label data of all primary types are made available on-line through the *SysTax* database system. In addition, collecting data, literature citations, comments on the type status, as well as digital images of many type specimens and museum labels are provided. Future projects should include 1) type research, i.e. clarifying the status of questionable material, 2) an inventory of an estimated 2,000 further molluscan paratype lots housed in our institutions, 3) a complete digital photographic documentation of specimens of all species with primary and secondary types together with their museum labels, as well as 4) providing digital images of the older original literature descriptions.

Objectives

The molluscan collections of the Zoologische Staatssammlung München (ZSM), the Zoologisches Museum of the Universität Hamburg (ZMH) and the Haus der Natur, Cismar together comprise over 400,000 specimens lots with an estimated number of well over 3,000 type lots. The preservation conditions in all three institutions are comparatively good, but previously only minor parts of the types were catalogued or recorded in electronic databases. During World War II, considerable parts of the collections of the ZMH were destroyed or may have been lost (ZSM), the true content of type material was unknown for all three collections. In order to facilitate international access to these large molluscan collections that are amongst the most important ones in Germany, and to provide online information on existing types, the MOTYMUNHACIS sub-project intended to perform an inventory, documentation, and revision of all type lots. Due to a significant decrease of the available budget, our project aims had to be restricted to the inventory of primary types and to making available basic information on species names and collecting data as present on the museum labels. This information is entered into a electronic database and transferred to the *SysTax* system that was selected to function as an Internet portal for all sub-projects of the node Evertebrata II within the framework of GBIF-Germany.

Results

In co-operation with other members of the GBIF-Germany Evertebrata II Node, a standard classification of molluscs was developed. The molluscan taxonomic tree was implemented in the

relational database *Specify* 4.6. The user interface and some field definitions of *Specify* were modified according to field definitions and requirements of the *SysTax* database system.

At the ZSM, the complete molluscan collection was screened for potential primary type material. In total, the collection includes 505 primary type lots (143 holotypes, 13 lectotypes, 8 neotypes, 106 cotype lots, 235 syntype lots). Basic information (i.e. species names, type status according to the museum labels, and accession id's) of all primary types and of an additional 554 secondary type lots (516 paratype, 38 paralectotype lots) was entered into the *Specify* database (Aug. 2003 – Sept. 2004, half-time). In a second step, of so far 354 types, extensive information on the taxonomy, type status, collecting event, specimens, museum label data, and literature citations were incorporated into the database. Many of the primary type specimens and the corresponding museum labels already were photographed digitally. Literature with original species descriptions is continuously being obtained and critically revised, the type database is supplemented and corrected accordingly. Type catalogues including all polyplacophoran, scaphopodan, cephalopodan, lower heterobranch and opisthobranch gastropod type material have been prepared, others will follow successively.

At the ZMH, large parts of the molluscan collection were screened for type material. So far, 342 type lots including 43 holotypes, 5 lectotypes, 1 neotype, and 78 syntype lots were identified. Available information was incorporated into a modified *Specify* database by student workers and the museum staff. Additional primary type lots are being discovered continuously. Syntype lots include e.g. several species described by Menke and L. Pfeiffer.

At the Haus der Natur, Cismar, complete information on 90 holotypes together with digital photographs of specimens and literature citations were made available electronically and transferred to *SysTax* by student workers and museum staff. 60 syntype lots were registered; their actual type status is in the process of being revised, additional potential syntypes are checked. About 500 lots of secondary types (most of them paratypes) still have to be incorporated.

Parts of the existing datasets have been transferred to *SysTax*, the remaining datasets are following at present. Data on further types and digital images of specimens and museum labels will be added until the end of 2005. Many type lots require research on their actual type status on the basis of original literature descriptions. This is, however, far beyond the scope of this MOTYMUNHACIS project.

Prospects

Funding of the current MOTYMUNHACIS project is already terminating at the ZSM and in Cismar, the set targets are being more than fulfilled in all three institutions. Our museum staff will supplement the existing datasets continuously, thus we are sure to provide *SysTax* with comprehensive information on all primary molluscan types known to us in our collections until end of 2005. Future projects should include 1) type research, i.e. careful revision of original literature and comparison with our type specimens, 2) inventory of approx. 2,000 paratype series which may include a substantial number of so far unknown primary types, 3) a complete digital photographic documentation of type specimens and museum labels, and 4) digital images of the relevant literature descriptions and illustrations of at least older material.

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Registration of the primary types in the mollusc collection of the Forschungsinstitut und Naturmuseum Senckenberg

Umbrella project: GBIF-Germany, Evertebrata II (Mollusca, Chelicerata, Myriapoda)

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Keywords: GBIF-D, GBIF-Germany, molluscs, primary types, Forschungsinstitut Senckenberg, *SeSam*

Abstract

The sub-project MOTYFIS (MOlluscan TYpes of the ForschungsInstitut Senckenberg) comprises the identification of primary types of molluscs and their registration in the database *SeSam*. It focuses on the superfamilies Orthalicoidea, Clausilioidea and Helicoidea. The types of Orthalicoidea have been completely identified, the other two groups are currently processed. The processing of data follows a strict procedure, thus ensuring a high quality of the resulting datasets. In parallel with this task, the datasets will be published as type catalogues to facilitate comprehensive access. At present, more than 3,000 datasets concerning primary types are available in the database.

Objectives

The project aims at identification and registration of the entire primary type material of molluscs housed in the collection of the Forschungsinstitut Senckenberg. The essential data related to these types (reference of original description, type locality, measurements, catalogue number, collector, source, remarks on original label etc.) are entered into the online searchable database (*SeSam*) together with a digital image of the specimens, if available.

Results

The successful implementation of MOTYFIS first of all required the development of a strategy to produce the largest possible number of datasets while ensuring high-quality (i.e. thoroughly validated) content. For this purpose, all data sources available were assessed in order to form an estimate of the number of primary type specimens (i.e. holo-, lecto-, neo- and syntypes) housed in the collection. Then followed the identification of key groups that could be considered as targets of a complete data collection within MOTYFIS. After ranking these groups according to criteria such as their number of species, general importance and representation in the collection, the ones to be treated within MOTYFIS were selected.

The main sources used were published type catalogues as well as unpublished notes from the archives of the Malacology Department of the Forschungsinstitut Senckenberg. Analysis was restricted to information on specimens that had already been identified as types. The second step was to calculate the actual number of types in view of the geographical, taxonomical and historical focus of the collection and the degree to which it covers the phylum Mollusca.

The preliminary assessment yielded 4,573 published records of molluscan type specimens. Unpublished notes and file cards hold information about another 3,005 nominal taxa, which results in a total of 7,578 records. Taking into account that the available data sources mainly cover terrestrial snails, we estimate the number of primary types in the entire collection at a minimum of 10,000 type lots (Fig. 1).

With the identification process completed, the stylommatophoran superfamilies Orthalicoidea, Helicoidea and Clausilioidea were chosen as key groups. Orthalicoidea embrace three families: Bulimulidae with the main distribution in South America, Orthalicidae from Florida, Cuba and Mexico, and Placostylidae from several island groups in the Central Pacific. In the course of the project, the complete set of type material of this superfamily present in the Senckenberg collections

was registered. Each specimen assumed to represent a type was examined in order to ascertain the validity of its status, especially so for historical material which had entered the collection via exchange with various authors from the 19th century. A time-consuming but crucial task was the extensive study of the pertinent literature, which proved necessary to determine the status of the majority of doubtful material. In our opinion, this procedure is indispensable to ensure reliable high-quality results and should in fact be a prerequisite for any scientifically sound data collection. Only data meeting this standard of verification should be entered into the database, rather than more or less uncritically copying data from existing labels or catalogues.

At present, the database *SeSam* contains approximately 3,000 datasets of primary types. In addition to these, another 1,300 lots of further type material, such as paratypes and paralectotypes, have been registered. Also, identification and registration of the types of Clausilioidea and Helicoidea, the two most important and specious Eurasian superfamilies of terrestrial gastropods, is in progress. A type catalogue for the Orthalicoidea with colour photographs of all type specimens is currently being published [1].

For the remaining duration of the current sub-project MOTYFIS, the work on parts of the superfamilies Helicoidea (Palearctic) and Clausilioidea (worldwide) will continue including transfer of already published datasets into the database *SeSam*. Regarding the anticipated continuation of the project within the framework of GBIF, it seems very promising to establish an international collaboration for type registration focused on selected groups of tropical terrestrial gastropods. Especially for taxa that are on the verge of extinction, type catalogues and online databases could stimulate and facilitate the urgently needed systematic work, and also demonstrate the amazing biodiversity of terrestrial snails. Our project was designed to follow these ideas, and we intend to include more of the tropical groups of land snails.

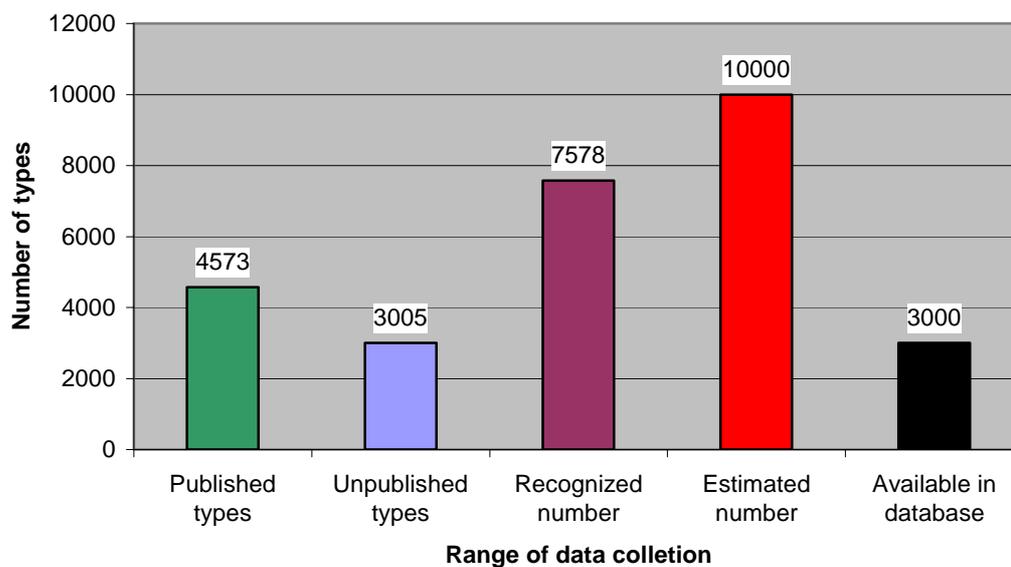


Fig. 1: Number of recognised primary type specimens

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Inventory of the molluscan types in the Museum of Natural History, Berlin (MOTYBER)

Umbrella project: GBIF-Germany, Evertebrata II (Mollusca, Chelicerata, Myriapoda)

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Keywords: GBIF-D, GBIF-Germany, Mollusca, types, inventory, Museum of Natural History Berlin, MOTYBER

Abstract

In the project MOTYBER (= Molluscan Types of Berlin), types and type series representing 4,220 taxa have been identified and databased in the Internet based facility *SysTax*. During the course of this project, numerous types were located at the Malacological Collection of the Museum of Natural History, Berlin (= ZMB; formerly 'Zoologisches Museum Berlin'), of which there was no previous record or which were supposed to be lost. Based on a comparison of the numbers of already catalogued with that of still un-catalogued types kept in this collection, the estimates on the total number of types held by the ZMB has to be raised from about 5,000 to approximately 8,000 to 10,000. Consequently, although information on a considerable number of types has been made available for the first time to the scientific community via the Internet, only approximately 50 to 70 percent of the holdings are inventoried so far. This underscores the necessity of a continued funding for type inventory and databasing in the near future.

Objectives

The Malacological Collection of the ZMB is one of the largest and most important in the world and can be compared by means of its scientific value and its extend only with those in London or Paris. Roughly nine million samples of more than 55,000 species of molluscs are held by ZMB. These represent all major groups and originate from all regions of the world, including e.g. the Antarctic and Deep Sea as well as the tropical forests of South America, Africa, and Asia.

The number of molluscan types and type series held by the ZMB is not exactly known because the collection is still poorly documented; cautious estimates based on preliminary surveys range between 8,000 and 10,000 taxa, which means that about 7 % of all described molluscan taxa are represented in the ZMB by their types.

This extensive type collection is owed to the scientific work of the former curators F. H. Troschel, E. von Martens, J. Thiele, and B. Rensch, whose types for the most part are housed with the ZMB. In addition to that, the museum harbours the collections of some important malacologists of their time, such as W. Dunker, F. Paetel, H. Rolle, H.A. Schmidt, and J.C. Albers, including most of their types as well as the exploits of major German research expeditions of the late 19th and early 20th century, such as the German Deep Sea Expedition (1898-1899), the German South Pole Expedition (1901-1903), the Michaelsen-Hartmeyer Expedition to South Australia (1905), and the Sunda Expedition (1927). Numerous types of taxa described by other well-known malacologists, such as for example R.A. Philippi, S. Clessin, K.L. Pfeiffer, O. von Moellendorff, H. von Maltzan, and C.F. Jickeli among German authors as well as for example A.T. Monterosato, H.B. Preston, P. Dautzenberg, and H.B. Smith from abroad complement these holdings.

Situated in the East of the formerly divided city of Berlin, the ZMB has faced a long period of neglect, however. A period of stagnation and omission in regard to either a modern collection management as well as to a prospering scientific communication and exchange was lasting from the beginning of World War II until the re-unification in 1990. Since then, the ZMB step by step is regaining its international reputation and impact as one of the major European scientific collections and natural history institutions. In this context, the international GBIF initiative has provided an excellent opportunity to conduct collection based research, which usually is underfinanced. However, the importance of this research for other biological disciplines cannot be overestimated.

Results

The MOTYBER project was planned and granted for a period of three years starting in 2003. A scientific assistant can only be employed for 1.5 years, however, due to budget cuts. For 2005 funding is limited and allows only for the employment of students by short termed contracts but not of a scientist, who would be able to work much more efficiently. Due to this shortage of funds and personnel, considerable further progress in the inventory is not expected to occur in 2005. So far, in the ZMB a total of 7,887 samples of types representing 4,220 described Molluscan taxa were identified and databased. Among these types, there are 1,181 holotypes, 447 lectotypes, 2 neotypes, 445 paratypes/paralectotypes or series of paratypes/paralectotypes, 2,022 syntypes or syntype series, and 123 specimens or series of uncertain type status.

How important the MOTYBER project was - and still is - to achieve a more comprehensive overview of the type holdings, is illustrated in the following table by some examples of smaller molluscan groups that have already been completely inventoried.

Tab. 1: Types of some smaller molluscan groups held by the ZMB

Taxon	Number of types previously known to exist	Number of types catalogued in the project MOTYBER
Cephalopoda	41	48
Aplacophora	0	27
Ampullariidae	12	42
Pteriidae	0	21
Teredinidae	2	60

Sub-project duration: Feb. 2003 – Dec. 2005, lead: Matthias Glaubrecht, matthias.glaubrecht@museum.hu-berlin.de

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The Global Myriapod Information System (GloMyrIS) – An aid for scientific research

Umbrella project: GBIF-Germany, Evertebrata II (Mollusca, Chelicerata, Myriapoda)

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Keywords: GBIF-D, GBIF-Germany, type material, database, Myriapoda, *SysTax*, GBIF, ZSM

Abstract

The GloMyrIS project provides information, e.g. on synonymy, taxonomic position, link to references, type localities and type depository, to help scientists of all disciplines, who need information about myriapods, to work more effective.

Objectives

The GloMyrIS project [1] provides databases that facilitate taxonomic research on myriapods (Chilopoda, Diplopoda, Pauropoda and Symphyla). Though the GloMyrIS databases are at the moment mainly used to establish an online-available database for myriapod types housed in German museums, their primary design is that of a worldwide myriapod information system providing data about, e.g., the status of taxon names, available descriptions and geographical distribution. The heart of the system is a module that prove the statements by published references. At present, these connections between taxon names and literature records are used to identify unsigned types.

The core of the current project phase is the refurbishment of the material described by Karl Wilhelm Verhoeff, being distributed over several German museums and for various reasons causing taxonomic and conservatory problems, e.g. type conflicts. The recording of material from all German collections by a single project guarantees that no differences caused by different taxon concepts occur and that all information of a given myriapod taxon is shown in a consistent manner.

The information collected by the GloMyrIS project is primarily stored in a local database system containing several features not yet implemented in the main portal [2]. The databases' content is mirrored to *SysTax*, and from there accessible on-line [3]. Additional information is loaded as soon as the portal provides the necessary interface. Together with TYMUNAC, TYTEARBER and TYTEARFIS, GloMyrIS is one of the TYTEARG sub-projects of the Evertebrata II node [4].

There are two main problems that hinder fast data checks: (i) Myriapod type recording suffers from the lack of global species catalogues. The few genus and/or species catalogues existing for some subgroups and countries, respectively, are linked to the database via literature-taxon-connections. (ii) The state of the collection of K. W. Verhoeff, especially its main part left as heritage to the ZSM in 1945, was highly unsatisfactory at the beginning of GloMyrIS. No inventory has ever been produced and the types were not signed. Hence, the complete collection had to be recorded and our type numbers include slides containing several specimens or specimens distributed over many preparations plus alcohol-stored material that cannot be grouped together at present. Therefore, the main focus has been set on the ZSM collections since the beginning of GloMyrIS.

Results

The micropreparations are now completely recorded, including several slide and label scans; the recording of the alcohol material is presently done. In addition, the old inventory catalogues of the Museum für Naturkunde Berlin and the Zoologisches Institut and Museum Hamburg have been recorded, but require a cross-check with the existing material. The content of other collections has been recorded to a smaller extent, based on published data only. Furthermore, a remarkable number of types have been recorded for which the present depository is not known.

For some species pictures (photos, drawings and scans of descriptions) are provided, which enable an online alignment of the user's material with collection material including the types. The geographical origin of some types, which have been supplied with co-ordinates, can be shown on a map via *SysTax*. A survey of the number of datasets and the types of information included is given in Tab. 1.

Tab. 1: Summary of results

Estimated type numbers	3,000
Material recorded	10,000
media files	5,000
taxon-literature connections	30,000
taxa in database	17,000

The results and methods of the project have been promoted through articles and presentations [5, 6].

Prospects

A large amount of work is still to be done on the ZSM collection and other German museums. The Senckenberg Museum collection (Frankfurt) remains as an incalculable factor, as the collection is hardly accessible at the moment. Fortunately it contains mainly recent types, documented quite well in literature (original descriptions) but not yet summarised. As a by-product GloMyrIS provides a remarkable contribution to a global species catalogue, and therefore to the ECAT (catalogue of names of known organisms) programme of GBIF. Furthermore, GloMyrIS will not only provide information about German types to the GBIF portal, but also distributional records for projects like the European Invertebrate Survey (EIS) and the Fauna Europaea project. Therefore the inclusion of non-types and geographical references to their locations is highly desirable.

Inclusion of partly identified material the GloMyrIS databases might encourage specialists to do extended studies. For such topics a photographic documentation of the main taxonomic features has been started. I should allow a fast online determination of myriapods and recognition of un-described species. Tools that facilitate descriptive research might complete the GloMyrIS databases in the future.

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TYMUNAC – The type database of the Munich Acari collections

Umbrella project: GBIF-Germany, Evertebrata II (Mollusca, Chelicerata, Myriapoda)

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Keywords: GBIF-D, GBIF-Germany, type specimens, database, Acari, *SysTax*, GBIF, ZSM

Abstract

Within the TYMUNAC project, a database is established containing information on the more than 3,500 type specimens of six large mite and tick collections gleaned in the 20th century by most reputable acarologists and now stored at the Bavarian State Collection of Zoology in Munich (ZSM). At present, the database contains, e.g., detailed information on primary types (> 900), taxon literature connections (> 1400) and media files for the *SysTax* portal. Our aim for the future is the completion of the type database and addition of further kinds and sources of information.

Objectives

The „Arthropoda varia“ collection housed at the ZSM includes six large Acari collections of high taxonomic importance, i.e. those of Graf H. Vitzthum, L. Kneissl, C. Willmann, W. Hirschmann and E. Popp with altogether about 3,700 type specimens, mainly in Hirschmann’s Uropodina. The TYMUNAC project seeks to establish a database providing thorough information on this type material including the locus typicus, citations, synonymy, taxonomic „backbone“, and media files accessible on-line via the GBIF-portal and *SysTax*, respectively (see also [1]). Together with GloMyrIS, TYTEARBBER and TYTEARFIS, TYMUNAC is one of the TYTEARG sub-projects of the Evertebrata II node.

Results

In order to establish the TYMUNAC database we followed a 3 step procedure:

- (i) As a taxonomic backbone J. Hallan's extensive Acari taxonomy was introduced, a comprehensive approach to establish a modern, complete mite system down to the subspecies level, made by leading authorities in the respective fields [2].
- (ii) In a second step potential type specimens are recorded based on information available from specimen labels and an older card-file based catalogue. Data verification and completion is reached by consulting the original species descriptions. This is of particular importance concerning information on the type status and the proper locality of the specimens, since information derived from our original labels only is usually very scarce. A survey of the number of datasets and the types of information included is given in tab. 1.
- (iii) Furthermore it is aspired to attach additional data on parts of the specimens very useful for the scientists using the database, e.g. media files of types and labels, as exemplified in figures 1-3, which show different data sources for our types (scan of original description, whole slide with primary label and image of a specimen).

Data are stored in a local database (*Specify* 4.6) used for data recording. Afterwards, all datasets are imported into the *SysTax* database system providing the GBIF-portal, which allows availability of these data via the Internet [3].

Tab. 1: Summary of results of the TYMUNAC project

Estimated number of types	3,770
Material recorded	2,281
Media files labels	524
Media files specimens	681
Taxon literature connections	1,412
Taxa in database	*18,200
Number of types	1,619
Number of primary types	**938

*including overlap with oribatid taxa from the OBIF-project;

**holotypes, syntypes, lectotypes and neotypes.

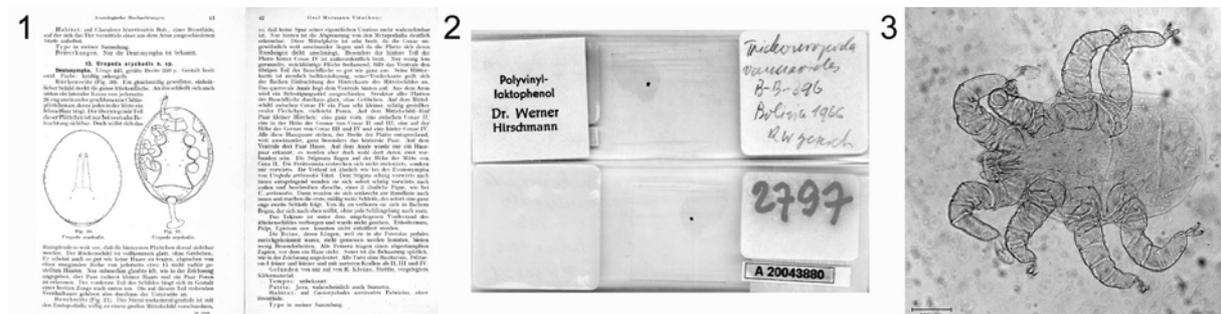


Fig. 1: 1: Scan of an original description; 2: Whole slide with primary labels; 3: Image of a specimen

Prospects

Our main goal for the remaining project time is to complete our datasets on the Munich Acari collections in a way that they fulfil all the needs of an electronic type catalogue. In the future we will seek to expand the “media file” part of the database, i.e. to establish a complete pictorial atlas of the types providing thorough information on the Munich types via the Internet. In addition type material of other German collections should be handled in the same way. Our long term objective is to contribute to a worldwide Acari database combining various types of information according to GBIF’s species bank concept.

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Sub-project duration: Oct. 2002 – Dec. 2005, lead: J. Bohn, j.bohn@zsm.mwn.de

Supported by the GBIF Programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0205, Oct. 2002 – Dec. 2005, lead: G. Haszprunar, haszi@zsm.mwn.de.

An electronic future for some famous old arachnids (Projects: TYTEARBER & TYTEARFIS – Types of the Terrestrial Arthropods of Germany, Berlin & Frankfurt)

Umbrella project: GBIF-Germany, Evertebrata II (Mollusca, Chelicerata, Myriapoda)

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Keywords: GBIF-D, GBIF-Germany, Arachnida, type material, database, GBIF, *SysTax*, *SeSam*

Abstract

Detailed data (repository, locality, collector, condition, etc.) for the types of 9,900 arachnid species held in Frankfurt and Berlin is now freely available on-line through the *SeSam* and *SysTax* databases as part of the GBIF (*Global Biodiversity Information Facility*) project. A large part of both collections has been researched and databased; the remainder will be added in 2005. The Berlin (TYTEARBER), Frankfurt (TYTEARFIS) and Munich (TYMUNAC) projects – the latter addressing mites – hope in future to expand these databases to include images of specimens and/or the relevant literature to create a collaborative online ‘picture atlas’ of German arachnid types.

Objectives

The TYTEAR projects in Frankfurt and Berlin are producing an online database of arachnid type material. These two Museums together house the largest and historically most important type specimens of spiders, scorpions, harvestmen, etc. in Germany. These are the reference specimens designated when naming new species, and those belonging to many of the ‘founding fathers’ of German arachnology (CL Koch, Karsch, Dahl, Strand, Roewer, Wiehle, etc.) are housed in our collections. A healthy, and increasing, number of international loan requests (approx. 70 – 80 per year across both institutions) shows that this material remains highly significant for studies of systematics, biogeography and biodiversity.

In order to facilitate access to, and information about, our types we wish to publicise data about *what* we have, *where* exactly it came from and *what condition* it is now in. This is taking the form of online databases – the ‘virtual museum’ concept – offering unrestricted access to German collection data. This is particularly important for developing countries (from which much of our material originates) where access to library facilities is poor, and it will greatly speed up collection-based research by allowing international users to effectively browse the contents of our museums and plan research trips or loans accordingly.

Results

Since 2002 one scientific associate (Berlin) and three student assistants (Frankfurt) have been researching the type status of material, checking what we expect to be present against inventory catalogues, older card-file systems and the original descriptions in the literature. This first phase concentrated on spiders, scorpions, pseudoscorpions and the so-called ‘minor’ arachnid orders. For all these groups there are – almost uniquely among invertebrates – detailed and comprehensive systematic

catalogues of all published names available. This has allowed us to check the current status of the species names, i.e. whether the name is still valid or whether it is now considered a different species, or a member of a different genus to the one given on the original specimen label.

In the second phase (Tab. 1) the assembled data has been entered directly into online, client–server databases (*SeSam* and *SysTax*) using a secure Internet connection. The advantage of this is that the data becomes instantly accessible. Search engines are now linked to the respective museum homepages and their availability was advertised via a poster at the International Arachnological Congress in Belgium in August 2004. Individuals requesting loans are now being directed to these sites to encourage usage; with positive feedback, e.g. “*The list you sent and the online database are really useful.*” (Jeremy Miller, Smithsonian Institution, USA, Oct. 2004.)

Transfer of the Frankfurt data into *SysTax* – the database of choice for TYTEARG – is being prepared at the time of writing. The data entries for each type series include not only the name and repository number, but details of the locality and collector and (where appropriate) further notes about the condition of the specimen and/or comments from previous researchers. Over 11,000 taxon names have been entered from Berlin. The search engines allow users to look for types by name, by geography or by the scientist who described them. For both projects the final year will be devoted primarily to checking and entering data about mites and ticks (Acari), a species rich-group of considerable economic significance, but for which there are only partial catalogues available. Nevertheless, we expect to enter at least the basic data about our mite collections by the end of the current project.

Tab. 1: Summary of results to date (as of Oct. 2004)

	Berlin	Frankfurt
Staff employed via GBIF	1	3
Estimated number of type species	5,000	10,000
Number of type species in database	2,400	7,500
% of expected data already available	48	75
Literature citations entered	270	-

Prospects

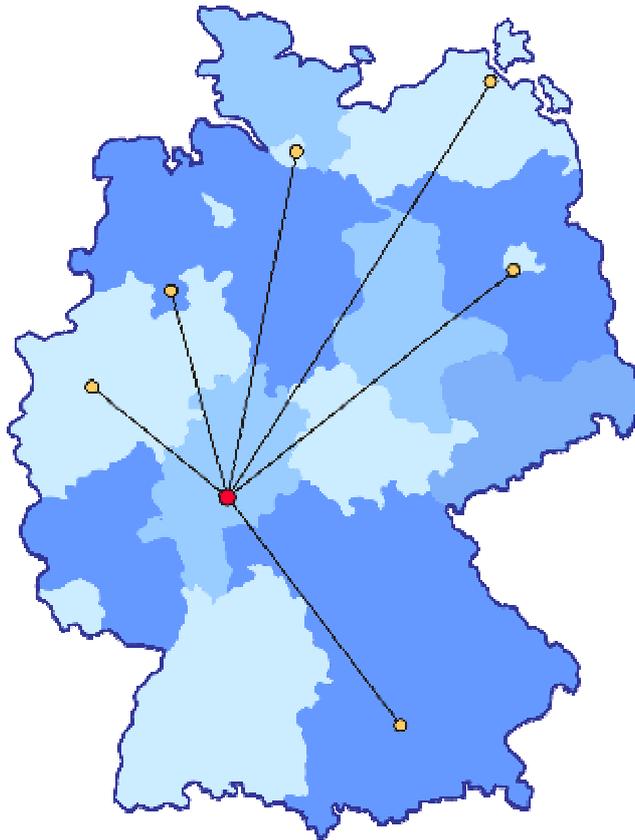
We expect to have almost all of our collection data on-line by late 2005. For the future we are hopeful of a continuation of the project, whereby our main focus would be the production of a *picture atlas* of our type material. What this means is associating each species entry with a digital image of the specimen(s) in its current condition, plus scanned, downloadable versions of the labels, original description and any illustrations in the earlier literature. We believe this could be largely achieved within a further three years and discussions with colleagues in arachnid research indicate this would represent a major service to our users.

Sub-project duration: Aug. 2003 – Dec. 2005, leads: J. Dunlop / P. Jäger, jason.dunlop@museum.hu-berlin.de / jaeger@senckenberg.de

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GBIF-D Evertebrata III

Crustacea, Evertebrata excl. Arthropoda and Mollusca



The GBIF-D Evertebrata III network

Digital documentation of type material of Octocorallia, and selected Hydrozoa and Scleractinia in German museum collections

Umbrella project: Co-ordination and type identification within the national GBIF Node "Evertebrata III" (Crustacea, Evertebrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-D, GBIF-Germany, Octocorallia, Hydrozoa, Scleractinia, type collections, Kükenthal, Haeckel, *SeSam*

Abstract

Type material of Octocorallia/Alcyonacea in German museums and Stechow's Hydrozoa types are recorded and databased in *SeSam* for reference through GBIF-D. Selected collections of Scleractinia of E. Haeckel (PMJ Jena, with types), and of H. Schuhmacher (UDE, Essen) are also included.

Objectives

The aim of the GBIF-D sub-project Cnidaria is the database compilation of type material of Octocorallia and selected Hydrozoa and Scleractinia in German zoological collections, including important reference specimens and collections (Haeckel collection). Based on the types review and database information selected genera will be subject to in-depth revision of taxonomic status.

Results

Octocorallia: To date (end of 2004) octocoral material of three co-operating museums was recorded and documented to prepare for data import into the *SeSam* collection database (for numbers see tab. 1). Type material in the ZM Berlin was divided into two sections (Alcyoniina and non-monophyletic Gorgonians) for optimisation of efforts. Tissue samples were taken in consent with curators responsible to complement data with sclerites characters (mounted in permanent slides). For input in *SeSam* all specimen data were referenced to primary literature, especially figures. Digital images and references were supplemented after elimination of remaining software bugs.

Tab. 1: Compilation of type material numbers recorded in collections of co-operating museums: Zool. Mus. Berlin (ZMB), Phyl. Mus. Jena (PMJ), Zool. Staatssammlung München (ZSM), Zool. Mus. Hamburg (ZMH), Senckenberg Mus. Frankfurt (SMF), Natural History Museum Vienna (NHMW), Zool. Mus. Wrocław (ZMW)

OCTOCORALLIA	till end 2004	scheduled in 2005
ZMB, Berlin	260 types recorded (Alcyonaria)	280 types (Gorgonaria)
PMJ, Jena	26 types recorded	-
ZSM, Munich	75 types recorded	-
ZMH, Hamburg	80 types recorded	80 types data input
SMF, Frankfurt	-	80 types
NHM, Vienna	(41 types listed)	to be included?
ZMW, Wrocław/Breslau	(64 types listed)	to be included?
Total no of types recorded	361+(80) types	360 (+80) (+ 105) types
Data input in <i>SeSam</i>	~ 315 datasets	~ 500 datasets
No of validated datasets	~ 100 datasets	~ 500 datasets
permanent sclerites mounts	80 types = 1040 slides	(40 types)
datasets with sclerite images	5	20-30 datasets

The largest proportion of octocoral types recorded refers to W. Kükenthal's work. Due to the former habit of swapping syn- or paratypes for reference between different museums, considerable numbers of such material were distributed throughout Europe. Reconstruction of type history and locations, cross-checking of labels and specimen IDs etc. thus often benefits from the compilation of data from different collections. The Vienna collection was included in the survey. Extension of the GBIF-project scope to include this collection was discussed with Dr. H. Sattmann. Type material in the Zoological Museum of Wrocław (ZMW, PL) will be surveyed in 2005 for the same reason. About 15% of type specimens revealed problems in verification of data and taxonomic status. Among the Alcyoniina, Nephtheidae and Nidaliidae are most prominent examples of taxa in need of further in-depth study.

Hydrozoa: From September 2003 to the end of 2004 the collection of Stechow's type material at the ZSM (Munich) was provisionally registered (Access), and will be transferred into the *SeSam* database (Tab. 2). Two approaches were used to identify type material from the collection (most of which with dubious documentation): (1) the literature re-examination of Stechow's descriptions and (2) the checking of hydrozoan samples in the collection. We found 467 units representing type material, which is substantially more than initially expected. So far it comprises of 102 alcohol samples and 365 micro-preparations on slides and seems to represent nearly the entire type material of Stechow. The type status of a major portion of the material will have to be left open – mainly because of difficulties with the synonymies used by Stechow. In extending the scope of the project, some 120 units of exchange type material from other authors can possibly be included after literature examination.

Tab. 2: Hydrozoa type material of Stechow in ZSM: numbers recorded and databased in *SeSam*

HYDROZOA	2004	2005
ZS Munich	all 140 units recorded and databased	Recording of 120 exchange types

Scleractinia: After a first visit to Jena in 2003 the Scleractinia collection by E. Haeckel and L. Plate was reviewed and recorded for the greater part during 2004. ID revision according to the current literature (Veron, 2000) and digital photo documentation was carried out for approx. 500 specimens of (tropical) corals with undoubted documentation, and listed in existing collection files (D. v. Knorre, Jena). Six type specimens published by Orthmann in 1889 were re-discovered from the collection, few others remained missing. All data filed will be transferred as an input format to be incorporated into the *SeSam* database. The scleractinian collection of the ZMB was surveyed for type specimens from Jena. ZMB holds several specimens collected by E. Haeckel in the Red Sea and Ceylon, carrying the note "from Museum Jena" (n=44). Among these some type specimens are labelled with reference to Brüggemann (1877, n=3) and to Orthmann (1889, n=8), with one colony being the holotype figured on Orthmann's plates. Other types in the ZMB collection refer to Ehrenberg & Hemprich (1834), Klunzinger (1877), and Studer (1887). Type material was documented by digital photos.

Tab. 3: Haeckel's and Plate's scleractinian collection in PMJ and ZMB recorded and databased in *SeSam*

SCLERACTINIA	2004	2005
PMJ, Jena	~ 500 recorded + ID, incl. 6 (?) types ~ 280 photographed	Data evaluation and publication, transfer into <i>SeSam</i> database
ZMB, Berlin	25+ types recorded	Dto.
UDE, Essen	Collection data recording in provisional file	Data transfer into <i>SeSam</i> database

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Sub-project duration: Aug. 2003 – Dec. 2005, lead: G. B. Reinicke, goetz.reinicke@meeresmuseum.de

Supported by the GBIF Programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0206, Oct. 2002 – Dec. 2005, lead: M. Tuerkay.

Enchytraeidae (Oligochaeta): Inventory and revision of type material in German collections

Co-ordination and type identification within the national GBIF Node "Evertebrata III"
(Crustacea, Evertebrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-D, GBIF-Germany, Annelida, Oligochaeta, Enchytraeidae, inventory, taxonomic revision

Abstract

Type specimens of Enchytraeidae (Oligochaeta) in German collections were registered and re-investigated light-microscopically for a taxonomically updated inventory.

Objectives

To establish a taxonomically updated inventory of type material of Enchytraeidae deposited at collections in Germany.

Results

Due to the complicated and largely unrevised taxonomy of the group, the main work consisted in the establishment of reliable baseline data. Apart from an inventory of museum collections, the exploration of type material was backed by a literature-based listing of types to be expected in German collections.

Most of the type specimens are deposited at the Hamburgisches Zoologisches Museum; a few more are present at the Staatliches Museum Karlsruhe and the Naturhistorisches Museum Berlin. Research for further collections (Knöllner and von Bülow) was unsuccessful. As to the Hamburg collection, several non-type vials were identified as containing type material. Collection-relevant data were added or rectified, based on a complete knowledge of the pertinent literature. The type status (holo-, syn-, paratype) was specified for older material. At present, 66 nominal species of Enchytraeidae are represented with type material in the Hamburg collection. The *Fridericia* collection, recently revised and considerably enlarged [1], was registered completely. Type and also several taxonomically important non-type specimens were investigated light-microscopically, those deposited by the first author excepted. Ethanol-preserved specimens were whole-mounted either in glycerine or in malinol and then re-transferred to ethanol. Misidentified specimens were removed from the respective type series. A few types are misidentified (or confused) as a whole. The exact number of type specimens (often a large bunch of previously uncounted syntypes, undifferentiated labelled "type") was established.

Type descriptions include state of preservation, state of maturity and light-microscopical anatomy of inner organs. Many new characters were discovered, mistakes in the original descriptions were rectified. In seven cases, the taxonomic status of the nominal species was altered.

Due to technical problems, all data are currently saved as a Microsoft Access File and will be entered into *SeSam* shortly. Several taxonomic decisions had to be postponed, pending additional investigations of material deposited in non-German collections. An enlargement of the programme towards a taxon-based focus is, from the viewpoint of this sub-project, highly welcome.

Reference

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Sub-project duration: Jan. 2003 – Dec. 2004, lead: W. Westheide, westheide@biologie.uni-osnabrueck.de

Supported by the GBIF Programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0206, Oct. 2002 – Dec. 2005, lead: M. Tuerkay, michael.tuerkay@senckenberg.de.

Databasing the crustacean collection of the Museum für Naturkunde Berlin

Umbrella project: Co-ordination and type identification within the national GBIF Node
"Evertebrata III" (Crustacea, Evertebrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-D, GBIF-Germany, collection, database, invertebrate, Crustacea

Abstract

The crustacean collection of the Museum für Naturkunde Berlin is one of the most important of its kind. There are 30,000 objects, many of them from the major expeditions dating back to the end of the 19th century (Gazelle Expedition, Deutsche Tiefsee Expedition, Deutsche Südpolar Expedition). Due to the age of the collection the number of types is very high.

The collection is currently being databased as part of the German GBIF Node Evertebrata III (co-ordinator Dr. M. Türkay, Forschungsinstitut Senckenberg, Frankfurt). The modern client-server collection database software *SeSam* is being used. The data are transferred from Berlin and Bonn to the Senckenberg Museum by a secure Internet connection (VPN). Certain data, such as geography and the systematic hierarchy, can be shared by all contributors to the database project.

Objectives

It is the aim of the project to digitise the collection data of the whole Berlin crustacean collection, consisting of 27,500 catalogued samples. The *SeSam* database, developed at the Senckenberg Museum, is being used.

The databasing of the Berlin crustacean collection occurs in two steps: 1) File cards containing only the most essential data (species name, catalogue number, type status and origin) are transferred into the database. 2) One important key group, the Amphipoda, will be databased in detail. The other systematic crustacean taxa will follow later.

The database will serve several purposes:

- modern collection management
- establishment of a data network between research museums
- significant progress in systematics and biogeography.

Results

In April 2003 two of us (Dr. Traudl Krapp and Dr. Franz Krapp) made initial preparations and co-ordination (research of the status and the classification of the taxa in the "Zoological Record" and the Internet) for the databasing of the crustacean collection. This started in September 2003. During the first phase only some data fields were filled out: species name and superspecific classification, catalogue number, localities and type status. By October 2004, 19,400 of the 27,500 catalogue

numbers were entered into *SeSam*. The remaining data sets will be in *SeSam* by early spring 2005 after which phase 2 will begin. This will handle identifiers, collectors, collecting events and, very important, the coding of geographical references. We will start phase 2 with the group Amphipoda, one of the focus groups of the collection. Later we will include other crustacean taxa.

We used the file cards and the hand-written catalogues as the basis for data entry, but in many cases had to cross-check with the original labels inside our collection jars which was very time consuming, but yielded extra data. Sometimes we found inconsistencies in the collection (for example: the doubling up of catalogue numbers) which we corrected immediately. This largely improved the overall quality of the data collection.

Some hard- and software has been financed by the Flora-Immerschitt-Stiftung and has also been used for the project.



Fig. 1: Collection hall of the crustacean collection of the Museum für Naturkunde Berlin

Sub-project duration: Apr. 2003 – Dec. 2005, lead: C.O. Coleman, oliver.coleman@museum.huberlin.de

Supported by the GBIF Programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0206, Oct. 2002 – Dec. 2005, lead: M. Tuerkay, michael.tuerkay@senckenberg.de.

Type catalogue of the Crustacea-Collection of the Senckenberg-Museum including other collections kept and managed at the same institute

Umbrella project: Co-ordination and type identification within the national GBIF Node "Evertebrata III" (Crustacea, Evertebrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-D, GBIF-Germany, Crustacea, type specimens, databasing, Senckenberg

Abstract

Since the beginning of the crustacean project several thousand specimens have been introduced into the *SeSam* database and are available on the World Wide Web. Historical collections have received special attention and type material is available on the Web at a ratio of about 70 % of the holdings. This corresponds to 885 type specimens.

Objectives

The goal of this project is to review and database the current status of all type-specimens of Crustacea kept at the Senckenberg-Museum including at least the collection of the Göttingen Zoological Museum which is deposited in and managed by Senckenberg. If time allows, further minor German collections are to be integrated into the database system. The main objective is a high quality standard in capturing data and information.

Results

The first step after the start of the project was to identify the publications and collection parts that were interesting for the project. The material was compared to the historical publications [1] based upon the Senckenberg and Göttingen collections. Soon it became evident that scattered type material from early exchanges and depositions was present which was not documented before. Such material includes types from Siebold's *Fauna Japonica* or early material from the *Museum National d'Histoire Naturelle* the exact status of which is still not totally clear. Because of these discoveries the entire old (dry) collection had to be re-checked and re-identified in order to find such hidden types. The same applied to the collection of the Göttingen Zoological Museum. This very important historical collection brought together in the 19th century was neglected for a long time. After World War II it was housed in a cellar of the Zoological Institute where it got inundated in the late 1950ies. Labels faded and some information was destroyed. In 1988 the collection was moved to Senckenberg. Fortunately the old catalogue had survived and through this and the readable labels a good number of types could be found and documented in the database. Because a still significant number was apparently missing, the whole collection was re-identified in order to find type material through careful comparison with catalogue data and published records. This endeavour is close to its end now and has revealed a good number of types that had been considered lost, due to missing or faded labels. There was no other way for the detection of these types than to go into such a detailed revision of the collection for which it was very helpful to have trained and skilful taxonomists employed in the project. As a spin-off the whole historical material of the Göttingen collection could be databased and is now available on the Internet as far as it has been worked out to date.

The whole historical material in which type-material was or could be contained has been revised taxonomically and all the associated information has been checked in detail. Localities have been traced down and entered into the database so that they can now be found in any geographic reference work, keeping and documenting, of course, original spellings and geographic systems. The same applies to the personal data associated with the material (collectors, identifiers) of which detailed information has been entered into the database. The literature in which the specimens were published was tracked down and checked with reference to the original prints and every primary and secondary identification has been entered into the database in a historically hierarchical scheme. This allows to search for a name published for a specimen in a historical paper and find out the actual identity as well as previous or subsequent identifications of that sample. The total numbers of crustacean datasets available through *SeSam* on the Web are presented in the following table:

Tab. 1. Numbers of Senckenberg Crustacea data sets available on the Web and progress made in 2004 (right column)

	Total	2004
All data sets (types and non-types)	14,625	830
All Types	885	320
Primary types total	255	102
Holotypes	236	90
Lectotypes	13	10
Neotypes	6	2
Secondary types	630	218



Fig. 1: Crab from old type collection of Eduard Rueppell

With this progress we are approaching about 50 % of the whole crustacean collection being databased and available on the Web. For type specimens the ratio is even higher and estimated at about 70 %. In the still missing type information non-decapod types have a higher ratio and must be tackled in the last year of the project.

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[1] Historical publications based on collections: http://www.senckenberg.de/Crust/Historische_Publikationen

Sub-project duration: Oct. 2002 – Dec. 2005, lead: Michael Türkay, michael.tuerkay@senckenberg.de

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Bryozoa types in collections of German natural history museums

Umbrella project: Co-ordination and type identification within the national GBIF Node "Evertebrata III" (Crustacea, Evertebrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-D, GBIF-Germany, bryozoa, type, collection, identification, validation, *SeSam* database

Abstract

Bryozoan types from collections of German Natural History Museums have been examined in detail to clarify their type status. From Berlin, 148 species were marked in the collection catalogue as types; after examination it turned out that 76 are valid, most of them originating from Antarctica. Further 25 species have to be examined due to their obscure status. After examination of 74 series from Hamburg, 6 series turned out to be real holotypes, additional 41 are syntypes. All data have been recorded in the *SeSam*-database including detailed SEM-pictures.

Objectives

Our main goal is to contribute to the nationwide management of collections in the field of bryozoology. Bryozoan collections containing type specimens must be identified as being important to the work of the institution. Accordingly, our task is to (1) document, (2) re-describe and (3) selectively re-illustrate all types and especially holotypes of extant bryozoan species that are present in German museums. Furthermore, we shall provide a list of bryozoan types to the project electronically as *SeSam* databank file, and distribute information for the colleagues organised in the International Bryozoology Association (IBA).

Basically, there are two main reasons for launching the project. First, both outside researchers and the institution (museum or university) keeping a bryozoan collection may not know about the value of the specimens if they lack a specialised curator. All types will be examined to check if they are still valid. Also the current systematic position will be acquired.

Secondly, similar to other taxa, many important taxonomic accounts date back to the 19th or early 20th century, and the old-fashioned style of descriptions often precludes their reliable use in species identification. Because of the improvement and development of technology it is possible to classify each species in a more detailed way. Today, electron microscopes have become a powerful tool for reliable descriptions in bryozoology, since a typical bryozoan colony module (zooid) is usually not larger than about half a millimetre. Researchers from all over the world now have the opportunity to look at the *SeSam* database via Internet and search in the collection data and view detailed pictures of the specimens without loans or visits to the museum.

Results

In the bryozoan collections of the "Museum für Naturkunde", Berlin, and the Zoological Museum of Hamburg, about 200 bryozoan-types from all over the world have been deposited. The Bryozoa collection in Berlin consists of 2,624 catalogue numbers, among them 148 assigned types. The Zoological Museum Hamburg (ZMH) is a repository of another important research collection of bryozoans with 1,881 catalogue numbers, including 74 originals labelled as 'types'. In addition some

type specimens are deposited in the Senckenberg Museum in Frankfurt / Main. All collections are in good order and condition.

The most important type-species in the Berlin collection have been collected during the German South-Antarctic Expedition (1901-1903). 55 types described by Kluge [1] have been located. Most of these species can be found in Hayward's "Antarctic Bryozoa" [2], but only with line-drawings. Also originals and type specimens from the Red Sea published by Waters [3] based on specimens of the Hartmeyer collection, await re-description. After examining all types it turned out that 76 are valid syntypes. 25 species have to be examined more in detail, their status is still unclear. All these have been recorded in the GBIF *SeSam* database, including pictures of the labels and SEM-pictures of the colony, zooids and other species-relevant characters.

In the collection in Hamburg 74 series were labelled as types. After examination it turned out that 6 are holotypes and 41 are syntypes. The most important species are Phylactolaemata (freshwater-bryozoans) from the genera *Plumatella*, *Victorella* and *Stephanella*. Also there are 10 syntypes from the German South-polar Expedition determined by Kluge.

Beside the work with the bryozoan colonies itself, a major part of the project was dedicated to literature research. All SEM-pictures of the examined specimens were compared with original literature and additional papers with re-descriptions to make sure that all characters mentioned are valid. Also the current taxonomical classification was determined. All results will be published, the first manuscript concerning the types described by Kluge is in preparation [4].

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Digital record of the Porifera, Cnidaria, Ctenophora, and Tunicata collections in the Senckenberg Museum Frankfurt (Germany)

Umbrella project: Co-ordination and type identification within the national GBIF Node "Evertebrata III" (Crustacea, Evertebrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-D, GBIF-Germany, Porifera, Cnidaria, Ctenophora, and Tunicata, collections, type species, reference material, expeditions, digitisation

Abstract

Building a database on the collections of the Porifera, Cnidaria, Ctenophora, and Tunicata housed in the Senckenberg Museum Frankfurt made it necessary to re-organise these collections in a first step, since they had suffered from disorder due to several translocations in the past. As a further preliminary step, before starting the digitisation using the collection management system *SeSam*, biosystematic background information for the taxa Porifera, Cnidaria, Ctenophora, and Tunicata was compiled. By now (October 2004) the catalogued Porifera, Ctenophora, and Tunicata have been completely digitised (type and non-type material) and the collection data verified and completed with literature data. Within the Ctenophora collection no type species are present, whereas the Porifera collection includes 179 primary type species, with 14 of them re-discovered, and the Tunicata collection includes 41 primary type species, with 9 of them re-discovered during the work for this project. The Cnidaria collection is currently refurbished and contains approximately 100 primary type species. Due to this project the data related to the collections of the Porifera, Cnidaria, Ctenophora, and Tunicata become available to the scientific community for the first time, and the access to the material itself is much improved.

Objectives

Digitising the catalogued material in the four collections Porifera, Cnidaria, Ctenophora, and Tunicata in the Senckenberg Museum Frankfurt (type and non-type material) using the collection management system *SeSam*.

Results

At the beginning of this project in July 2003 only handwritten or card catalogues were available for part of the collections of the Porifera, Cnidaria, Ctenophora, and Tunicata. Some curatorial units had been recorded digitally in MS Access before, but without comparing the material itself with the corresponding literature. Moreover, the collections had suffered from several translocations in the past, making a complete re-organisation of the collections and comparison with literature data necessary before starting the digitisation.

A further preliminary step was the compilation of the biosystematic background information of the taxa Porifera, Cnidaria, Ctenophora, and Tunicata necessary for the recording in the collection management system *SeSam*.

In the course of this project, the Porifera collection was completely re-organised. Every catalogued specimen or lot of specimens (curatorial unit) was checked, the collection data compared with literature if available and completed, and then digitally recorded (in total 2,466 catalogued curatorial units). As a result of this work a list of type species present in the Porifera collection could be established, in total 179 primary type species (holotypes and syntypes), with 14 of them re-discovered. In addition to the availability of these types on the Internet, a printed type catalogue has been prepared and will be submitted for publication in the near future. Since the taxonomy and systematics of the Porifera are to date a research topic in our institute, the collection is growing continuously and approximately 1,000 identified curatorial units still need to be catalogued and digitally recorded.

The Ctenophora collection is rather small and our work revealed that there are no type specimens present. The re-organisation and digitisation of this collection has been completed (in total 93 catalogued curatorial units).

During the last year the Tunicata collection was refurbished. In total 638 catalogued curatorial units were digitally recorded, including 41 primary type species, with 9 of them re-discovered. Another 300-400 identified curatorial units are still waiting to be catalogued and digitised.

The comparatively large Cnidaria collection is currently re-organised (October 2004). Of the estimated 3,000-3,500 catalogued curatorial units in total, the taxa Hydrozoa, Scyphozoa, and Cubozoa, i.e. 444 curatorial units, have already been checked and digitised, being thus available via *SeSam* on the Internet. The estimated number of primary type species is about 100. In addition to the catalogued material, 500-600 identified curatorial units still need to be catalogued before digital recording.

This work on the four collections mentioned above revealed their importance, not only with regard to the number of type species, but also with regard to the considerable amount of reference material from most of the major German expeditions to various geographical areas, for example from the „Forschungsreise in den Molukken und Borneo (Kükenthal) 1894“, the „Deutsche Tiefsee-Expedition 1898/99“, the „Deutsche Expedition in das nördliche Eismeer (Römer & Schaudinn) 1898“, the „Deutsche Südpolar-Expedition 1901/03“, the „Forschungsreise in den südöstlichen Molukken (Aru und Kei-Inseln, Merton) 1908“, the „Reisen nach den subantarktischen Inseln bei Neuseeland und Südgeorgien (Kohl-Larsen) 1924“, and the ANDEEP I & II expeditions (Janussen) in 2002.

Although some effort and time is still necessary to achieve the complete digitisation, the benefit for the material in the four collections from this project is obvious, with the collection data becoming for the first time easily accessible to the scientific community.

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Type specimens galore – The collections Echinodermata, Hydrozoa and Porifera @ the Museum für Naturkunde, Berlin

Umbrella project: Co-ordination and type identification within the national GBIF Node "Evertebrata III" (Crustacea, Evertebrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-D, GBIF-Germany, Porifera, Hydrozoa, Echinodermata, types

Abstract

Since start of the databasing process in April 2003 roughly 10,000 specimens were checked for their status. 471 echinoderm species and 95 hydrozoan species are represented by types in the MfN collection. In the sponge collection databasing of types is half-way completed and 485 lots are already verified to contain type specimens.

Objectives

The goal of the project is to survey the collections of extant echinoderms, hydrozoan cnidarians and sponges in the Museum für Naturkunde, Berlin for type specimens, to identify potential types with the relevant literature, to database all available data from collection catalogues and specimen labels after positive type identification, and finally to make these data internationally available on the Internet via the Senckenberg collections management software *SeSam*.

Results

Within the project, a scientist and a volunteer student work in the collection since April 2003, with the volunteer student databasing the echinoderm and hydrozoan types and the scientist concentrating on the enormously rich sponge collection, which – apart from the sheer number of specimens - bears the additional problem that in the past type specimens were cut in pieces and partly sent to other collections in Germany and worldwide. Thus, to reconstruct the paths taken by specimens and parts of specimens throughout the history of the collection and to verify their potential type status requires visiting other collections and extremely careful literature research including secondary or grey literature like museum catalogues, collection lists and letters.

The **echinoderm** collection due to its well ordered status and quality of the catalogue was the first target for the databasing process. The collection holds 6,530 echinoderm lots, with 85 species represented by holotypes, and 386 species represented by syntypes, i.e. with ~6,000 recent echinoderm species described so far, the MfN collection holds the types of 8% of the World's known diversity of this group. During the project two electronic catalogues containing echinoderm data emerged, (i) a type catalogue and (ii) a catalogue of the whole collection including cabinet and shelf numbers for orientation. The validation of a type status of a specimen sometimes requires laborious literature research and tracking down references containing the original description may be time consuming. However, the comparison of original description, label data and specimen shape and morphological details is the only reliable way to identify types beyond doubt. Thus, as a third product of the type identification process, a hardcopy folder system was generated, containing copies of all original

descriptions of species the types of which were found in the collection. This species catalogue is an invaluable source of information also for further studies of the Berlin echinoderm collection and for the ongoing publication of echinoderm type catalogues in peer-reviewed journals. Only recently it was possible to establish a co-operation with M. Jangoux, an echinoderm specialist at the Université Libre de Bruxelles, who visited the MfN in 1986 in order to identify echinoderm types and subsequently publish a type catalogue. This project was never completed due to communication difficulties during cold war times, but can now be finished integrating Jangoux' data into the comprehensively compiled echinoderm database.

The **hydrozoans** in the collection sum up to 2,764 lots. E. Vanhöffen, who served as curator at the MfN between 1906 and 1918, was the only hydrozoan specialist ever curating the MfN's cnidarian collection. As a result, the hydrozoans were orphaned for more than 80 years, stuffed in an unordered cabinet with dry and alcohol-preserved specimens roughly sorted by genus names deciphered from labels by a technician in the late 1980's. In the past, a separate hydrozoan catalogue was established (possibly by Vanhöffen) resulting in a complicated mixture of registration numbers of specimens. Newly given numbers mainly lack cross-reference to the specimen's previous number in the main catalogue of "Coelenterata", where the hydrozoans used to be registered. Additionally, hydromedusae were split from polyps again with a separate numbering system. To re-establish a single catalogue based on the original ZMB registration numbers in the main catalogue, the first activity was to database the whole collection with all available specimen data from both catalogues and labels. In a second step, the type material could be identified, covering 95 hydrozoan species. So far, 3 holotypes, 7 syntypes and 1 neotype were identified beyond doubt. The status of the remaining type specimens is currently under examination. Comparable to echinoderms, two electronic databases and a hardcopy folder with copies of original species descriptions were produced.

The **sponge** collection is the largest within MfN's marine invertebrate collections with over 12,000 registered lots and about 20,000 microslides. So far, 485 lots could be verified to contain type material, but according to catalogue data, we are expecting almost twice as much types once the type identification is finished at the end of the project. Identification of sponge types is sometimes hampered by "type-sharing" between museums in the past (see above). Thus, reconstruction of the history of a single specimen is sometimes as important as the bare identification of the type to verify its status. The identification process of sponge types, therefore, is much more time consuming and needs special knowledge about sponge research in the past and the involved scientists. Here, only a single electronic type database emerges and so does a hardcopy folder system with copies of the original descriptions. As a by-product, we were able to localise and identify all hexactinellid sponge types resulting from the Deutsche Tiefsee-Expedition (1898-1899). This is the first time that all these hexactinellids described by F. E. Schulze in 1904 were united in one collection.

Acknowledgements

Thanks are due to P. Schuchert, Natural History Museum of Geneva, for an unpublished version of his World-catalogue of hydrozoan species. We also thank C. Nielsen, Zoological Museum Copenhagen, for re-sending "Valdivia" echinoderms, which belong to the MfN collection. Hardware and software programs used for the project were partly financed by the Flora-Immerschitt-Stiftung.

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Databasing of all parasitic worm-species and of primary types of free-living “worm-like animals” at the Museum für Naturkunde, Berlin

Umbrella project: Co-ordination and type identification within the national GBIF Node "Evertebrata III" (Crustacea, Evertebrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-D, GBIF-Germany, marine, invertebrate, parasite, type

Abstract

In the collection “Worm-like Animals”, data of primary types have been entered into the database *SeSam* (Cestoda, Trematoda, Rotatoria, Gastrotricha, Nematoda, Kinorhyncha, Priapulida, Oligochaeta, Hirudinea, Polychaeta, Echiurida, Sipunculida), milestone 1 has been fully achieved for these groups. Data of all species of the parasitic groups Acanthocephala and Nematomorpha have also been entered into *SeSam*, milestones 1 and 2 have been completed for these animal groups and will be accomplished for Trematoda, Cestoda and Nematoda by the end of the project. The same is expected for milestone 3 (inclusion of information from the original registry catalogue in addition to the data on the card board index) for all parasitic groups. Primary types have been identified for the Chaetognatha and free-living Plathelminthes; milestone 4 has been fully accomplished.

Objectives

Housing about 22 million zoological objects, the Museum für Naturkunde is the largest natural history museum in Germany and therefore serves as an international reference centre for biodiversity studies. Large parts of the collection “Worm-like Animals” date back to either important scientists such as the “father of helminthology” Carl A. Rudolphi or major expeditions during the 19th and 20th century, e.g. the German Deep-Sea Expedition (1898–1899) and the German South Polar Expedition (1901–1903). A total number of about 30,000 lots containing the type material of more than 2,500 species is registered in the collection “Worm-like Animals” with its mainly marine and parasitic species.

The goal of the project in this collection is to identify primary type specimens among the 364 species of Chaetognatha and free-living Plathelminthes, to digitise all type specimen data and also data of the entire collection of parasitic worms in the database *SeSam*, and to make this information internationally available through the Internet [1].

Results

In the frame of GBIF, Dr. Andreas Brösing (1.6.–31.10.2003), Dipl.-Biol. Stefanie Lerche (1.8.2003–31.1.2004) and Dr. Karin Schütt (6.2.2004–) have carried out the following tasks (comp. Tab. 1):

- entering data of primary types into *SeSam* (Cestoda, Trematoda, Nemertini, free-living and parasitic Nematoda, Rotatoria, Gastrotricha, Priapulida, Kinorhyncha, Oligochaeta, Hirudinea, Polychaeta, Echiurida, Sipunculida) or into a Word table (Chaetognatha) (milestone 1),
- entering data of all species of parasitic groups into *SeSam* (Acanthocephala, Nematomorpha) (milestones 1-2),

- search and checking of primary type material of 145 species of free-living Plathelminthes (milestone 4),
- search and checking of primary type material of 14 species of Chaetognatha (milestone 4).

Tab. 1: Databased material of the collection „Worm-like Animals“October 2004

Animal group	kind of databasing	total of databased catalogue numbers	total of databased catalogue numbers of renamed species
Trematoda *	primary types	444	252
Cestoda *	primary types	361	78
Acanthocephala	all specimens	589 (106 types)	73 (68 types)
Nemertini	primary types	91	10
Gastrotricha	primary types	9	-
Rotatoria	primary types	23	-
parasitic Nematoda	primary types	517	357
free-living Nematoda	primary types	225	39
Nematomorpha	all specimens	331 (52 types)	10 (8 types)
Kinorhyncha	primary types	1	-
Priapulida	primary types	1	-
Hirudinea	primary types	69	16
Oligochaeta	primary types	429	134
Polychaeta	primary types	831	112
Echiurida	primary types	10	-
Sipunculida	primary types	64	24
Chaetognatha	all specimens	281 (14 types)	-
Total of databased lots:	<u>5,381</u>	4,276	1,105

* All species of these parasites will be databased.

During databasing it turned out that species have been frequently renamed or revised and required time-consuming extra work to historicise these names in the database *SeSam*. Checking the type status of 36 species of Chaetognatha and 328 species of free-living Plathelminthes required a comprehensive literature search in the libraries of the museum. The type status of the 1,124 lots is often ambiguously or erroneously indicated in the catalogues or on labels.

This work completes previous search for type material in the collection „Worm-like Animals“ [2] and will allow full Internet access to this type material and to the lots of all parasitic worm-groups at the Museum of Natural History, Berlin for the first time. The current project will make the research of scientists both within and outside Germany working with worm-like animals significantly more efficient.

Some hard- and software has been financed by the Flora-Immerschitt-Stiftung and has also been used for the project.

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GBIF: Digital documentation of selected type material of the collection 'Invertebrates I' (Oligochaeta and Ascidiacea) of the Zoological Museum Hamburg

Umbrella project: Co-ordination and type identification within the national GBIF Node "Evertebrata III" (Crustacea, Evertebrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-Germany, *SeSam* database, type material, Ascidiacea, Oligochaeta

Abstract

The Zoological Museum Hamburg (ZMH) comprises one of the world's oldest and, scientifically, most valuable Oligochaeta collections, based to a great extent on the scientific work of Wilhelm Michaelsen (1860–1937), former curator and departmental head at the old Natural History Museum of Hamburg. The Oligochaeta collection includes Michaelsen's material of his three research and collecting expeditions to Namibia, South America, and to Western Australia. More than 1,000 oligochaetan types respectively type series of Michaelsen represent the basis of the ZMH collection. Currently it contains 4,200 catalogue entries; among these, the type material covers more than 1,250 species (Fig. 1a, 1b). The ZMH also houses the Ascidiacea collection of Michaelsen. The ascidians are listed under 1,250 catalogue numbers, including 310 types. At present, type specimens of both collections are databased under the protection of GBIF (Global Biodiversity Information Facility).

Objectives

The aim of this GBIF-D project is the database compilation of the internationally significant type material of Oligochaeta and Ascidiacea of the ZMH using the modern collection management system *SeSam*. Data is transferred from Hamburg via a secure VPN-Internet connection to the Senckenberg Institute in Frankfurt, where the database is centrally installed. This electronic catalogue includes detailed scientific data on primary types; e.g. species name, taxonomic position, type status, catalogue number, identifier, detailed locality data, collector, and publications (focus on primary literature). The compilation of synonyms, supply of selected literature, as well as the revision of historical information on sites are main aspects of this GBIF-project. Moreover, digital images of the original labels shall be transferred into the *SeSam* database.

The *SeSam* database represents a pool of most valuable scientific primary data accessible to a wide public via the Internet. As it provides a reliable source for scientists, it is an important contribution to biological diversity research.

Results

The sub-project started in February, 2003. Current focus is on the digitisation of the comprehensive Oligochaeta collection. As of October, 2004, about half of the catalogued type series of Oligochaeta has been incorporated into the *SeSam* database (Tab. 1). Minor supplements (e.g. publications) are needed.

Databasing is based on catalogue entries, handwritten file cards, and, principally, primary literature (Fig. 2). Historical information on localities is adapted to the valid geographical situation. Type status is cross-checked. A few types which were considered lost in literature have been re-discovered in the course of this research.

Michaelsen's valuable ascidiacean types still await databasing. Images of original labels shall complete the digital documentation of the Oligochaeta and Ascidiacea type material of the Zoological Museum Hamburg.

Tab. 1: Oligochaetan types databased until October, 2004

Catalogue entries*	Number of type specimens				
	Holotypes	Syntypes	Paratypes	Lectotypes	Paralectotypes
665	77	1,766	136	25	80

*One catalogue entry can include more than one type specimen (type series).



a)



b)

Fig. 1a, b: Selected type material of the Oligochaeta collection of the ZMH

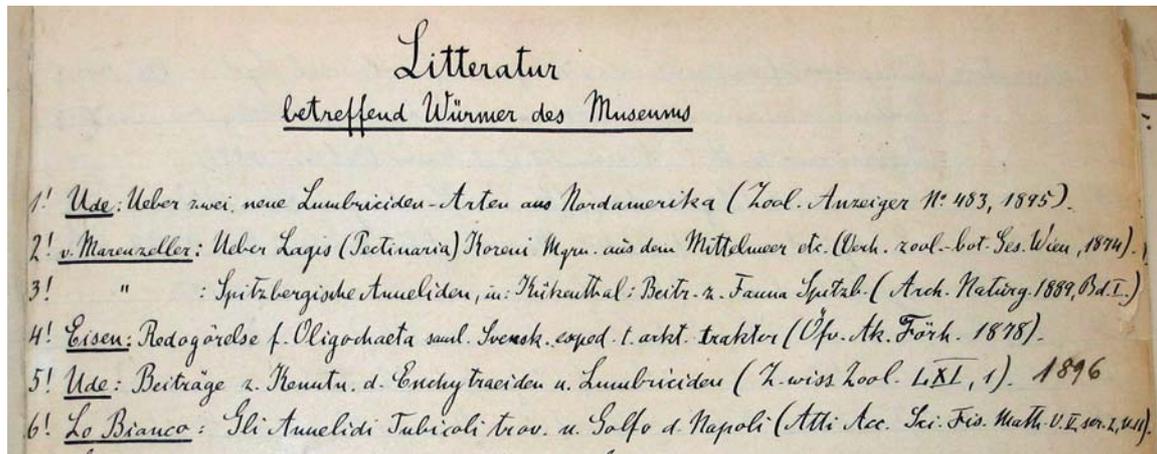


Fig. 2: Original catalogue entries by Wilhelm Michaelsen (approximately 1896)

Sub-project duration: Feb. 2003 – Dec. 2005, lead: Hilke Ruhberg, ruhberg@zoologie.uni-hamburg.de

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Digital documentation of the type material of the collection 'Invertebrates II'(Crustacea and Polychaeta) of the Zoological Museum Hamburg

Umbrella project: Co-ordination and type identification within the national GBIF Node
"Evertibrata III" (Crustacea, Evertibrata excl. Arthropoda and Mollusca)

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Keywords: GBIF-D, GBIF-Germany, *SeSam* database, type material, Crustacea, Polychaeta

Abstract

The aim of this GBIF-D project is the presentation of a first electronic type catalogue of the Crustacea and Polychaeta collection 'Invertebrates II' of the Zoological Museum Hamburg (ZMH). Currently it contains more than 1 million specimens of crustaceans, including about 3,500 types. These are listed under 40,072 catalogue entries and cover more than 33,000 species. The polychaetes are represented by more than 150,000 specimens. They are stored in 24,434 numbered vials, including about 2,200 types. The crustacean material focuses on Pfeffer's research and collecting expeditions (1879–1923) and comprises animals of the former Gondwana area: South Australia, South Africa, South America and the Southern Ocean. Moreover, material from North-East Greenland and Svålbard is stored in the collection.

Objectives

Focus of this project is the digitisation of type material in the Crustacea and Polychaeta collection of the ZMH. Detailed primary data on taxonomy, systematics, distribution, collector and literature supported by digital images of the original labels shall be transferred into the *SeSam* database. This modern collection management system is established at the Forschungsinstitut Senckenberg in Frankfurt and allows a worldwide exchange of relevant scientific data via the Internet. Thus, it is an essential facility for comprehensive biodiversity research.

Results

The sub-project started in February 2003. The present level of the digital documentation of the crustacean type material is shown in Tab. 1; 737 catalogue entries including 2,306 types/-series have been incorporated into the *SeSam* database covering about the half of the crustacean types.

The number of the above mentioned types/-series is not relevant to the number of catalogue entries, except the holotypes and neotypes. The paratypes are the most dominant group among the crustaceans.

The digitised type material of Crustacea is completed with images of original labels. The average number of labels are 2-3 per type/-serie and are stored inside of each vial. Examples of electronic images are presented in Fig. 1 after they have been edited.

Tab. 1: Number of catalogue entries and types/-series of Crustacea (Invertebrates II) (Oct. 2004)

Catalogue entries Crustacea	Holotypes	Syntypes	Paratypes	Lectotypes	Paralectotypes	Neotypes
737	150	231	1,489	14	421	1



Fig. 1: Original labels, digitised as images

Furthermore, supplements of primary crustacean literature need to be entered into the *SeSam* database and the digitisation of the comprehensive Polychaeta collection of the Zoological Museum Hamburg has to be added.

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Sub-project duration: Feb. 2003 – Dec. 2005, lead: Angelika Brandt, abrandt@zoologie.uni-hamburg.de

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SeSam – A web-based collection management system to serve GBIF-D Evertebrata III

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Keywords: GBIF-D, GBIF-Germany, database, *SeSam*, GBIF, data storage, common array

Abstract

Data of the GBIF-D Node Evertebrata III have been captured on-line in the web-based system *SeSam*. To date a total of about 7,100 type specimens are offered through the Internet to the scientific and broader public.

Objectives

The goal of this project was to ensure a common web-based tool for cataloguing historically interesting material including types. Furthermore, the participating institutes had to be coordinated as to deliver compatible material as a contribution towards the German GBIF National Node System GBIF-D.

Results

Data entry was performed by all participating groups in the common database system *SeSam*, which was already in use in the Senckenberg-Institute for several years and had proven to be functional in providing collection data to the scientific community and broader public through the Internet. For the GBIF-project a second database was set up in which the participating institutes besides Senckenberg could enter data on-line. To ensure the data flow shown in Fig. 1, a Virtual Private Network (VPN) was set up and clients were installed on workstations of the participants. By this, all groups and persons were able to use the common data array and contribute to the database hosted by Senckenberg.

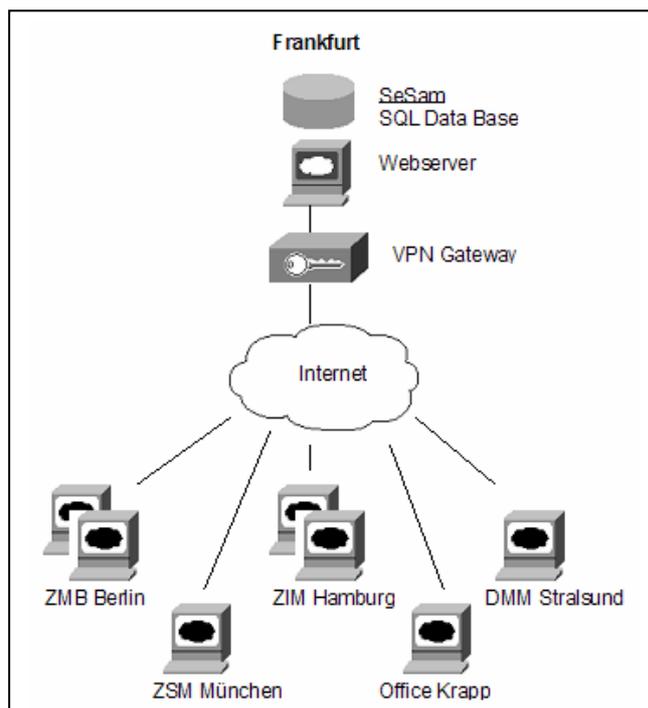


Fig. 1: Data capture and update directly in *SeSam*.

To make data available to the GBIF network, a BioCASE wrapper serving ABCD-standard data will be installed. We decided not to restrict the data offered to GBIF to those produced by the present project, but to offer all data included in *SeSam* (including the entire databased Senckenberg-collection). To avoid duplication, we therefore refrained from copying information about the type material from the main Senckenberg system to the GBIF project-database. Both, the project database and the main Senckenberg *SeSam* database will be connected to the GBIF-portal. Tab. 1 shows the number of datasets captured during the project and now available in *SeSam*.

Tab. 1: Number of datasets available on-line through *SeSam* by November 2004. The first column includes the total of specimens databased, while the following columns cover the type material which is mainly referable to data capture effected during the GBIF-project. The collections holding the types have not necessarily been responsible for the data capture, there are several cross-cutting projects which are explained in detail in the respective sub-project summaries.

Collection	Total	Types	Holot.	Parat.	Synt.	Lectot.	Paralectot.	Neot.	Unspec.
Cnidaria – DMM Stralsund	313	308	53	5	248	1			1
Hydrozoa – ZSM München	242	235	1		21				213
Bryozoa – ZMB Berlin	93	93	5		86				2
Crustacea – SMF Frankfurt	14,125	1,022	278	597	99	11	15	7	15
Crustacea – ZMB Berlin	20,008	260	41	20	6	10	1	4	178
Oligochaeta ZIM – Hamburg	441	429	71	8	349				1
Porifera – SMF Frankfurt	2,569	241	87	18	136				
Crustacea – ZMG Göttingen	764	80	22	3	42	6	7		
Porifera – ZMB Berlin	2	2	1		1				
Crustacea – ZIM Hamburg	547	531	97	326	48	6	13		41
Bryozoa – ZIM Hamburg	39	39	5		34				
Bryozoa – SMF Frankfurt	88	7	5	1				1	
Vermes – ZMB Berlin	5,145	3,807	526	65	2,307	37	60	3	809
Echinodermata – ZMB Berlin	0								
Hydrozoa – ZMB Berlin	0								
Ctenophora – SMF Frankfurt	93								
Tunicata – SMF Frankfurt	621	51	21	3	26				1
Total	45,090	7,105	1,213	1,046	3,403	71	96	15	1,261

For security reasons, the production database in use by the participating groups is not directly available on the Internet. The publicly accessible webserver contains a mirror which is updated every 1-2 days, while the production database remains within a “Demilitarised Zone”. We believe that here security must take priority over being totally up-to-date.

The Senckenberg *SeSam* and the GBIF *SeSam* (other participating institutions) can be reached by the Internet addresses [1] and [2]. Both data collections are accessible through the GBIF-D and Senckenberg web pages.

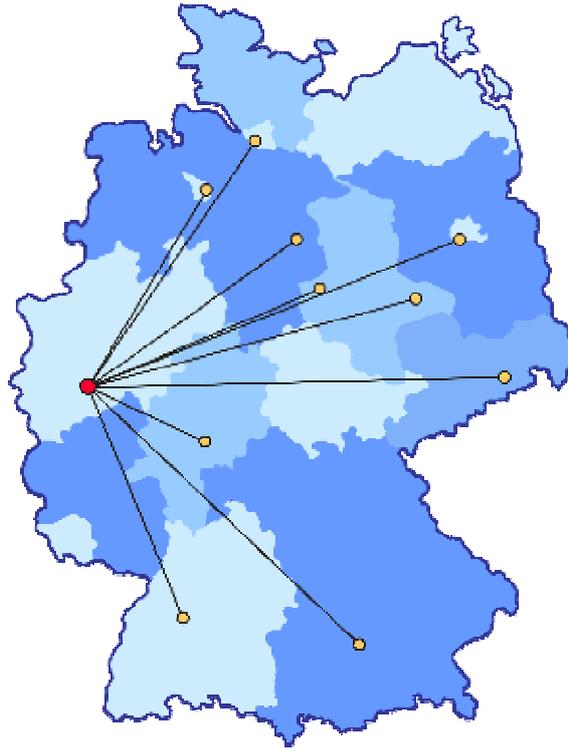
References

- [1] GBIF Evertabrata III: <http://sesam.gbif-evt3.senckenberg.de>
 [2] Senckenberg-DB: <http://sesam.senckenberg.de>
 Username: sesam, password: [nothing]

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GBIF-D Vertebrata



The GBIF-D Vertebrata network

GBIF-D Vertebrata: An electronic catalogue of primary types of vertebrates in German research collections

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Keywords: GBIF-D, GBIF-Germany, Vertebrates, digital type catalogue, database, German natural history collections

Abstract

The electronic catalogue of vertebrate primary types combines specimen-linked information from scattered collections, literature, and archival sources into a virtual museum. Currently, the digital catalogue includes 12,394 data sets of types that have been investigated in little more than half of the German natural history collections. These first results clearly indicate that the number of vertebrate types housed in Germany has been remarkably underestimated. Additional historical material has been databased in the GBIF-D- sub-nodes for fishes and mammals.

Objectives

The German GBIF Node for Vertebrates aims at giving online access to digitised collection-based biodiversity information. In its three year pilot phase, GBIF-D-Vertebrata focuses on an electronic type catalogue of vertebrate species housed in German museum collections, comprising all vertebrate classes from fishes, amphibians, reptiles and mammals to birds. Additionally, some historical collection data are made available.

Type specimens play a key role in biodiversity research as name bearing organisms and standards of nomenclature. They provide the base for any communication between scientists in a wide range of basic and applied research activities worldwide. They are vouchers durably uniting a scientific name with the external appearance of an organism, the phenotype. They link to genetic information, physiology or natural history data or information on geographic distribution patterns. Therefore historical collection data are also documenting biodiversity loss. Comparison of historical distribution patterns of species with their actual distribution ranges allows to quantify habitat loss and habitat change or deterioration.

Results

A first estimate of primary type numbers for vertebrates in German research institutions gave 12,000 taxa (or names for organisms) (Tab. 1). With data capture progressing, the estimated number of types increased, because specimens originally thought to be lost were rediscovered within different collections. Eleven research and university institutions are holding about 90 % of all vertebrate primary types in Germany. In a common effort these participants (Fig. 2) concentrate taxonomic information (up to now hidden and scattered) in one single database. In October 2004 data input had reached already 12,394 type specimens, with only about half of all collection materials (Tab. 1) scrutinised. Additionally, several thousands of literature references and digital images now allows for rapid and secure determination of questionable taxa. A searchable database is provided at www.gbif.de/vertebrata, the GBIF-D Vertebrate homepage, by our IT-partner *SysTax*, Ulm. Taxonomic data can already be investigated on-line.

Tab.1: Estimates and first results of digitised vertebrate type numbers

Sub-project	1. estimate 2002	Type input Oct. 2004
Mammals	1,400	2,634
Birds	3,800	1,260
Amphibians/Reptiles	2,300	3,096
Fishes	4,500	5,204
Sum	12,000	12,394

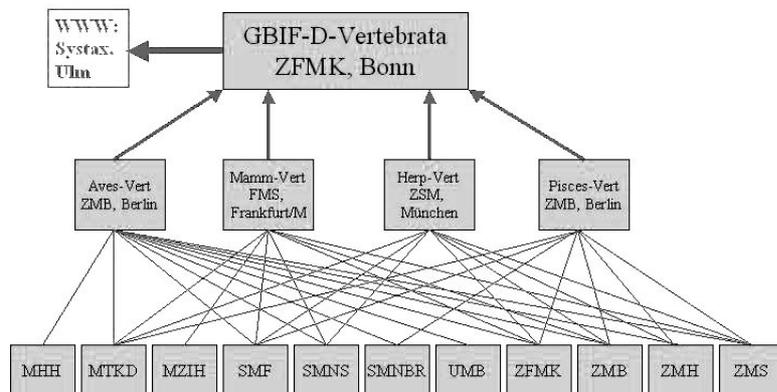


Fig. 1: Subnode structure and participants within GBIF-D Vertebrata

Perspectives

The electronic catalogue of vertebrate primary types essentially contributes in building a communication platform for the international scientific community, nature conservation organisations, and society. It provides worldwide access to the phenotypes of organisms, their valid scientific names and their synonyms. In a way it also hands back biodiversity information to those countries where the specimens originated, and increases quality of future research.

Supported by the GBIF Programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0207, Oct. 2002 – Dec. 2005, lead: Renate van den Elzen, r.elzen.zfmk@uni-bonn.de.

A digital catalogue of primary type specimens in German ornithological collections in the framework of GBIF-D: status and perspective

Umbrella project: GBIF-D Vertebrata: an electronic catalogue of primary types of vertebrates in German research collections

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Keywords: GBIF-D, GBIF-Germany, Aves, digital type catalogue, database, Germany

Abstract

Within the digital catalogue of primary bird types in German natural history collections, more than 1,200 of the expected 4,000 primary type taxa have been investigated and digitised to date, comprising data from more than 2,000 specimens and photographs of most of them. Investigations of the collections in Bonn, Braunschweig, Bremen, Hamburg and Stuttgart are already complete, while data input in Berlin, Munich and Frankfurt is still ongoing. It is expected that by the end of 2005, 50-75 % of all primary types in German bird collections will be digitised.

Objectives

The aim of the project is to make information about primary bird types of German collections available via Internet. This information includes the original description, status of type specimens (syntype, holotype, etc.), updated taxonomical nomenclature, collecting data, mode of preparation, actual location of the type, as well as digital images of type specimens. For the first time, a digital catalogue brings together all the information from different collections. This will help to locate unknown or missing types and to clarify their status.

Primary types are the major reference for taxonomy and nomenclature, so this information is of great interest to all avian taxonomists as well as for all questions concerning precise identification. A large proportion of the types were collected before 1900. Their collecting data also give an impression of historical distribution patterns of the corresponding species and are of special importance for tracing historical changes in biodiversity. Furthermore, as the types are collected from all over the world, it is a special aim to make their data freely available, especially for the countries of their origin. As birds are strongly subscribed, popular among scientific circles and a well-investigated group, the catalogue will be of interest to the entire ornithological community, as well as for researchers interested in questions concerning changes and conservation of biodiversity.

Results

The registration of the data has been completed in the collections of Bonn (ZFMK), Braunschweig (SNMB), Bremen (UMB), Hamburg (ZMH) and Stuttgart (SMNS). The work is still ongoing in Berlin (ZMB), Frankfurt (SMF) and Munich (ZSM). Until now, more than 2,200 specimens from more than 1,600 taxa have been investigated and digitised (Tab. 1). Most of them have also been photographed. Consequently, about one-third of the expected primary bird types have been registered.

Until now, no type catalogue of any kind existed for the largest German collection in Berlin (ZMB). During the work in this collection, it turned out that there are approx. 1,000 type taxa more than the

estimated 2,000. Additionally, several missing type specimens have been discovered in the collection, including 15 mounted hummingbirds.

Of special interest was the registration of taxon authors in the different collections. For example, it was known that the museums in Stuttgart and Vienna (NMW) have large collections of types described by von Heuglin [1, 2]. But some types of this author were also discovered in Berlin (ZMB). Thus, the first step of the digitisation of the types has shown a new potential for co-operations which will be realised at least among German collections in the second step.

Tab. 1: Institutions included in the GBIF-type-project for birds, estimated numbers of primary type specimens (taxa) and present work status (+ investigation in progress).

Institution	Estimated number of type-taxa	Data sets type specimens	Literature data sets
MHH	200	scheduled for 2005	
MTD	200	scheduled for 2005	
SMF	250	in process	+
SMNS	120	132	+
SNMB	50	78	27
UMB	270	283	186
ZFMK	400	278	183
ZMB	2000	1267+	521+
ZMH	100	230	80
ZSM	300	in process	+
total	3890	2270	997



Fig. 1: Type specimen of the Red-cheeked Parrot from Obi-Island, Moluccas, *Pionias obiensis* Finsch, 1868, actual *Geoffroyus geoffroyi obiensis* (Finsch, 1868).

Perspectives

By the end of the project all known types of the ten largest German ornithological collections will be available via the GBIF database, except those of the collection in Berlin. Of the 3,000 type taxa now expected in the collection in Berlin one third of the types will have been entered into the database. This includes in particular groups with large holdings of tropical species (e.g. parrots, hummingbirds, birds of paradise).

With this content, the digital catalogue will be an important tool in the search for information about the primary types scattered across German ornithological collections. The catalogue will greatly facilitate all future investigations about type specimens. The final aim of these investigations about types is the compilation of a catalogue about all bird types in the world; the first activities to link European digital type catalogues has already begun.

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A digital type catalogue of amphibians and reptiles in German research collections: progress and perspectives

Umbrella project: GBIF-D Vertebrata: an electronic catalogue of primary types of vertebrates in German research collections

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Keywords: GBIF-Germany, Amphibia, Reptilia, database, digital type catalogue, Germany

Abstract

Currently, the digital type catalogue of amphibians and reptiles in the seven major German research collections includes 1,948 data sets on primary and 1,148 on secondary type specimens, as well as 1,929 key references (i.e. original descriptions, taxonomic revisions). In addition, more than 2,862 photographs are available for the primary types. The data input is finished for the collections in Bonn, Dresden, Frankfurt, Hamburg, Munich, and Stuttgart but is still ongoing in Berlin.

Objectives

Primary type specimens are the major reference for taxonomy and nomenclature. The focus of this project is to build up an electronic database with relevant information on the primary type material of amphibians and reptiles stored in seven major German research collections. In contrast to mammals and birds, a large number of new amphibians and reptiles are discovered and described each year, leading to an increasingly complex taxonomy. The digital type catalogue will therefore facilitate taxonomic work and also hands back biodiversity information to those countries where specimens were taken from.

Results

The data input of the type specimens is finished for the collections in Bonn (ZFMK), Dresden (MTD), Frankfurt (SMF), Hamburg (ZMH), Munich (ZSM), and Stuttgart (SMNS), but still ongoing in Berlin (ZMB). The numbers of collected data sets are listed in tab. 1.

Tab. 1: Number of collected data sets (* data incomplete, work still in progress)

	data sets primary types	data sets secondary types	data sets literature	Number photos
MTD (Dresden)	24	5	50	-
SMNS (Stuttgart)	46	51	94	113
SMF (Frankfurt)	579	-	519	857
ZFMK (Bonn)	257	578	408	560
ZMB (Berlin)	[570]*	70	[452]*	[702]*
ZMH (Hamburg)	92	-	106	91
ZSM (München)	378	444	300	539
Total	1,948	1,148	1,929	2,862

Several types that have been considered destroyed or lost were re-discovered. Especially the inventory of the Munich collection – which heavily suffered during World War II – allowed to resolve taxonomic and nomenclatural problems which had not been clarified for many decades. In this collection, 143 of the 379 primary type specimens (38%) are considered as lost.

The need for an online type catalogue is, for instance, documented by the fact that 60% of the ZSM primary types are from Latin America (150 from Brazil), today a region with a viable herpetological research community.

The digital type catalogue also contains information on all type specimens of important German herpetologists such as Oscar Boettger, Robert Mertens, and Lorenz Müller (more than 250 taxa), as well as on the historically important material of Johann Baptiste Ritter von Spix and Johann Georg Wagler (more than 120 taxa).

Perspectives

The digital type catalogue will become a platform for information based on formerly scattered or unavailable data. Moreover, high quality photographs provide easy access to the external morphology and colour pattern of the primary type specimens.

Amphibians and reptiles are often used as model groups to assess the biodiversity and level of endemism. Especially amphibians are sensible indicators of environmental changes and many species are endangered by a global decline [1]. To recognise such trends, future GBIF work should therefore focus on access to the enormous pool of locality data in scientific collections.

References

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Fig. 1: High quality photographs provide easy global access to certain aspects of the morphology and colour pattern of type specimens (ZSM 203/1925, holotype of *Elaps ehrhardti* Müller 1926, collected by W. Ehrhardt on 8 June 1925 at "Manacapuru am Solimoens, Brasilien").

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Basic species and specimen-linked information revived for modern approaches in biology – A digital type catalogue of fishes in German research collections

Umbrella project: GBIF-D Vertebrata: an electronic catalogue of primary types of vertebrates
in German research collections

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Key words: GBIF-D, GBIF-Germany, Fish, digital type catalogue, database, Germany

Abstract

Aimed primarily at the most valuable type material, the digital catalogue currently includes data sets on 5,204 primary type specimens and type series, including key references for all of them, and 465 images. Data entry is fairly complete for the collections in Bonn, Frankfurt, and the original ZMH-collection in Hamburg. A further 850 data sets of historically important specimens have been entered at ZMB in Berlin.

Objectives

The focus of the work in this sub-project is on the improvement of the availability of reliable basal taxonomic and accession data of the primary type specimens of fishes stored in the seven larger and two smaller German research collections. This is because these specimens produce the crucial reference system of taxonomy and nomenclature for surveys of biodiversity as well as a multitude of applied approaches in biological sciences. The group of "Fishes", approaches 30,000 recognised species today. Many new species descriptions each year indicate a still insufficient basic knowledge of those limnic and marine habitats that are remote from regular human activities. At the same time fishes form an important food resource for humans and as such are an essential economic factor. Over-exploitation and environmental change are slogans often connected with fish stock evaluation and recruitment of populations. It is therefore expected that the digital type catalogue will at first contribute much to international basic taxonomic work, to later develop into a more complete digital collection record of wider use for systematic, biogeographical, and ecological applications.

Results

The original estimate in 2001 was that German natural history collections hold about 4,300 type specimens and series of fishes. This figure will probably turn out to be a substantial underestimate by the end of the project. In the work aimed particularly at the valuable type specimens, recovery of scattered data and improvement of the data sets is a major point. Some material poses problems of documentation that can only be resolved in the long term, by the research of individual specialists all over the world. In view of the difficult situation with respect to the necessary work of research and documentation, we started with the oldest German fish collection of international perspective at ZMB in Berlin. We concentrated our efforts from the beginning only on those major groups of fishes that include a large component of valuable food species or are particularly important with respect to nature conservation. Though Eschmeyer's catalogue of the recognised species and types of the major Natural History Museums worldwide can be accessed on-line already [1], and valuable additional biological information is available via Fishbase [2], it is not expected that we can finish a complete digital type catalogue within the framework of this project. By now, 1816 type specimen linked data sets were

created concerning salmoniform, characiform, cypriniform, siluriform, scombroid, and gadiform species at ZMB alone, or had to be updated according to international standards. The specimen was identified, checked for availability and condition, original description, collector, locality data, and important references. The highly species-rich order of perciform fishes, for example, is covered only to a small extent. Instead, we took the opportunity to include the historically important data of the restored Bloch collection from the late 18th century and of the Gazelle-Expedition (1872–1874) derived from former research and collection management projects.

Tab. 1: Primary type specimens of “fishes” in German natural history collections (*original estimate in 2001 was a total of 1,700 primary types and type series).

Collection	primary types by cat./ID no.	additional material	comments, % of the type collection
ZMB (Berlin)	1,205	850	finished as scheduled, new estimate 50*
ZMH (Hamburg)	631		100
ISH (Hamburg)	[210]		under way
ZFMK (Bonn)	1,638		100
SMF (Frankfurt)	1,644		95 (few problematic ones left)
ZSM (München)			starts by the end of 2004
SMNS (Stuttgart)			starts by the end of 2004
SMNB (Braunschweig)			starts by the end of 2004
MTD (Dresden)	86		100
total	5,204		

Perspectives

A multitude of positive effects of the recovery and modernisation of collection data is visible already. For example, 50 additional, unrecorded characiform type specimens from South America described by the eminent ichthyologist C. H. Eigenmann were found; the survey of the collector and locality information from different collections generally indicate a far higher number of preserved and documented specimens than was expected in view of the turmoil of the 2nd World War. Morphological characters as provided by photos and x-ray images are increasingly requested by the high number of international collaborators of natural history collections. The importance of the measure with respect to reducing the volume of loan procedures is already felt. Certainly, the web-accessible collection database will provide a much better platform for identification of taxonomic and biogeographic "hot spots". It also lends much needed support to the study of fishes in those regions where vibrant ongoing research on piscine species diversity creates a major demand for information.

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- [2] Froese, R. and D. Pauly. Editors. 2004. FishBase. World Wide Web electronic publication: www.fishbase.org, version (08/2004).

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Registration of mammal type specimens within GBIF-D: Status quo – Perspectives

Umbrella project: GBIF-D Vertebrata: an electronic catalogue of primary types of vertebrates
in German research collections

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Keywords: GBIF-D, GBIF-Germany, biodiversity, Natural History collections, mammal types

Abstract

In German Natural History collections 1,350 primary types of mammals had been expected, but at the Zoological Museum Berlin (ZMB) many type specimens had been quite insufficiently marked or labelled at the time of receipt or of their description. In the framework of the GBIF-project we registered by the end of October 2004 a total of 1,124 primary and 1,460 secondary type specimens. Our results implicate that the actual inventory of types is considerably more numerous than originally expected. We estimate the real stock in the German collections to about 2,000 primary and 2,000 secondary type specimens.

Objectives

Mammals play a key role in biodiversity research. Such investigations require as much information for each species as possible. The base for a scientific description of a species is a type specimen, which usually is preserved in a museum collection. Making the data of type specimens accessible does not only provide a phenotypic reference for e.g. taxonomic or systematic studies, but also hands back biodiversity information to those countries where the specimen originated. Some species are very rare and the type or a type series may be the only existing specimens for this species.

Approximately 5,000 mammal species and up to 40,000 subspecies of mammals are known, with a steady increase of a few new species per year. The number of synonyms is unknown. In German Natural History collections 1,350 primary type specimens were expected. Many of them have been collected, described and preserved in the 19th century. Two world wars caused destruction, losses and disorder in parts of these collections, so a new registration and evaluation becomes necessary.

Results

All available data on receipt books, old labels, original descriptions and relevant secondary literature have been collected and evaluated. On the base of the collected data we finally checked the valid status of each type specimen. By the end of October 2004 we registered 1,124 primary and 1,460 secondary type specimens in the main German collections (s. Tab. 1). In addition 7,500 photographs of primary types are available.

Tab. 1: Vertebrate type specimens in German natural history collections

	Berlin [ZMB]	Bonn [ZFMK]	Desden [MTKD]	Frankfurt [SMF]	München [ZSM]	Stuttgart [SMNS]	Total
Primary types	640	99	57	174	101	53	1,124
Secondary types	314	414	56	476	51	149	1,460
Types total	954	513	113	650	202	202	2,634
Photographs	3,469	744	286	1,817	452	728	7,496
Data collection	appr. 50 %	finished	finished	finished	appr. 50 %	finished	

Moreover, almost all the bats (12,700) in the collection of the ZMB had been registered and were made available in digital form for the first time.

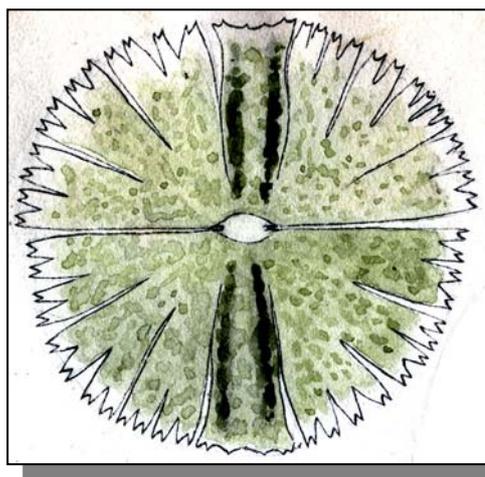
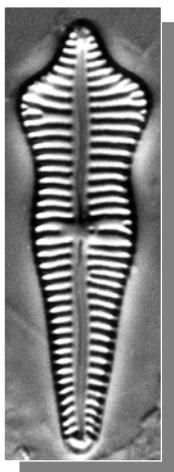
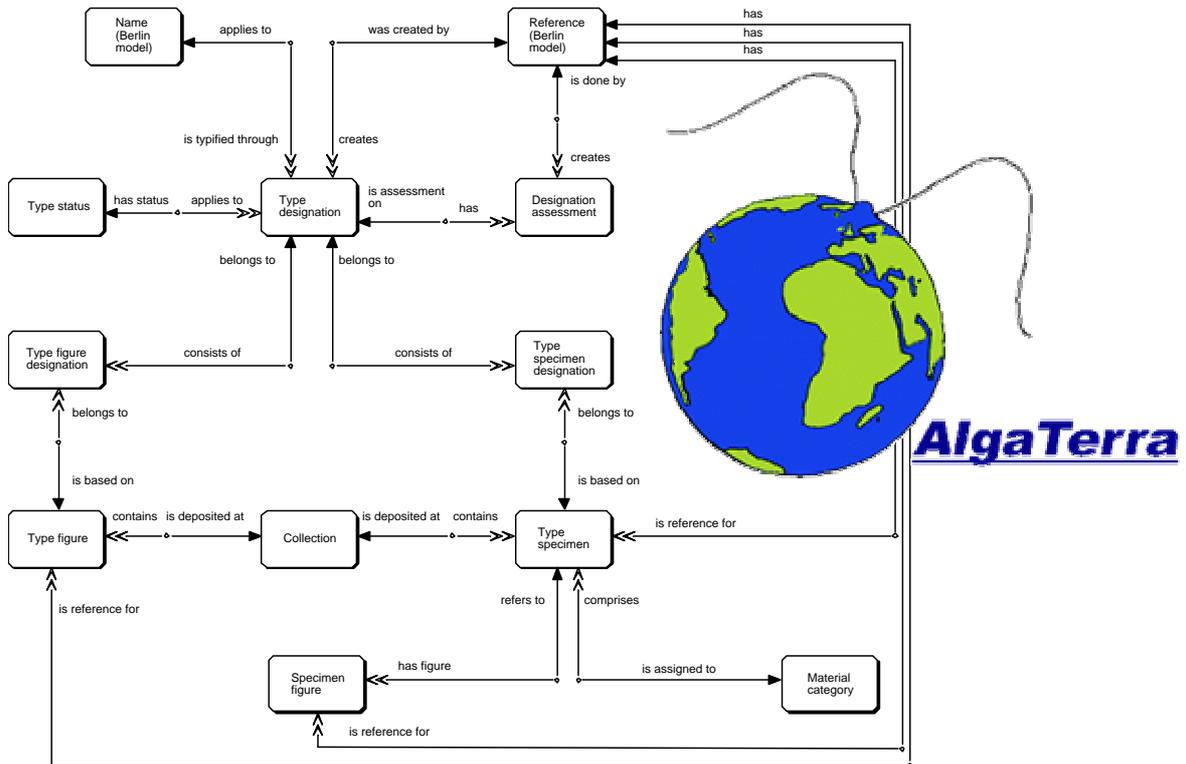
Perspectives

Almost from the start of the examination of the collection in the ZMB it became clear that the actual holdings of types were considerably more numerous than expected. Many original specimens (types) had been quite insufficiently marked or labelled at the time of receipt or the time of their description at the ZMB. Some had not even been inventoried, thus rendering their equation with published types difficult. Consequently, numerous type specimens in the collection remained unrecognised, being presently undetermined or labelled with synonymous or even manuscript species names. The real stock of types can only be ascertained by a complete inventory of all mammals (approx. 150,000) stored at ZMB. This work has been started by us and is still in progress. We expect at least 650 further primary and 400 further secondary type specimens; but to find them requires an immense amount of additional investigations in terms of correct generic allocation and species identifications, which will not be realised within time limits of the present project.

Sub-project duration: Jan. 2003 – Dec. 2005, lead: Gerhard Storch, gstorch@sng.uni-frankfurt.de; Hendrik Turni hendrik.turni@t-online.de

Supported by the GBIF Programme of the German Federal Ministry of Education and Research, umbrella project ID: 01LI0207, Oct. 2002 – Dec. 2005, lead: Renate van den Elzen, r.elzen.zfmk@uni-bonn.de.

BIOLOG-Biodiversity Informatics Programme: *AlgaTerra*



Umbrella project: *AlgaTerra*: An information system for terrestrial algal biodiversity: a synthesis of taxonomic, molecular and ecological information

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Keywords: AlgaTerra, biodiversity informatics, data model, micro algae, research infrastructure, typification, virtual collection, GBIF-D, GBIF-Germany

Abstract

In the pilot phase of *AlgaTerra* (Oct. 2001 – Dec. 2004) [1] five groups joined forces for research on micro algae. Their data were structured, evaluated and synthesised to fit the concept-oriented *Berlin Model* database, thus making use of past and present information for the Internet. It is shown that scientific information from diverse areas such as taxonomy, nomenclature, morphology, ecology and molecular biology can be synthesised for an Internet information system on algal biodiversity. Thus, the *AlgaTerra* information system can fill the gap between databases which are name-based and those purely oriented towards molecular results.

Objectives

Aim of this BIOLOG-project is the establishment of an Internet available information system on terrestrial micro algae, integrating name, molecular, taxon, type, environmental, and collection data as well as illustrations. The main target groups are scientists pursuing basic research as well as applied researchers. In future, the *AlgaTerra* information system can be extended to serve policy makers, e.g. in the context of water policies (EU Water Framework Directive), as well as for capacity building (e.g. in biomonitoring) and public education. The integrated information system will serve as a prototype application for the GBIF Species Bank Programme, while the supported digitisation efforts in algal collections represent direct high-quality input for the GBIF specimen network in the context of the Botanical Node of GBIF-D.

Results

The *AlgaTerra* database was implemented by sub-project AT1 (Jahn et al.), the underlying data model was developed in co-operation with the Biodiversity Informatics Department at the BGBM. It was extended by specific modules for *AlgaTerra* that handle type data and incorporate voucher information.

Basic research data have been digitised and prepared for the *AlgaTerra* database: About 200 algal strains (diatoms) have been newly established, characterised morphologically and sequenced by sub-project AT3 (Medlin et al.); 200 algal strains (green algae and cyanobacteria) have been sequenced by sub-project AT4 (Friedl & Hepperle), 200 algal types of C.G. Ehrenberg have been typified by sub-project AT1, about 80 cultures of aeroterrestrial algae have been isolated and characterised by sub-project AT5 (Reisser & Salisch).

The infrastructural research service supplied by *AlgaTerra* was the indexing of scientific names and types (sub-project AT1, Jahn et al.), databasing of original material of the Ehrenberg Collection (sub-project AT2, Lazarus) digitizing of diatom types of the Hustedt Collection (sub-project AT3, Medlin et al.), and digitizing of bibliographic data (sub-project AT5, Reisser), see reports in this volume and [1-6].

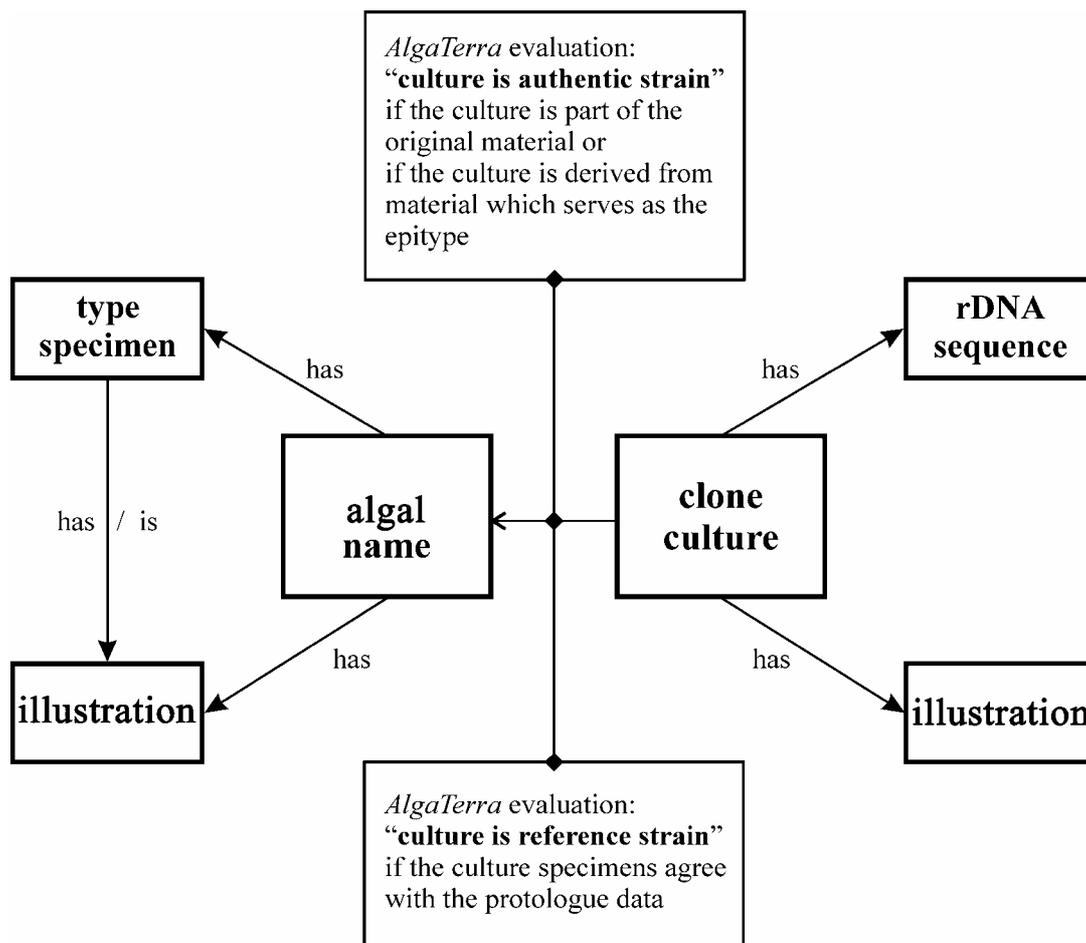


Fig. 1: Concept of the main elements of the AlgaTerra Information System (after [3])

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Project duration: Oct. 2001 – Dec. 2004, lead: Regine Jahn, r.jahn@bgbm.org

Supported by the BIOLOG programme (Biodiversity Informatics) of the German Federal Ministry of Education and Research, umbrella project ID: 01LC0026, Oct. 2001 – Dec. 2004, lead: Regine Jahn, r.jahn@bgbm.org, www.algatererra.org.

The *AlgaTerra* database including the typification module and Ehrenberg's types

Umbrella project: *AlgaTerra*: An information system for terrestrial algal biodiversity: a synthesis of taxonomic, molecular and ecological information

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Keywords: database, micro algae, nomenclatural types, taxonomy, virtual collection

Abstract

Within the *AlgaTerra* database project the BGBM (sub-project AT1) is responsible for the development and implementation of the database and for the evaluation of Ehrenberg's original material. The illustrated types serve as calibration tool for related taxonomic concepts. Factual data (sequence data, morphological data, and ecological data) from the *AlgaTerra* sub-projects AT3 (Medlin et al.), AT4 (Friedl & Hepperle), and AT5 (Reisser & Salisch) are linked to those concepts. A test version of the database including a bibliographic database (AT5) is running since 2003 and will be published in December 2004 on the Internet [1].

Objectives

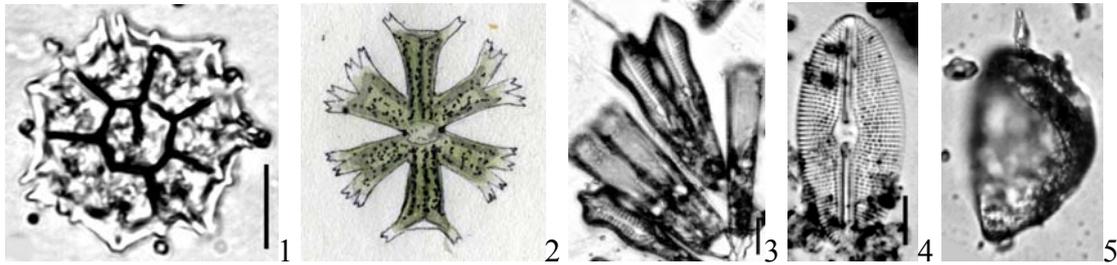
The main objectives of the sub-project AT1 (Jahn et al.) are modeling and implementation of the *AlgaTerra* Internet-database, merging of factual data of the other sub-projects, evaluation of algal names, typification, and digitisation of Ehrenberg type specimens.

Results

The core of the *AlgaTerra* database is based on the concept oriented *Berlin Model* which has been developed and was documented in co-operation with other projects at the BGBM [2]. *AlgaTerra* was leading in the development of an extension module, that allows administration of data on typification and on vouchers [3-4]. In 2003/2004 most parts of this model were implemented, and the web-interface has been developed and modified according to the needs of all project partners.

By September 2004 the *AlgaTerra* database included 16,816 algal names. 4,190 genus names plus their type species had been imported from the NCU-database [5]. For 2,184 algal names data of 3,281 nomenclatural types were databased, mainly from the Hustedt-Collection (BRM). 586 type specimens are shown, digitised by *AlgaTerra* sub-project AT3. At the BGBM more than 200 algal types, mainly Ehrenberg taxa, are being prepared for publication on the Internet. The evaluation and typification of currently 68 algal names, many of them genus names such as *Amblyophis*, *Cocconeis*, *Cryptoglana*, *Gomphonema*, *Lyrella*, *Microtabella*, *Prorocentrum*, *Rhoicosphenia* are being published in a series of papers (see e.g. [6-9]; for the complete *AlgaTerra* publication record see [10]). In co-operation with H. Lange-Bertalot approx. 350 illustrations of diatom types, designated by Lange-Bertalot and co-workers are being databased and digitised. 70 illustrations of clonal culture strains have been integrated into *AlgaTerra*, further 200 are being processed from the other projects for the *AlgaTerra* database. 12 video clips by O. Skibbe, showing motile microalgae within six algal classes were integrated in *AlgaTerra*. 199 datasets of morphological fact data have been databased and 668

molecular datasets have been delivered by the sub-projects AT3 (Medlin et al.) and AT4 (Friedl & Hepperle).



Figs 1-5: Original material and designated types from the Ehrenberg Collection. Bar=10µm

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The *Berlin Model* database was to a large extent developed at the BGBM in the course of the Euro+Med PlantBase project, which was funded by the European Commission under the fifth Framework Programme; significant additional input came from the MoReTax project financed by the German Federal Environment Ministry – Federal Agency for Nature Protection.

Improving accessibility of the Ehrenberg Collection

Umbrella project: *AlgaTerra*: An information system for terrestrial algal biodiversity: a synthesis of taxonomic, molecular and ecological information

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Keywords: algae, collection, database, museum, taxonomy

Abstract

The Ehrenberg Collection (Christian Gottfried Ehrenberg 1795-1876) of microorganisms at the Museum für Naturkunde in Berlin was newly curated to make the thousands of algal type specimens in it accessible. A full inventory and new relational database (approx. 20,000 records) were made of all objects (samples, microscopic preparations, drawings and other items). Objects were labeled, placed in new storage units, and thousands of pages of documents were scanned. The database and documentation were placed on the Internet [1] and will be made available via GBIF.

Objectives

The Ehrenberg Collection of micro-organisms and microfossils is one of the world's oldest and most important, as it contains type specimens for thousands of common species, including approx. 10 % of the type species for diatom genera. Ehrenberg worked before the rules for typification and type deposition were established, but enough information was deposited with the collection to allow type specimens to be subsequently designated. Unfortunately this information is scattered over the several kinds of objects that make up the collection – his microscope preparations on mica, original samples, and drawings of organisms, many unpublished. The Ehrenberg Collection in the Museum obtained its first regular curator only in 1996, and as *AlgaTerra* began, much basic work still needed to be done to make the collection effectively usable for the taxonomic goals of the project. These included: An inventory of all objects; new labels for samples and preparations and new storage for endangered objects; backing-up all documents via scanning; cross-referencing all objects in a relational database; and making all information accessible over the Internet.

Results

All major kinds of objects in the collection have now been fully inventoried [2]. It is perhaps easiest to discuss these and their position in the database simultaneously. Database tables are indicated in uppercase. SAMPLES (5,847 entries) are the central object type in the collection. The samples were partially collected by Ehrenberg himself, but many were sent to him by post from travellers around the world (including Darwin). All text labels on, or in the samples have been databased; further, the geographic location of each sample (often given in obsolete form) has been matched to modern lists of GEOGRAPHIC NAMES. The master list for this aspect of the work was derived from those created by G. Hagedorn for the *DiversityWorkbench* project. Samples were used by Ehrenberg to create his own microscopic preparations on strips of MICAS. Each strip (7,529 entries) consists of 5 individual mica discs, glued together, which are marked and labeled by Ehrenberg for taxa of interest (up to several dozen per strip). Anywhere from one to 16 strips were made from each sample. From the strips selected specimens or entire fields of view were drawn onto approx. A4 sized sheets of paper (DRAWINGS: 3,111 entries). One sheet can contain more than 100 specimen illustrations. Significant

taxa were noted on the sheets, all such notations are also entered into the database in the drawings table. In addition to these main data tables, additional tables were created to capture sample and mica information written on larger sample storage units – SAMPLE PACKAGES, CASES, and TRAYS.

The result of the databasing effort is that it is now possible to quickly determine which objects in the collection exist that match any given query from a user, and to provide the user as well with immediate matches (via relational links) between the different types of objects – the original samples, the micas made from them, and the drawings made from organisms observed on the micas. This information has made use of the collection much more efficient, and has supported the work of the taxonomists in the other sub-projects of *AlgaTerra*.

Physical curation of collection objects has also been done to insure their safe storage and use. All samples have been newly labeled and placed in dust-proof plastic bags to prevent adjacent samples contaminating each other in the storage drawers. All drawings have been placed in archival quality folders with pergamin sheet separators. All drawings were also scanned into high-resolution image files. All mica strips have been labeled, and many have been transferred into new cabinets to replace the original wood/cardboard boxes, which had been previously damaged by a fire in the Museum in the early 1980s. Other important documents, including plates and other pages from key publications, have also been scanned.

To make this information available via the Internet, both the database and the scanned documentation have been placed for free download on an ftp server run by the Museum für Naturkunde. The database uses a free-for-academic use software system (4D). A website version was not technically possible at our Museum and thus remains a future goal, but the current offering – accessible via the *AlgaTerra* website [3] – has been proved to be adequate, and has received positive comments from users. A BioCAsE Wrapper will be installed to provide access via portals in the GBIF Network.

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Molecular and ecological data on terrestrial diatoms

Umbrella project: *AlgaTerra*: An information system for terrestrial algal biodiversity: a synthesis of taxonomic, molecular and ecological information

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Key words: diatoms, ecology, morphology, phylogeny, rDNA

Abstract

Diatoms are a ubiquitous group of unicellular eukaryotic algae. The main practical importance of their freshwater species for us lies in their excellent applicability to biological water quality monitoring. Due to their morphological feature-richness unparalleled among micro organisms, studies of their diversity using molecular approaches lag behind those of many other microalgal groups. Our sub-project aimed at collecting morphological and molecular data about freshwater diatom species in order to contribute to a better understanding of their diversity and evolution. We also sought to link the diversity data obtained to classical taxonomical information on the one hand, and ecological data on the other, within the scope of the *AlgaTerra* Information System.

Objectives

Sub-project AT 3 aims at 1) providing the *AlgaTerra* Information System with data (including detailed annotation and photomicrographs of the type specimens) about type material of diatom taxa described by Hustedt from localities in North Germany; 2) revisiting and ecological characterisation of the type localities of these taxa in order to isolate cultures of them and other important diatom taxa; 3) deposition of the cultures isolated at the Collection of Algal Cultures, Göttingen (SAG); 4) morphological (light- and electron microscopic) and molecular (especially sequencing of ribosomal genes) characterisation of the isolated strains; 5) using the DNA sequences obtained for detailed phylogenetic and micro diversity analyses.

Results

From the database of the F. Hustedt Diatom Collection, housed at the AWI, Bremerhaven (BRM), the type data and pictures of more than 300 species have been exported to the database of the *AlgaTerra* Information System using the concept-based *Berlin Model*. The classification and scientific names of extracted type data of the Hustedt Collection Database have been merged with data already present in the *AlgaTerra* database by relating their taxonomic concepts. Merging of these data included a prior evaluation of the data delivered as well as adaptation to the standards of *AlgaTerra* Information System. The type data attached to the names have been extracted from the data delivered and processed to fit into the type extension of the *Berlin Model*. The collection-based type data of names from the Hustedt Collection have thus been integrated into a database where factual data can be attached to the taxonomic concepts.

221 samples from 87 sampling sites throughout Northern Germany were collected in the course of the project. More than 500 unialgal cultures were isolated from these, about 200 of which (representing about 150 species) have been characterised morphologically and by ribosomal DNA sequencing [1-3], and deposited at the SAG, Göttingen.

Taxonomic and morphological data on these cultures, as well as light and electron micrographs, are being made available through the *AlgaTerra* Information System. Complete 18S rDNA (103), partial 28S rDNA (184), ribosomal ITS (63) and partial *psaA* (89) sequences have been obtained from the cultures. The sequences were used to perform detailed phylogenetic analyses of taxa belonging to two major groups of freshwater diatoms (the orders Fragilariales [3] and Naviculales [2]), as well as an analysis of micro diversity in the genus *Cyclotella* [1] as an example of a diatom group providing difficulties for morphology-based taxonomy. Whereas the results of the molecular analyses were in part congruent with earlier hypotheses based on morphological data, conflicting results have also been obtained. For example in the phylogenetic tree of the Naviculales (Fig. 1) all genera comprising species that have been separated from the genus *Navicula* appear elsewhere in the tree (Δ). But this is also true for several species, still named *Navicula* (\otimes).

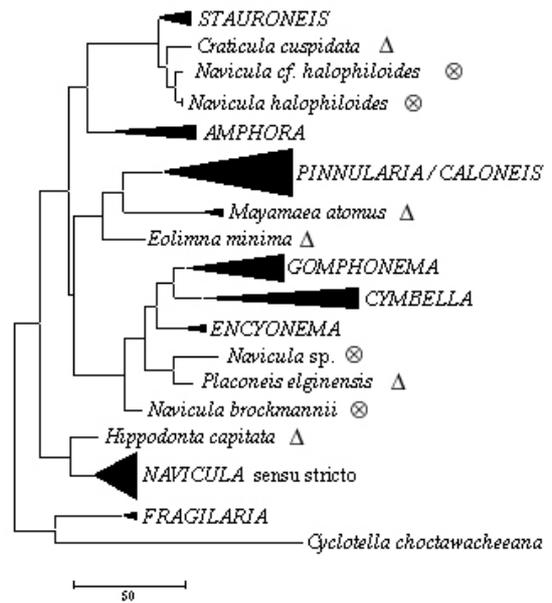


Fig. 1: Phylogenetic tree of the Naviculales, derived from the sequences of the 18s rDNA, using maximum likelihood method after performing a modeltest.

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Documentation of characters of terrestrial algae in culture: rDNA sequence analyses, morphology and cryo-preservation of reference strains

Umbrella project: *AlgaTerra*: An information system for terrestrial algal biodiversity: a synthesis of taxonomic, molecular and ecological information

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Key words: cyanobacteria, green algae, morphology, phylogeny, terrestrial algae

Abstract

Micro algae are an enormously diverse group of primary producers, abundant in almost all ecosystems on earth and with key roles in carbon fixation and oxygen production. The diversity of microalgae is still little understood and DNA sequence analyses are essential in order to investigate their biodiversity. The project combined molecular data with phenotypic characters and other descriptive data that were available from cultures of micro algae and cyanobacteria in order to assess their biodiversity and phylogenetic relationships.

Objectives

In this sub-project (AT4) of *AlgaTerra* genotypic and phenotypic data of micro algae in culture are being made accessible in an Internet-based database in order to provide an important tool for assessing the biodiversity of micro algae. The focus is on terrestrial green algae and cyanobacteria from soils and substrate-air interfaces. To address taxonomic issues, authentic strains which represent the culture material used for the description of new taxa were studied. Reference strains were selected for those taxa where no authentic material is available.

Results

Almost all authentic strains from the SAG culture collections (which is among the three largest algal culture collections in the world) were investigated for their ribosomal RNA Gene sequence signatures and morphological characters. In addition, a core of the authentic strains maintained at the specialised culture collection of the University of Innsbruck (Austria) has been evaluated at both molecular and morphological levels. Where necessary, important culture material has been purified. A large fraction of the studied strains has successfully been cryopreserved, which is particularly important for the genetically stable maintenance of type material and reference strains. In order to view the large phylogenies produced within the project, a special Java-based application ("TreeMe", Fig. 1) has been developed which enables the easy navigation (overview and details) and updating; it will be integrated into the web-based database of *AlgaTerra*. For most of the taxa that were studied by DNA sequence analyses also morphological characters as available from the cultures were carefully documented and are being integrated together with images into the database. The capabilities of the documented data to identify new subaerial isolates have been successfully tested on unidentified culture strains provided by sub-project AT5 (Reisser and Salisch) and two ongoing research projects on algal-dominated biofilms at SAG.

Sequencing of ribosomal RNA Genes (complete SSU rDNAs in 214 strains, complete SSU and ITS-1,2 rDNAs in 172 strains of green algae, complete SSU rDNAs in 120 culture strains of cyanobacteria) revealed an unexpected diversity: species of micro algae once considered as members of a single genus due to their morphological similarity were found to be distinct at the level of orders or even classes. Sequence comparisons of the highly variable ITS rDNA regions were used to unravel relationships of species/strains of green algae within the genus boundaries; these sequences unequivocally define species. These data form the basis for solving the taxonomic problems in many species and genera. They provide also new insights into the diversity and phylogeny of the green algal class Trebouxiophyceae which can be primarily characterised by members from subaerial habitats and explain the distribution of certain adaptive characters within the class [1, 2]. In about 20 % of the studied green algae up to four group I introns (a class of RNA enzymes) per 18S rDNA sequence were detected. Using phylogenetic analyses, the origin and distribution of the rDNA introns is studied.

Tree Navigator

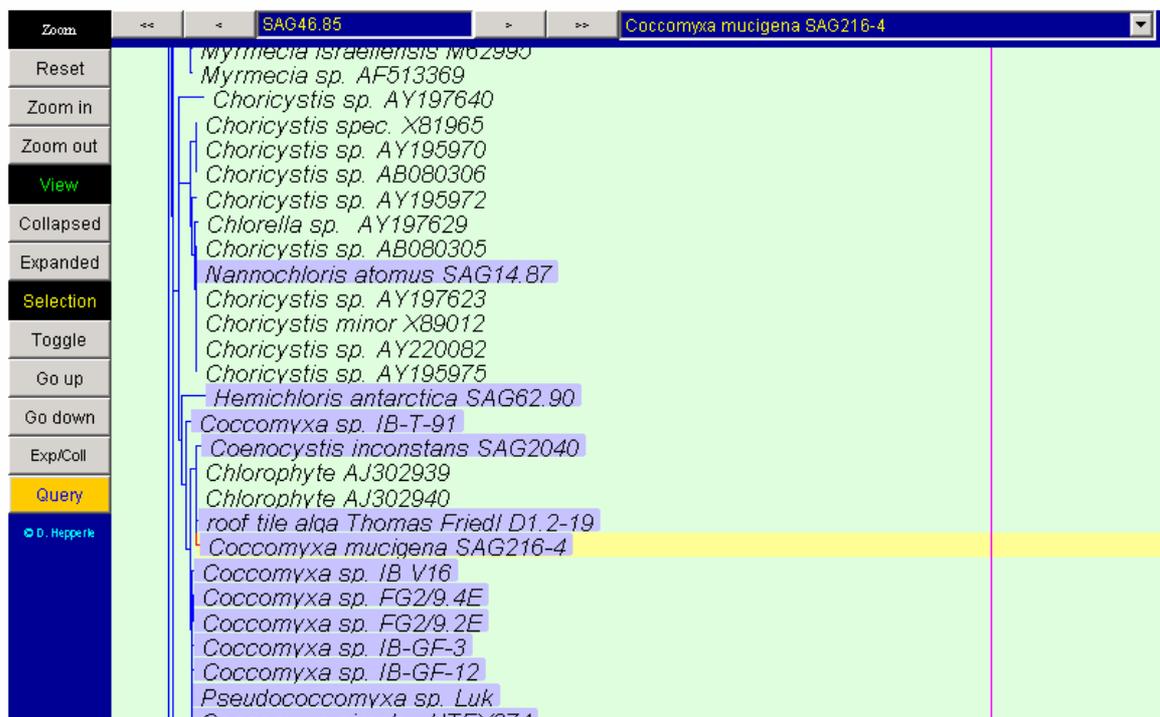


Fig.1. Example page of the "TreeMe" software developed during the *AlgaTerra* project

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Characteristic data of green and bluegreen algae

Umbrella project: *AlgaTerra*: An information system for terrestrial algal biodiversity: a synthesis of taxonomic, molecular and ecological information

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Keywords: aeroterrestrial algae, bibliography, cyanobacteria, green algae

Abstract

In this sub-project (AT5) of *AlgaTerra* data of approx. 250 abstracts of studies on aeroterrestrial algae have been prepared to be made available for Internet search. About 80 strains of aeroterrestrial algal of Central European habitats have been systematically collected and described using classical phycological features, and an access interface to the data on aeroterrestrial algae living on tree barks has been developed.

Objectives

This sub-project AT5 of *AlgaTerra* aimed at (a) collecting and processing of ecophysiological data on green and bluegreen aeroterrestrial algae, (b) the isolation and taxonomic identification of aeroterrestrial algae from Central European habitats, and (c) the development of an access interface to the information on common taxa of aeroterrestrial algae based on descriptions and figures.

Results

a) Data mining has been done for information on aeroterrestrial algae with preference on ecophysiological and taxonomic data. Special attention has been paid to Russian and Ukrainian sources and local congress and academy reports, which were translated and thus made available to a broader scientific audience. About 250 datasets are now available; each consisting of the bibliographic reference, an abstract and notes [1]. Data has been transferred to the sub-project AT1 of *AlgaTerra* (Jahn et al., this volume) where they are key-worded and processed for publication on the Internet. The data are searchable by full-text search in the abstract as well as by a categorised search on locality, subject and algal name (Fig. 1). Special attention has been paid to references containing valid diagnoses of aeroterrestrial algal species. From those papers, both English and Latin diagnoses and relevant figures have been included in the data set.

b) About 80 chlorophycean, trebouxiohycean and xanthophycean taxa of aeroterrestrial algae have been isolated from soils in Central Germany in order to get an overview of the aeroterrestrial algal flora at a defined site. They are kept as axenic cultures (Fig. 3). For each isolate, relevant features observable by light microscope are documented in a dataset that contains morphological features, such as cell size, structure of the cell wall, shape of chloroplast, pyrenoid, number and type of flagella, mode of propagation, figures of typical developmental stages, etc. (Fig. 2). Some of the isolates represent species that have not been reported before from comparable sites or are probably new taxa. Isolates have been sent to sub-project AT4 (Friedl & Hepperle) of *AlgaTerra*, where data have been completed by a molecular analysis; the information was thereafter sent to sub-project AT1 (Jahn et al.).

List of Abbreviations

ABCD: Access to Biological Collection Data
AlgaTerra: Information System for Terrestrial Algal Biodiversity
BfN: German Federal Agency for Nature Conservation
BGBM: Botanic Garden and Botanical Museum Berlin-Dahlem
BIG: Bundesinformationssystem Genetische Ressourcen
BioCASE: Biological Collection Access Service for Europe
BioCASE: Biological Collection Access Service (designation for protocol and software)
BMBF: German Federal Ministry of Education and Research
BSM: Botanische Staatssammlung München
CABRI: Common Access to Biological Resources and Information
CMS: Content Management System
CVS: Version Control System
CODATA: Committee on Data for Science and Technology
DEEMY: Information System for the Determination and Characterisation of Ectomycorrhizae
DIGIT: Digitisation of Natural History Collections (GBIF Programme)
DSMZ: German Collection of Microorganisms and Cell Cultures
ECAT: Electronic Catalogue of Names of Known Organisms (GBIF Programme)
EDIS: Entomological Data Information System
ENBI: European Network of Biodiversity Information
EU: European Union
FEST: Framework for European Services in Telemedicine
FIS: Forschungsinstitut Senckenberg Frankfurt
GBIF: Global Biodiversity Information Facility
GIS: Geographic Information System
GLOPP: Global Information System for the Biodiversity of Plant Pathogenic Fungi
GTZ: Deutsche Gesellschaft für Technische Zusammenarbeit
ITFG: IT Expert Group
LIAS: Global Information System for Lichenized and Non-Lichenized Ascomycetes
OECD: Organisation for Economic Cooperation and Development
SMNS: Staatliches Museum für Naturkunde Stuttgart
TDWG: Taxonomic Database Working Group
TGWG: Technical Guidance Working Group
UNESCO: United Nations Educational, Scientific and Cultural Organisation
VPN: Virtual Private Network
XKMS: XML Key Management Specimen Classification
XML: Extended Markup Language
ZFMK: Zoologisches Forschungsinstitut Museum Alexander Koenig, Bonn
ZSM: Zoologische Staatssammlung München



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