Important Information Systems for Plant Genetic Resources in the World

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One of the major challenges for food security in the next generation is the effective management of plant genetic resources worldwide. Thus, documentation of plant genetic resources becomes very important at the national, regional and global levels for effective conservation of rapidly disappearing genetic stocks for possible future use and also for immediate utilization of already conserved and evaluated/characterized germplasm in the on going crop improvement programmes. In the present article, an attempt has been made to compile the list of some of the most important web sites related to issues, databases, availability and information systems of plant genetic resources.

Key Words: Databases, Information System, Plant Genetic Resources, Taxonomic databases, Web sites

Plant genetic resources (PGR) for food and agriculture consists of the diversity of genetic material contained in traditional varieties and modern cultivars grown by farmers as well as wild relatives of crops and other wild plant species that can be used for food, feed fiber, clothing, shelter, wood/timber, energy, etc. One of the major challenges for food security in the next generation is the effective management of PGR worldwide. Thus, documentation of PGR becomes very important at the national, regional and global levels to effective conservation of rapidly disappearing genetic stocks for possible future use and also for immediate utilization of already conserved and evaluated/characterized germplasm in the ongoing crop improvement programmes. The recent advancement in information technology especially two activities namely development of databases and the internet has led to an explosion in the compilation and collation of information in all fields, including PGR. This wealth of information available in the world wide web through the internet is searchable using various search engines such as *www.google.com, www.altavista.com, www.yahoo.com,* etc. However, when specific information is required by scientists, policy makers, teachers etc. for a specific topic such as PGR management, it would be helpful to have a ready reference to the varied information sources on the internet, rather than the cumbersome search through a search engine.

Thus information on the important institutes, organizations, working groups dealing with PGR has been compiled along with their exact web addresses, important objectives and the type of information available on each of these sites. It is hoped that this compilation would serve as a ready reckoner for all PGR workers.

A. International/Regional Databases and Information Sites

1. *World Information and Early Warning System (WIEWS) on PGR (http://apps3.fao.org/wiews/wiews.jsp)*

The WIEWS website is hosted by FAO World Agricultural Information Centre (WAICENT) presently consists of a number of relational databases, resulting from direct contributions from Member Countries and from routinely (e.g. World Seed Review; data gathering from publications; etc.) and event-related data collating activities (e.g. Country reports for the IV International Technical Conference on PGR; Regional Meetings; etc.) carried out by AGPS staff; a Global Network of Country Correspondents on PGRFA Information Exchange, officially nominated by the Governments (for India it is the author); a repository directory of documents and proceedings related to: the activities of the Global Network on PGRFA Information Exchange; the Early Warning System on Genetic Erosion; and the Global Plan of Action for the conservation and sustainable utilisation of PGRFA (GPA).

Among WIEWS and SIS relational databases, there are:

- the Country Profiles database, including the structure of 190 national PGR programmes and activities;
- the *Ex-situ* Collection database, containing summary records of PGR holdings (more than 5 million accessions belonging to more than 18,000 species) reported by more than 1,500 national, regional or international genebanks;
- the PGRFA and Seed Laws and Regulations database (70 countries);

- the World List of Seed Sources database (approx. 8,000 entries from 150 countries); and
- The List of Crop Varieties database (about 65,000 varieties from 1,249 cultivated crops).

2. ***CGIAR System-wide Information Network for Genetic Resources (SINGER) (http://singer.grinfo.net/)***

The CGIAR System-wide Information Network for Genetic Resources (SINGER) is the genetic resources information exchange network of the Centres of the Consultative Group on International Agricultural Research (CGIAR). It provides access to information on the collections of genetic resources held by the CGIAR Centres. Together, these collections comprise over half a million samples of crop, forage and tree germplasm of major importance for food and agriculture.

SINGER links the genetic resources databases of the CGIAR Centres and allows simultaneous searches for information concerning the identity, source, characteristics and transfer of the genetic resources in the individual Centre collections.

3. ***Commission on Genetic Resources for Food and Agriculture (CGRFA) (http://www.fao.org/WAICENT/FAOINFO/AGRICULT/cgrfa/)***

The FAO Commission on Genetic Resources for Food and Agriculture (CGRFA) is a permanent forum for governments to discuss and negotiate these matters. Its main objectives are to ensure the conservation and sustainable and fair utilization of genetic resources in food and agriculture. Membership is open to all FAO members and associate members, on request. The site has information about the aims and activities of the CGRFA, documents published by the commission, (in PDF, requiring Adobe Acrobat Reader), and specific information on global strategies for animal and plant genetic resources. The site is available in English, French and Spanish, but some documents are available only in English.

4. ***Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (http://www.fao.org/WAICENT/FaoInfo/Agricult/AGP/AGPS/GpaEN/gpatoc.htm)***

The Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture, as adopted by 150 countries at the International Technical Conference. It contains 20 priority activities grouped in four theme areas:

- *In situ* conservation and development
- *Ex situ* conservation
- Use of Plant Genetic Resources
- Institution and capacity building

The following information is categorized in this site-

- Global Plan of Action
- State of the World
- Global system
- International Technical Conference

5. ***International Undertaking on Plant Genetic Resources for Food and Agriculture (http://www.fao.org/ag/cgrfa/IU.htm)***

The International Undertaking was the first comprehensive international agreement dealing with plant genetic resources for food and agriculture. It was adopted by the FAO Conference in 1983 (Resolution 8/83), as an instrument to promote international harmony in matters regarding access to plant genetic resources for food and agriculture. This complete text of the 1983 undertaking and the information about the negotiations for the revision of the international undertaking is also available on this site.

6. ***International Plant Genetic Resources Institute (http://www.ipgri.cgiar.org/)***

The International Plant Genetic Resources Institute (IPGRI) was established in 1975 and is one of the 16 research centres which come under the Consultative Group on International Agricultural Research (CGIAR). Details are provided about IPGRI, its aims and activities. Information on the research programmes currently undertaken by IPGRI is available. A collection of online information resources is provided and include germplasm databases, training materials and publications. Many training materials and IPGRI publications are in PDF format and can be downloaded and viewed online. All IPGRI online materials are available in English but some can also be viewed in French and Spanish. Press releases and topical news articles and reports are also provided on this site.

7. ***The International Treaty on Plant Genetic Resources for Food and Agriculture (http://www.fao.org/ag/cgrfa/itpgr.htm)***

This site gives the details in the following categories.

- Official versions of the Treaty
- Video on the Treaty
- Signatures and ratifications
- Comments on compliance
- Funding Strategy

- Questionnaire
- Background Study
- Paper on Compliance

8. ***The International Union for the Protection of New Varieties of Plants (UPOV) (www.upov.int)***

The UPOV is an intergovernmental organization with headquarters in Geneva. This site has provision to download all the documents related to various meetings and technical committees of UPOV. It gives a comprehensive coverage of all the news, calendar of events, archives, list of publication etc.

9. ***IPGRI Directory of Germplasm Collections (http://web.ipgri.cgiar.org/germplasm/default.asp)***

IPGRI maintains a number of databases with summary information on *ex situ* germplasm collections worldwide. The data include address information on organizations holding germplasm and summary information on the type of germplasm that is maintained, such as: species names, number of accessions per species, type of accessions, etc. Currently, summary information on more than 5 million accessions worldwide is available. IPGRI attempts to keep these databases up to date by continuously incorporating new information. The updating and collation of ex situ germplasm holding data is done in close collaboration with FAO which provides a similar type of data as part of its World Information and Early Warning System (WIEWS). Synchronization of common data types is achieved through bi-monthly data exchange.

10. ***CIAT database on plant genetic resources (http://www.ciat.cgiar.org/pgr/)***

The Genetic Resources Unit (GRU) contains 60,000 accessions (samples of seeds and other reproductive plant materials), mostly unimproved landraces. Representing 720 species, this germplasm is documented in bean, cassava, and forage databases, from which users can generate reports on selected accessions in the collections.

11. ***International and Regional Crop-related Networks Supported By FAO (http://www.fao.org/WAICENT/FaoInfo/Agricult/AGP/AGPS/cnet.htm)***

The International Agreement on Genebanks for the network of *ex situ* collections and the links to individual crop-related networks under the auspices of FAO can be found on this site.

12. ***International neem network (http://www.fao.org/forestry/foris/webview/forestry2 index.jsp?siteId=2021&langId=1)***

The International neem network is made up of national institutions from 23 countries under the overall coordination of FAO's Forestry Department. It focuses its work on exploring and evaluating the genetic diversity of the neem (*Azadirachta indica*) tree. The Web site gives details of the organization and activities of the network, including workshops, and publications by the network (most of which are available online) and others.

13. ***Seed and Plant Genetic Resources Service: AGPS (http://www.fao.org/waicent/faoinfo/agricult/AGP/AGPS/)***

A Service of the FAO's Plant Production and Protection Division, the AGPS provides technical and policy advice on plant genetic resources conservation and use, seed and planting materials improvement, and production, including seed security. This site provides information about the Service, its aims and activities. Access is provided to several online databases, namely World Seed Review, World List of Seed Sources, and Olive Germplasm, Cultivars and World-Wide Collections. Information about AGPS publications is available. Information, and in some cases links, to crop-related networks supported by the FAO is provided. News and events of relevance to the AGPS is available as is a collection of links to useful Web sites.

14. ***Genetic Resources Action International (GRAIN) ((http://www.grain.org)***

It is a comprehensive and very rich web site providing information and views on issues related to PGR, bio-diversity, environment and other issues related to the subjects.

15. ***The Convention on Biological Diversity (http://www.biodiv.org)***

- The information about the Convention, the Biosafety Protocol, Programmes and Issues,
- Clearing-House Mechanism, CBD Information Centre, Public Participation, Press Room
- Discussion Forums, Secretariat, Divisions, Opportunities, Quarterly Reports and the information about the latest notification is available on this CBD Site.

16. ***Plant Genetic Resources Abstracts (http://www.cabi-publishing.org/AbstractDatabases.asp?SubjectArea=&PID=46)***

Plant Genetic Resources Abstracts is a fully searchable abstracts database of internationally published research. Derived from the CAB Abstracts database, PGRA provides

the latest information on the genetic resources of all plant species of economic value and their wild relatives. This includes their taxonomy and evolution, biotechnology, genetic diversity, conservation, ethnobotany, gene banks, characterization and utilization. Information is also included on quarantine issues related to germplasm exchange.

Each week Plant Genetic Resources Abstracts delivers all the new highly-targeted, searchable summaries comprehensively covering key English and non-English language journal articles, reports, conferences and books on plant genetic resources. Over 2,500 records are added to the database annually.

Plant Genetic Resources Abstracts Online includes a fully searchable 10-year backfile of nearly 34,000 records and brings a wealth of current and seminal research in this subject area.

The search is divided in following main categories-

- Genetic resources, general aspects
- Taxonomy, evolution and origin
- Genetic diversity
- Conservation
- Local and traditional uses of genetic resources
- Biotechnology
- Gene banks, documentation and information management
- Germplasm characterization and evaluation
- Germplasm enhancement and utilization
- Plant health, quarantine and safe movement of germplasm

Plant Genetic Resources Abstracts is updated weekly online, it is also available quarterly in print.

B. National Databases

1. ***Federal Information System on Genetic Resources (BIG) (http://www.big-flora.de/index_e.html)***

The Federal Information System Genetic Resources (BIG) integrates relevant data on genetic resources for cultivated and wild flora in Germany by establishing a set of related internet databases. Four partner institutions with extensive databases on wild and cultivated plants are jointly developing the **B**undes **I**nformations system **G**enetische Ressourcen (Federal Information System on Genetic Resources – BIG) as an on-line system for the internet.

(i) The Federal Office for Nature Conservation (Bundesamt für Naturschutz - BfN) in Bonn collects databases on variety inventories (*in situ*), distributions, populations and the ecology of native wild plants as well as information on the conservation and trade of varieties protected by national and international law (*http://www.bfn.de/*).

It provides the following database-

- Information Network Plants and Vegetation (Flora Web)
- Distribution data and situation of the population (FLORKART)
- Information on endangerment: federal and state Red Lists
- Taxonomy und systematics
- Information on distribution (spatial) Database WISIA (Scientific Information System in Species Protection)
- Protection status of species appearing in trade according to international and national agreements and laws
- Distribution based on countries of origin

(ii) Plant collections of botanical gardens in Germany (*ex situ*) are registered and documented by the Botanical Garden of the Ruhr-Universität Bochum (RUB) (http://www.boga.ruhr-uni-bochum.de/) for the Association of Botanical Gardens (Verband Botanischer Gärten) (http://www.biologie.uni-ulm.de/verband/index.html).

It provides the following database-

- SysTax - Botanical Garden Information System
- Data on living material from until now 18 botanical gardens
- Information from reference collections (herbaria)
- Taxonomic data (systematics/taxonomy/naming)
- Pictures
- Distributions
- Literature references

(iii) The Institute for Plant Genetics and Crop Plant Research (Institut für Pflanzengenetik und Kulturpflanzenforschung – IPK) (*http://www.ipk-gatersleben.de/englisch*) in Gatersleben holds the database of nearly 100,000 cultivated plant accessions of the gene bank (*ex situ*) and is creating a database on "Mansfeld's World Manual of Agricultural and Horticultural Crops" as well as working on basic questions of cultivated plants taxonomy.

It provides the following database-

- Mansfeld's World Database of Agricultural and Horticultural Crops (Hanelt, P. and Institute of Plant

Genetics and Crop Plant Research (Eds.) 2001: Mansfeld's Encyclopedia of Agricultural and Horticultural Crops. 1-6: 3716 pp.)

- Information about taxonomy, names, synonyms, folk or common names, distribution, uses, literature on more than 6,000 cultivated plants world-wide
- Gene Bank – Search for Accessions
- Data on about 85,000 samples from the Gatersleben gene bank collection on taxonomy and origins.

(iv) The Information Centre for Biological Diversity (Informationszentrum Biologische Vielfalt - IBV) (*http://www.zadi.de/ibv/en*) of the German Centre for Documentation and Information in Agriculture (Zentralstelle für Agrardokumentation und -information - ZADI) (*http://www.zadi.de/en/index-en.htm*) in Bonn has many years of experience on Internet-based information systems and provides in addition to a number of variety-specific databases the main database on German plant genetic resources on the Internet.

It provides the following database-

- PGRDEU – Collections of Plant Genetic Resources in Germany
- Sample-related and taxonomic information on about 130,000 samples in 40 German *ex situ* collections
- FGRDEU – Forest Genetic Resources in Germany
- Information on *in situ* – and *ex situ* – conservation of forest genetic resources in Germany (more than 100 important forest trees and woody shrub species)

2. ***Centre for Genetic Resources (CGN) (http://www.plant.wageningen-ur.nl/about/Biodiversity/Cgn/default.htm)***

The CGN maintains the Dutch genebank for plant genetic resources for food and agriculture and this site provides information on the CGN, its organisation, aims and activities. Information is provided on CGN research projects and project leader contact details are available. There is a wealth of documentation on the CGN approach to genetic resource management, covering seed handling procedures, material acquisition, seed storage facility, regeneration protocols, and information systems. The CGN holds collections of several agricultural and horticultural crops, the passport data of which can be searched online or downloaded per crop. Evaluation data is also available but can only be downloaded per trait. All downloadable datasets are provided in zipped Excel format.

3. ***Danida Forest Tree Seed Centre (DFSC) (http://www.dfsc.dk/)***

Danida Forest Seed Centre (DFSC) is an institution under the Danish International Development Administration, providing "technical support to developing countries in the fields of procurement and handling of seed of tropical and subtropical tree species, basic tree improvement and conservation of forest gene resources." Information is provided on their publications, research, training, seed supply services and staff.

4. ***EUFORGEN Bibliography (http://www.ipgri.cgiar.org/networks/euforgen/biblio/select.asp)***

This online bibliography from EUFORGEN (European Forest Genetic Resources Programme) contains 1674 references, mainly to grey literature on conservation and use of forest genetic resources in Europe, but a number of articles from refereed journals are also included. It can be searched free-text or by initial letter of the title. Reference materials are held in the IPGRI (International Plant Genetic Resources Institute) library in Italy.

5. ***European Vitis Database (http://www.dainet.de/eccdb/vitis/)***

Published on the Web by the German Centre for Documentation and Information in Agriculture (ZADI), the European Vitis Database was established as one of the objectives of the GENRES#081 project, and provides free access to European grapevine genetic resources information. The database provides access to grape "passport" information, covering grape species, holding institute, country of origin, accession name, accession number, use, and pedigree. In addition, a collection of grape images is available to view online, and photographs are organised by either plant part or accession name.

6. ***GENRES #081 Vitis (http://www.genres.de/vitis/index.htm)***

This is the homepage for the European Network for Grapevine Genetic Resources Conservation and Characterization. Established in 1997, this is a collaborative project which aims to establish a free online database of genetic grapevine resources thereby enhancing the utilization of relevant and valuable germplasm in breeding. There are 15 partners involved in the project, all of whom are European National research institutes with a strong interest in viticulture. The site hosts 2 searchable databases which contain a range of information relating to grape

cultivars including; plant images, country of origin, holding institute, species, colour of berry and accession name. The project terminates in 2002 and provides useful information for scientists and researchers working in the field of viticulture.

7. ***Greek vitis database (http://www.biology.uch.gr/gvd/)***

Published on the Web by the Department of Biology, University of Crete, the Greek Vitis Database aims to "present all the possible information about Greek cultivars including genetic data and ampelographic data." The Greek Vitis Database comprises 6 separate databases: Information Database, which records exhaustively all possible information about Greek cultivars; Nuclear Microsatellite Database, which provides nSSR profiles of Greek cultivars; Chloroplast Microsatellite Database, which provides cpSSR profiles of Greek cultivars; nSSR – cpSSR Database, a combined database of the two previous databases; Ampelographic Database, a descriptive database of the ampelographic characteristics of 270 cultivars; and the Rootstocks Database, which provides nSSR profiles of Vitis species and hybrids used as rootstocks. Each database can be searched separately using an individually designed search page. In addition, the site provides access to an email discussion forum, links to related sites, and a full bibliography. The database was authored by Francois Lefort and Kalliopi A. Roubelakis-Angelakis who both work at the Laboratory of Plant Physiology and Biotechnology, University of Crete.

8. ***Information System on Genetic Resources: GENRES (http://www.genres.de/genres-e.htm)***

GENRES is an information service of the Information Centre Genetic Resources (IGR), which in turn is a Department of the German Centre for Documentation and Information in Agriculture (ZADI). Information is provided on the IGR, its aims, projects and activities. IGR databases can be accessed online and include, central crop databases, AGRDEU Living Aquatic Resources in Germany, and PGRDEU - Ex situ - Collections of Plant Genetic Resources for Food and Agriculture. GENRES provides information on German, European and International activities on conservation and the sustainable use of genetic resources, for food, agriculture and forestry. The information available relates to cultivated and wild plants, forest plants, domestic animals, aquatic resources, microorganisms, and the policy framework. The site can be searched by keyword and is available in English and German.

9. ***Nordic gene bank: a plant genetics resources centre (http://www.ngb.se/)***

Situated in Sweden, the Nordic Gene Bank (NGB) operates as a centre for the conservation and utilization of plant genetic resources within Scandinavia. The NGB preserves species used in Nordic agriculture and horticulture and include their wild relatives. Materials are preserved in one of three ways; frozen as seed in the seedstore, held in clonal archives or preserved as mini plants in test-tubes. This site provides access to the three main NGB databases: the Taxon database which describes taxa within the mandate of the NGB; the Culton database which is an inventory of commercial and primitive cultivars of taxa within the mandate; and the Accessions database which contains information about the accessions in the NGB seedstore. In addition, access to other NGB databases which cover seed accessions of crops stored in European gene banks, and data collection on perennial plants and cultivars in Nordic botanical gardens, is provided. Summaries of NGB project reports are available online via the "Library" section of the site, which also provides access to some full-text NGB documents. Details of genebanks set up through NGB aid work in the Baltic region and Africa is available.

10. ***Czech Information System on Plant Genetic Resources (EVIGEZ) (http://genbank.vurv.cz/genetic/resources/asp2/default.htm)***

Information system EVIGEZ has been developed since 1984 in the Research Institute of Crop Production, Prague as a special user programme for documentation of plant genetic resources in former Czechoslovakia. Since 1992 it has been used by all institutions dealing with plant genetic resources in the Czech Republic (11 institutions located in 14 places). Presently the programme runs under FoxPro environment. Documentation system EVIGEZ consists of three main data sets:

(a) Passport data

(b) Characterization and evaluation data (values in scale 1-9, estimated on the base of national descriptor lists, which are presently available for 27 crops)

(c) Documentation of seed store in the Gene Bank

Centrally is the information held in the Gene Bank of RICP Prague and partial information is stored in crop specialized institutions, which co-operate within the "National Programme for Plant Genetic Resources Conservation and Utilisation". On-line availability is for passport data only.

11. ***Information System on Plant Genetic Resources in Egypt (http://apps3.fao.org/wiews/Morocco/Paper3.htm)***

Most of the data on plant genetic resources are manually recorded. The National Plant Genetic Resources Unit is developing a computerized data system using "ACCESS" version 7.

The information within the database is divided into following main subjects:

- Scientific name of species (in English and Arabic).
- Morphology and general characteristic features
- Ecosystem of each species and the habitat
- Geographical distribution
- Economic importance
- Publications on each species which include information about the author, title of the paper, pages no. etc.
- Collaborators (Family Name, position, title, Institute contact, address, Tel., Fax etc.)
- Status of each species and measures has been taken for its protection
- Species within the protectorate and the name of each one
- Various protectorates and their distribution in the country, type of ecosystem and environmental conditions, people and their activities, etc.
- Other information under "Notes"

12. ***BioCASE - A Biodiversity Collection Access Service for Europe (http://www.zadi.de/ibv/en/igr_projekte_biocase_en.htm)***

The aim of the European project BioCASE is the development of an advanced electronic access system for biological collections. A network out of national and thematic nodes will provide integrated access to heterogeneous, distributed base data of varying completeness, quality and depth.

13. ***Establishment of European Plant Genetic Resources Information Infra-Structure (EPGRIS) (http://www.ecpgr.cgiar.org/EPGRIS/)***

The main objective of the project (a concerted action) is to develop national inventories of passport data for *ex situ* collections of plant genetic resources and to establish an European Search Catalogue, called EURISCO to make the national inventories jointly searchable via the internet. The EU-financed project is coordinated by the Plant Research International, Centre for Genetic Resources (CGN), Wageningen.

14. ***National Plant Germplasm System of United States Department of Agriculture (http://www.ars-grin.gov/npgs/)***

In 1990, the U.S. Congress authorized establishment of a National Genetic Resources Program (NGRP). It is the NGRP's responsibility to: acquire, characterize, preserve, document, and distribute to scientist users germplasm of all life forms important for food and agricultural production. The Germplasm Resources Information Network (GRIN) web server provides germplasm information about plants, animals, microbes and invertebrates. This program is within the U.S. Department of Agriculture's Agricultural Research Service.

This site proves the user with a very good search facility for the germplasm and also the on line request for the germplasm can be registered. The following types of queries can be executed from this website-

- Accession Area Queries
- Multi-Database Query (test)
- Crop Science Registration
- Plant Variety Protection
- Taxonomic Queries
- Research Crops and
- Descriptor/Evaluation
- Data Queries

15. ***NIAR database (http://www.gene.affrc.go.jp/plant/image/gbsys.html)***

National Institute of Agrobiological Resources (NIAR) a MAFE (Ministry of Agriculture, Forestry and Fisheries Genebank) of Japan has divided its Illustrated Plant Genetic Resources Database in 4 plant groups-

- Legume (*http://www.gene.affrc.go.jp/plant/image/legume.html*)
- Vegetables (*http://www.gene.affrc.go.jp/plant/image/vegetable.html*)
- Flower&Ornamental Plants (*http://www.gene.affrc.go.jp/plant/image/flower.html*)
- Millet and Forage Crops (*http://www.gene.affrc.go.jp/plant/image/millet.html*)

Japan has also developed a new system to integrate plant genetic resources database with image data. This system has a consistency of image data and an ease of data manipulation.

16. ***Resource Identification for a Biological Collection Information Service in Europe (http://www.bgbm.fu-berlin.de/biocise/DataBase/default.htm)***

BioCISE address information on more than 2500 European biological collections available in the Collection Catalogue (*http://www.bgbm.fu-berlin.de/biocise/DataBase/default.htm*). Collaboration: BioCISE initiated the Portuguese Biological Collection Data Resource (*http://central.igc.gulbenkian.pt/BioCISE/drpbc.html*). Collection information held by the Belgian BIODIV (*http://www.bgbm.fu-berlin.de/BioCISE/TheProject/IntroCollab.htm*) programme, the Institute of Botany, Polish Academy of Sciences, Cracow (*http://www.ib-pan.krakow.pl/*) for Polish herbaria, the CABRI Project (*http://www.cabri.org/*) for biotechnological resources and information, NatureWeb (*http://www.natureweb.at/*) for Austrian collections and the IPGRI Directory of Germplasm Collections (*http://www.ipgri.cgiar.org/germplasm/dbintro.htm*) is directly accessible through the BioCISE collection catalogue; this serves as an example for the kind of cooperation agreement we envision for the next phase of BioCISE. BioCISE is followed up by a new project called BioCASE (*http://www.biocase.org/*)

17. ***N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (VIR) database (http://www.vir.nw.ru/data/dbf.htm)***

The N.I. Vavilov Institute of Plant Industry (VIR) is the only research institution in Russia whose activities include plant genetics resources (PGR) collection, conservation and study. There are 3 types of search available on this page. Passport data:

- Index Search Form
- Passport Search Form
- Passport Descriptors

18. ***Database of Plant Gene Resources of Canada (http://pgrc3.agr.gc.ca/search_grinca-recherche_rirgc_e.html)***

This database searches for germplasm through the Germplasm Resources Information Network (Canadian version). It has three types of searches-

- Accession Queries (*http://pgrc3.agr.gc.ca/acc/search-recherche_e.html*)
- Taxonomic Queries (*http://pgrc3.agr.gc.ca/tax/index_e.html*)
- Research Crops Descriptor/Evaluation Data Queries (*http://pgrc3.agr.gc.ca/cgi-bin/npgs/html/croplist.pl*)

The details of the major holdings and distribution details can be also found from the link (*http://pgrc3.agr.gc.ca/holdings-stocks_e.html*) available on this site.

19. ***SHIGEN database (http://www.shigen.nig.ac.jp/)***

SHIGEN stands for SHared Information of GENetic resources.

The objectives of the SHIGEN project are to

1. provide a portal site for science researchers to find where they can get resource information, (WGR)
2. provide a useful database for researchers to find as much resource-related information available in Japan as possible,
3. provide the latest information about the Genetic Resource Committee's activities in Japan, (GRC)
4. support the database construction of resources on demand by researchers who maintain genetic resources.

20. ***National Plant Genetic Resources Center – Taiwan database (http://192.192.196.3/npgrc/apec010e.htm)***

National Plant Genetic Resources Center (NPGRC) provides four types of queries from the germplasm database.

- Query from crop lists and their descriptors
- Query from taxonomy
- Query from passport data
- Query for germplasm image data

21. ***National Inventories under EPGRIS - European Plant Genetic Resources Information Infra-Structure (http://www.ecpgr.cgiar.org/epgris/Partners/NatInvent.htm)***

A number of European countries have established national PGR inventories and are available on the web. The national inventories and can be consulted here:

- Austria (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Austria.htm*)
- Netherlands (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Netherlands.htm*)
- Bulgaria (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Bulgaria.htm*)
- Nordic Countries (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/NordicCountries.htm*)
- Czech Republic (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/CzechRepublic.htm*)
- Poland (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Poland.htm*)

- Estonia (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Estonia.htm*)
- Russian Federation (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Russia.htm*)
- France (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/France.htm*)
- Slovenia (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Slovenia.htm*)
- Germany (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Germany.htm*)
- Spain (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Spain.htm*)
- Lithuania (*http://www.ecpgr.cgiar.org/epgris/National_Inventory/Lithuania.htm*)

22. ***National Centre for plant genetic resources, Poland (http://www.ihar.edu.pl/gene_bank/)***

The collections maintain their own computerized documentation. All data available are sent to the documentation centre at the Centre for Plant Genetic Resources. The documentation there is updated once a year. Additional data concerning the condition of the samples (viability, water content), and the evaluation data are also collected. Databases stored at the Centre for Plant Genetic Resources provide a safety duplication of the collection data. The data are stored in duplicate and updated once a week. The information is available in a local computer network.

23. Indian Plant Genetic Resources Information System

National Bureau of Plant Genetic Resources is maintaining database containing information about the passport data, evaluation and characterization data, genebank information data, and the details about the import and export of the data. The databases have not been made on line but the databases can be queried by making a request to the Director, NBPGR (*director@nbpgr.ernet.in*).

C. Taxonomic, Herbarium, Botanical Gardens Databases

1. ***The Royal Botanic Gardens, Kew (http://www.rbgkew.org.uk/)***

The information about the scientific research and horticultural activities, collection (including herbarium and reference), conservation and wild life, education and data is available on for download and search. The other botanic garden and museum links are also linked ion this site (*http://www.rbgkew.org.uk/aboutus/links.html*).

2. ***International Legume Database & Information Service (http://www.ildis.org)***

The International Legume Database & Information Service (ILDIS) is an international project which aims to document and catalogue the world's legume species diversity in a readily accessible form. Research groups in many countries are participating on a co-operative basis to pool information in the ILDIS World Database of Legumes. This database is in searchable form.

3. ***TDWG (Taxonomic Databases Working Group) Subgroup on Biological Collection Data (http://www.bgbm.org/TDWG/acc/Software.htm)***

Links for various herbarium, taxonomic databases and botanical gardens etc. are available on this site.

(a) Multiple Collection Types

BIOLINK. *http://www.ento.csiro.au/biolink/software.html*

BioOffice - Datenbank und geographisches Informations system. *http://www.biooffice.at/*

BIOTICA - Systema de Información. *http://www.conabio.gob.mx* [Look under "Sistema de Información BIÓTICA".]

BIOTA - The Biodiversity Database Manager. *http://viceroy.eeb.uconn.edu/Biot*

DEMUS - museum collection system (currently only in Czech). *http://www.mzm.cz/engmzm/demus/demus.html*

KE EMu - Electronic Museum. *http://www.ke.com.au/ke/products/emu/emu.html*

FieldNote - Mobile computing in a fieldwork environment. *http://www.cs.ukc.ac.uk/projects/mobicomp/Fieldwork/Software/index.html*

Multi MIMSY 2000. *http://www.willoughby.info/mimsy/*

MUSE - The KUNHM MUSE Project software for curation of natural history collections. *http://www.biodiversity.uno.edu/muse/*

SAMPADA - Natural History Collection Database Software. *http://www.ncbi.org.in/sampada/index.html*

SPECIFY. *http://usobi.org/specify/*

SysTax *http://www.biologie.uni-ulm.de/systax/index.html*

TAXIS - Taxonomic Information System: *http://bio-tools.tcn.ru/products/taxis/index.htm*

VERNON - Collection Management System: *www.vernonsystems.com*

(b) Botanical Gardens

BG-BASE Collections Management Software. *http://rbg-web2.rbge.org.uk/BG-BASE/*

BG-MAP Botanical Garden Mapping System/GIS [for BG-Base]. *http://www.bg-map.com/*

Calypso for Windows [3.11 to 98]. [English version:] *http://hortus.karelia.ru/com/soft_e.htm* [Russian:] *http://hortus.karelia.ru/com/soft.htm*

(c) Herbarium collections

BibMaster – A database application for nomenclature, literature and specimen management. *http://www.rjb.csic.es/bibmaste/bibcaract.htm*

BRAHMS – Botanical Research And Herbarium Management System. *http://www.brahms.co.uk*

FLORIN Information System. *http://www.florin.ru/florin/*

HERBAR – una aplicación en MS-Access para la gestión de herbarios. *http://www.rjb.csic.es/herbario/herbar.htm*

The PANDORA taxonomic database system. *http://www.ibiblio.org/pub/academic/biology/ecology+evolution/software/pandora/*

PLabel: Herbarium Label Program. *http://www.flmnh.ufl.edu/natsci/herbarium/pl/*

TRACY – A Herbarium Management System. *http://www.csdl.tamu.edu/FLORA/input/inputsys.html*

University of California Davis Herbarium Management System. *http://herbarium.ucdavis.edu/database.html*

Virtual Herbarium Express. *http://www.nybg.org/bsci/vh/*

(d) Entomological collections

Mantis – A Manager of Taxonomic Information and Specimens. *http://140.247.119.145/Mantis/*

Mandala. *http://pherocera.inhs.uiuc.edu/index.htm*

(e) Surveys/ Observations

AditSite Wildlife Recording System *http://www.adit.co.uk/html/aditsite.html*

AvianStore Birdwatcher Database *http://sparc.airtime.co.uk/users/cygnus/avianstr.htm*

AviSys Birding Database Software *http://www.avisys.net/*

BIRDBASE and BIRDAREA Birding Software *http://members.aol.com/sbsp/bbba.htm*

Birder's Diary by Thayer Birding Software *http://www.thayerbirding.com/*

Bird Info for Windows – Birding Software *http://netspeed.com.au/birds/birdinfo/*

Bird Recorder 32 *http://www.wildlife.co.uk/*

Faunist *http://home.hccnet.nl/mp.van.veen/*

LANIUS Bird Sighting Database *http://www.onmymountain.com/*

LANIUS Excalibur 2.0 - The Ornithological Database for the Natural World *http://www.laniussoftware.com/excalibur.htm*

LEPILIST Lepidoptera Listing Software *http://members.aol.com/sbsp/lepilist-info1.htm*

RECORDER 2000. *http://www.dorsetsoftware.com/recorder/*

(f) Palaeontological collections

PaleoTax – Information System for Palaeontologists. *www.paleotax.de*

(g) Other software sites

Digital Taxonomy, Database Software *http://www.geocities.com/RainForest/Vines/8695/software.html#Databases*

(h) Data quality control (here: distribution mapping and modelling)

Jones P.G. and Gladkov, A. (2001). *Floramap Version 1.01*. Cali, Colombia: CIAT. *http://www.floramap-ciat.org/ing/floramap101.htm*

Hijmans, R.J., Guarino, L., Bussink, C., Barrentes, I. and Rojas, E. (2003) *DIVA-GIS Version 3. A geographic information system for the analysis of biodiversity data. http://www.diva-gis.org*

4. ***Taxonomic Nomenclature Checker (http://pgrdoc.ipgri.cgiar.org/taxcheck/grin/)***

It allows for quick and convenient checking of large numbers of scientific names against other standardized databases. The Taxonomic Nomenclature Checker currently checks lists of scientific names against weekly downloaded data from the Germplasm Resources Information Network (GRIN) (http://www.ars-grin.gov/npgs/tax) of the United States Department of Agriculture, Agricultural Research Service. GRIN TAXONOMY currently contains over 18,000 generic and 65,000 specific or infraspecific records of vascular plants from throughout the world, with a focus on plants important to agriculture or other commerce.

Following is a list of links to other taxonomic databases for additional checking of individual names:

- VAST Missouri Botanical Garden (nomenclature and taxonomic usage) (*http://mobot.mobot.org/W3T/Search/vast.html*)

- IPNI International Plant Names Index (bibliographic details of names) (*http://www.ipni.org/ipni/query_ipni.html*)
- IOPI Global Plant Checklist (currently provisional) (*http://bgbm3.bgbm.fu-berlin.de/IOPI/GPC/query.htm*).

D. Indian Acts

1. The Biological Diversity Act, 2002 of India (http://www.envfor.nic.in/divisions/biodiv/act/bio_div_act.htm)

The complete information about this Biological Diversity Act is hosted on this Ministry of Environment and Forest web site. All the details related to the Act can be downloaded in html, PDF and Word format.

2. The Protection of Plant Varieties of Farmers Rights Rules, 2003 (http://agricoop.nic.in/seeds/farmersact2001.htm)

Information related to notification, different schedules, plant variety registration forms and plant variety forms can be downloaded from this site. This site is hosted by Department of Agricultural and Co-operation, Ministry of Agriculture, Govt. of India.