

Sources of information on existing germplasm collections



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Introduction

The planning that takes place before a germplasm collecting mission will ultimately determine its success. Since germplasm collecting has been going on for a considerable period of time and collections of many different species are now maintained by many organizations, part of such planning must be to learn as much as possible about any relevant previous work. Doing this may provide:

- firm justification for collecting particular species in a particular area at a particular time, or reasons for the modification of the original intentions and timing of the collecting mission;
- a better understanding of particular geographic areas that have already been explored for germplasm and of the genetic diversity found there;
- an alternative method of acquiring required germplasm through exchange.

This chapter will examine the various sources of information that may be available on existing germplasm collections. It will be assumed that the collector begins the planning of the collecting well in advance of the fieldwork. Depending on the information source, it may be necessary to request information up to a year or more ahead of time and the collector needs to schedule accordingly.

Sources of information

There are two broad categories of information on past collecting work, both of which will need to be consulted by the collector before setting out:

- general information on any relevant past collecting mission;
- specific information on individual samples collected during a mission and later included as accessions in a germplasm collection.

The key points of entry into the subject are existing germplasm collections. To help collectors locate pertinent collections, directories of germplasm collections are published by the International Plant Genetic Resources Institute (IPGRI) for most of the major groups of crops. These publications, a list of which is provided at the end of this chapter (Appendix 8.1) are available from IPGRI and many libraries. They list, on a species basis, all collections of which IPGRI is aware and give the following information on each:

- name and address of the collection/curator;
- number of accessions;
- status of samples (wild, cultivated, etc.);
- geographic coverage (country where samples were originally collected);
- documentation status (manual, computerized, etc.);
- availability and exchange regulations;
- level of characterization/evaluation;
- information on other institutes where duplicates of the collection are kept.

This information is a direct restructuring of IPGRI's in-house database of the world's germplasm collections. The database is continuously updated. If needed, up-to-date listings from the database for given species can be obtained from IPGRI headquarters in Rome as well as from its regional offices.

The information in the database and the directories of germplasm collections can be used to identify the best sources of the detailed information that will be required in planning a germplasm collecting mission or programme. A number of institutions have accepted responsibility for maintaining global or regional base collections of particular species, forming the basis of a proposed Food and Agriculture Organization (FAO) network of base collections. This is noted in their entry in the appropriate directory of germplasm collections and a list of these gene banks is available in IBPGR (1990). When the major holdings of germplasm of the target and any other relevant species from the target region, adjacent regions or other areas of interest have been identified, the curator(s) may be contacted for details both of the collecting missions and of the collections themselves.

A separate database is being developed by IPGRI for forestry species (TRESOURCE). Another major source of information on such species is the Forest Resources Division of FAO. It maintains information, available upon request, on forest genetic resources collections and on *in situ* conservation of forest genetic resources. It publishes an annual newsletter, *Forest Genetic Resources Information* (see below). Together

with the International Union of Forestry Research Organizations (IUFRO), FAO's Forest Resources Division has also published a *Directory of Forestry Research Organizations* (FAO, 1993). This records whether each organization listed has a genetic resources programme. Carlowitz (1991) lists sources of seeds and microsymbiont inoculants for multipurpose trees and shrubs. National Research Council (1991) has an appendix listing sources of forestry species germplasm for research.

General collecting mission information

General information on a past collecting mission can be obtained from mission reports, which may be published or unpublished, and collectors' notebooks.

Collecting mission reports may be available fairly soon after the mission is completed and provide an important supplement to the directories of germplasm collections, which lag some years behind the collecting. Many collectors publish accounts of their missions in the *Plant Genetic Resources Newsletter* (the continuation of the *FAO Plant Introduction Newsletter* and the *FAO/IBPGR Plant Genetic Resources Newsletter*), which is issued four times a year. FAO's *Forest Genetic Resources Information* publishes mission reports as well as other kinds of information, including a list of recent literature of interest. Other relevant internationally available publications include various crop-specific newsletters (e.g. those of crop networks and those of the international agricultural research centres (IARCs), such as the International Center for Agricultural Research in the Dry Areas (ICARDA)'s *Rachis* for wheat and barley) and specialized national agricultural research journals in countries with large national plant genetic resources programmes (e.g. Germany's *Kulturpflanze*, continued internationally as *Genetic Resources and Crop Evolution* in 1992, the *Australian Plant Introduction Review* and the *Indian Journal of Plant Genetic Resources*).

Crop-specific *CAB Abstracts* may be consulted to track down published mission reports. A more general publication, *Plant Genetic Resources Abstracts*, produced in collaboration with IPGRI, has been available from 1992 (this is also available on CD-ROM). Its subject index lists collecting missions by species. Hawkes *et al.* (1983) is a useful bibliography derived from various *CAB Abstracts* for the period 1976–1983. See Chapter 13 for information on bibliographic databases in agriculture, including CD-ROMs.

Accounts of collecting missions published in these sources usually include general data on the natural and human environment of the collecting region (climate, topography, land use, agricultural systems and practices, etc.), the number of samples of each species collected, the collecting route taken, the degree of genetic erosion encountered and any important general features of the germplasm collected. They occasionally have limited information on individual accessions. The gene bank(s) where the material is stored is also normally specified. If it is

not, the information can be obtained from the collector or the institute involved. The curator may then be contacted for fuller specific details on the samples collected.

Not all mission reports are published. To locate unpublished reports, the institute that sponsored or actually carried out the collecting mission should be contacted. The directories of germplasm collections will assist in locating institutes. The institute listed as maintaining the germplasm should be contacted, with a request that the query be forwarded accordingly if another institute within the country was in fact responsible for collecting the germplasm. In addition to national programmes, other sources of unpublished mission reports are IPGRI, the commodity IARCs and other crop-specific and regional research centres. A digest of collecting activities is usually available in the annual reports of these organizations. IPGRI also publishes regional bulletins which include information on recent collecting activities.

The institute to which germplasm collected through missions sponsored by the International Board for Plant Genetic Resources (IBPGR) (and now IPGRI) has been sent is recorded in another of IPGRI's databases. IPGRI does not maintain germplasm, but it does hold reports and passport data (either on paper collecting forms or in dBASE or ASCII files) on the germplasm collected on the missions it has sponsored. Each sample collected is divided into at least two subsamples. One is left in the country in which it was collected and the other is sent to an existing germplasm collection that has agreed to maintain and make it available for distribution, perhaps after regeneration and multiplication. Often, this institute will further duplicate the material. IPGRI's database contains the names and addresses of each of the institutes in which duplicates were originally deposited by the collector. This information is available on request.

The data in the database from which the directories of germplasm collections are derived to some extent duplicates that found in the database on IBPGR/IPGRI collecting missions. Generally, the directories and the associated database provide a more reliable indication of what is maintained in collections since germplasm may have died or not been successfully regenerated upon receipt. They should always be consulted as a primary source of information.

The notes and diaries collectors keep in the field may also provide valuable information, particularly those of collectors working for botanical gardens. Collectors often deposit their notebooks in their institute's library. The older botanical gardens have collectors' notebooks dating back many decades, comprising an invaluable source of historical information. For more recent collections, copies of notebooks may sometimes be obtained directly from the collectors themselves. Limited accession-specific data will be found in these documents. Information which may be found in notebooks but not always in reports includes the accessibility (and exact method of access) of specific locations, problems

encountered, ethnobotanical observations, and casual observations of interesting species which were not collected.

Accession-specific data

Accession-specific data are often essential for proper planning, but very time-consuming to acquire and work with. For this reason, and because it is difficult to anticipate needs at the beginning of the planning process, as many data as possible should be acquired, consistent with one's capacity to process them. Accession-specific data include passport, characterization and evaluation data.

1. Passport data are information about a germplasm sample and the collecting site, recorded at the time of collecting. Examples are collector's name and institute, collecting date, collecting number, botanical name of species and any vernacular names, location of collecting site (name of locality and longitude and latitude), sample type (seed, vegetative, etc.), sample status (wild, cultivated, etc.), and site environmental characteristics such as altitude, topography and various soil features.
2. Characterization data are observations collected on traits that are highly heritable, can be seen with the naked eye and are fairly consistently expressed in all environments. Examples of such characters, which for some 60 crops are included in descriptor lists published by IPGRI, are flower colour, pod size, leaf shape, time to flowering, etc. A list of IPGRI descriptor lists is provided at the end of this chapter (Appendix 8.2).
3. Evaluation descriptors represent characters whose measurement is strongly influenced by the environment in which measurement is made, so that replication over years and/or location is needed for an accurate portrayal of accession-specific variation. Examples include number of fruits per plant and yield. Descriptor lists also have some evaluation characters.

The IARCs maintain germplasm collections of their mandate crops and their wild relatives. They also maintain passport, characterization and possibly some evaluation data. Besides the information on the material they hold, some IARCs may maintain databases with global or regional scope (also referred to as central crop databases). For example, the Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT) has a regional database on maize and ICARDA maintains a global database on wild *Triticum* and *Aegilops* species as well as a regional (Mediterranean) forages database. The European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR) has sponsored the setting up of 22 central databases as of 1991 (Perret, 1990). All of these include passport data (9–30 fields) but some also include a minimum set of characterization descriptors. A total of 140,750 accessions are represented, of *Helianthus*, forage grasses and legumes, *Hordeum*, *Avena*, *Prunus*, *Allium*, *Brassica*, *Beta*, *Pisum*. IPGRI can be contacted for more details on these databases.

Many gene banks publish printed catalogues and distribute them more or less widely. These usually contain data for passport and characterization descriptors. A printed catalogue may be very difficult to use, as the order of the entries is not always what is required for the particular task in hand, and much searching may have to be done. The data may, however, be available in computer readable format from the institute. Data on the CIMMYT maize holdings are available on CD-ROM, for example. Any request for such data should include precise details on which accessions are of interest and which data fields. It is not always reasonable to request all the data for a particular crop or species, or for all the crops from a given country, as this may represent several thousands of accessions and this size of data set may prove unmanageable. Journals such as *Economic Botany* and *Euphytica* occasionally publish the results of germplasm characterization and evaluation (Chapter 13 has more on literature sources).

Accessions of wild species are often accompanied by herbarium voucher specimens collected either in the field or during any subsequent growing-out. Such a voucher should be easy to locate as its identification number and place of deposit should be part of the passport data of the associated germplasm accession. Voucher specimens are normally collected at least in duplicate and often in triplicate, to be stored in the herbarium of the collecting institute, the national herbarium and a major international herbarium.

Botanic gardens are also involved in germplasm collecting and maintain a wide range of species, particularly if endangered or rare, taxonomically important or of ornamental value. Details of the live specimens they maintain are usually available on request. Collecting mission reports are not generally published, but summaries of collecting activities may be available in the annual report and similar publications. The periodical *Botanic Gardens Conservation News* often carries news of new additions and established collections. National data systems of botanical garden holdings are planned for Australia, China, the former USSR and the USA. Information on botanic gardens is summarized in the *International Directory of Botanic Gardens* (Heywood *et al.*, 1991). The typical entry includes the following information:

- name, address and status of the institution and names of director and curator(s);
- area, latitude and longitude, altitude and rainfall;
- taxa in cultivation;
- special collections;
- conservation collections;
- special gardens;
- associated nature reserves and natural vegetation in the garden;
- herbarium;
- seed list and seed bank;

- catalogue and records system;
- research and other facilities (e.g. library).

Many botanic gardens are now cooperating in the standard recording of their specimen data. This is called the International Transfer Format for Botanic Garden Records (ITF) and is available in a number of languages, including for example Chinese. Botanic Gardens Conservation International (BGCI, formerly the Botanic Gardens Conservation Secretariat) maintains a database, increasingly incorporating ITF records, containing information on about 1500 of the world's botanical gardens and their resources, *ex situ* conservation collections and their origins.

References

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- National Research Council (1991) *Managing Global Genetic Resources. Forest Trees*. National Academy Press, Washington DC.
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APPENDIX 8.1

IPGRI directories of germplasm collections

Cereals (1990)	<i>Avena, Hordeum, millets, Oryza, Secale, Sorghum, Triticum, Zea</i> and pseudocereals
Food legumes (1985)	<i>Glycine</i>
Food legumes (1989)	<i>Arachis, Cajanus, Cicer, Lens, Lupinus, Phaseolus, Pisum, Psophocarpus, Vicia</i> and <i>Vigna</i>
Forages (1992)	Legumes, grasses, browse plants and others
Industrial crops (1981)	<i>Camellia, Cocos, Piper, Saccharum</i> and <i>Theobroma</i>
Industrial crops (1989)	<i>Beta, Coffea, Gossypium, Elaeis</i> and <i>Hevea</i>
Root and tuber crops (1986)	Aroids, <i>Dioscorea, Ipomoea, Manihot, Solanum</i> and others
Temperate fruits and nuts (1989)	<i>Actinidia, Amelanchier, Carya, Castanea, Corylus, Cydonia, Diospyros, Fragaria, Juglans, Malus, Mespilus, Morus, Olea, Pistacia, Prunus, Pyrus, Ribes, Rosa, Rubus, Sambucus, Sorbus, Vaccinium</i> and others
Tropical and subtropical fruits and tree nuts (1993)	<i>Anacardium, Ananas, Annona, Artocarpus, Carica, Citrus, Ficus, Mangifera, Musa, Passiflora, Persea, Phoenix, Psidium</i> and others

Vegetables (1990) *Abelmoschus, Allium, Amaranthus, Brassicaceae, Capsicum, Cucurbitaceae, Lycopersicon, Solanum* and others

Directory of European Institutions Holding Crop Genetic Resources Collections (3rd edition, 1986)

In preparation: Oil crops
Root and tuber crops

APPENDIX 8.2

Descriptor lists published by IPGRI

Anacardium occidentale (1986)
Ananas comosus (1991)
Arachis hypogea (1992)
Avena sativa (1985)
 Beta (1991)
Brassica and *Raphanus* (1990)
Brassica campestris (1987)
Cajanus cajan (1993)
Carica papaya (1988)
Carthamus tinctorius (1983)
Chenopodium quinoa (1981)
Cicer arietinum (1993)
 Citrus (1988)
Colocasia (1980)
Dioscorea (1980)
Echinochloa millet (1983)
Elaeis guineensis (1989)
Eleusine coracana (1985)
 Forage grasses (1985)
 Forage legumes (1984)
Fragaria vesca (1986)
Glycine max (1984)
Gossypium (revised, 1985)
Helianthus (cultivated and wild) (1985)
Hordeum vulgare (1982)
Ipomoea batatas (1991)
Lens culinaris (1985)
 Lupinus (1981)
Malus (apple) (1982)
Mango mangifera (1989)
Medicago (annual) (1991)
 Musa (1984)
 Oryza (1980)
Oxalis tuberosa (1982)
Panicum miliaceum and *P. sumatrense* (1985)
Paspalum scrobiculatum (Kodo millet) (1983)
Pennisetum glaucum (1981)
Phaseolus acutifolius (1985)
Phaseolus coccineus (1983)
Phaseolus lunatus (1982)

Phaseolus vulgaris (1982)
Prunus (cherry) (1985)
Prunus armeniaca (apricot) (1984)
Prunus domestica (plum) (1985)
Prunus dulcis (almond) (1985)
Prunus persica (peach) (1985)
Psophocarpus tetragonolobus (revised, 1982)
Pyrus communis (pear) (1983)
Secale cereale and *Triticale* (1985)
Sesamum indicum (1981)
Setaria italica and *S. pumila* (1985)
Solanum melongena, *S. aethiopicum*, *S. macrocarpon* (and others) (1990)
Solanum tuberosum (cultivated) (1977)
Sorghum bicolor (1993)
Triticum and *Aegilops* (1989)
Tropical fruits (1980)
Vicia faba (1985)
Vigna aconitifolia and *V. trilobata* (1985)
Vigna mungo and *V. radiata* (revised, 1985)
Vigna radiata (mung bean) (1980)
Vigna subterranea (Bambara groundnut) (1987)
Vigna unguiculata (1983)
Vitis vinifera (1983)
Xanthosoma (1989)
Zea mays (1991)

In preparation: *Arracacia xanthorrhiza*, *Capsicum*, *Dioscorea*, *Elettaria cardamomum*, *Fagopyrum esculentum*, *Hordeum*, *Juglans*, *Persea americana*, *Piper nigrum*, *Psidium*