Reporting on germplasm collecting missions

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The mission report

Having completed the tasks of processing and dispatching germplasm samples and data, the collector must then write a mission report. No collecting mission or programme can be considered over until a full report has been prepared. Its purpose is to record the mission's objectives, planning, execution and findings. It provides an important reference for follow-up collecting and also informs breeders and other users of the availability of germplasm that may be of interest to them.

It is very important, however, that the report is not seen as a substitute for properly filled-in collecting data forms. It is really only as sample-specific collecting forms that data can be readily related to the corresponding germplasm sample and copied, disseminated, entered into databases and accessed. As much information as possible about the individual germplasm samples and their collecting sites should be recorded on the individual collecting forms. The mission report is the appropriate place for more general observations and summaries of the collecting data.

The collecting report should include:

- a statement of the objectives of the collecting;
- a description of the environment of the target region;
- an account of the logistical and scientific planning;
- details of the execution of the mission (timing, itinerary, sampling strategy and collecting techniques);
- a summary of the results (germplasm collected and areas surveyed);
- details of the onward distribution of the germplasm and data;
- recommendations for follow-up;
- acknowledgements.

Objectives

The reasons for mounting the mission in the first place must be explained. The aim may have been to rescue germplasm at risk from changes in land use or cultural practices; the information sources suggesting a threat of genetic erosion should then be reported. Or the objective may have been to fill 'gaps' in existing collections or to sample populations identified as being particularly diverse or of potential use. Data on earlier collecting activities and on research carried out on the material will then need to be presented and discussed. Sometimes, the mission is part of an ongoing study of particular plant gene pool(s) or of the resources of a larger region. If it is a follow-up mission, or part of a programme, reference must be made to the reports and findings of the previous missions. If a collecting proposal had previously been prepared, for example in order to obtain funding for the work, it will certainly have included a statement of why the collecting was thought to be necessary. This section of the report will clearly draw extensively on the earlier document.

Box 29.1 is an example of the introductory section of a report on collecting forages in Lesotho and Box 29.2 is another extract from the same report, itemizing specific considerations with respect to the target groups and target area.

Target area and target species

Information should be provided on the geography, climate, soils and land use of the collecting region as a whole. This will include maps, which are discussed further below. In wild species collecting reports, there should be information on floristics and vegetation, including references to any poorly known local Floras, checklists, etc. Some mention should also be made of protected areas such as national parks. In crop collecting reports, background information should be provided on the history and character of the human population of the area, and on the agriculture that is practised there. The mission's target areas (whether administrative units or agroecological zones) must be defined, and the collecting priority assigned to each explained. The target species should also be listed and prioritized. Both target areas and target species are then described in more detail in the section of the report dealing with the germplasm collected.

The example in Box 29.3 illustrates the kind of information required in this section. It is taken from an actual report on collecting forages in Namibia, where it was accompanied by vegetation maps of the whole country and of the Etosha National Park and by isohyet and isotherm maps of the whole country.

Logistics

There must be a clear identification of all the people and organizations involved in the mission, whether in planning, funding or execution, and of their respective roles. A full list of expedition members must also be

Box 29.1
Collecting forages in Lesotho: introduction and objectives

The mountainous Kingdom of Lesotho represents a unique environment in that it is a temperate 'island' surrounded by an otherwise subtropical area. The high-altitude pastures are adapted to an inhospitable and extreme environment, and as such are valuable sources of genetically isolated and exceptionally hardy, cold-tolerant forage legumes and grasses.

This unusual reservoir of genetic resources has for a considerable period been under severe pressure from overgrazing and overuse, and many of the more valuable genotypes and even species are known to be disappearing at a rapid rate. An ongoing and comprehensive genetic resources collecting programme is thus of the utmost urgency in Lesotho.

Two collecting trips have already been undertaken by Lesotho's National Plant Genetic Resources Committee in collaboration with IBPGR (International Board for Plant Genetic Resources) during 1989 and 1990. Efforts have been concentrated on the mountain zone proper. About 400 seed samples and 350 herbarium specimens (in sets of four) have been collected. Of particular interest are the high-altitude legumes, *Trifolium africanum* and *T. burchellianum*, growing at almost 3000 m, as well as what appears to be a new variant of *Medicago laciniata*. An indigenous wild barley species, *Hordeum capensis*, is of interest to barley breeders because of its geographic isolation from the rest of the gene pool. Several species of *Lotononis* occur in dense, prolific mats on the barren, windy summits of the highest mountains. By virtue of their prostrate growth habit they survive heavy browsing and trampling, and also have exceptional soil-binding capabilities. Although these species have been collected in the two previous missions, only a small part of the available genetic diversity has so far been captured. Although 28 species of *Lotononis* are recorded in Jacot Guillarmos's *Flora of Lesotho* written 20 years ago, less than a quarter were found in the previous two missions. It is likely that overgrazing of this palatable genus has reduced its distribution severely. Also, certain palatable and nutritious grasses recorded at the turn of the century were not seen at all in spite of extensive searching.

In an attempt to locate and collect germplasm of some of the more palatable forages not found in earlier missions, it was decided to undertake a third collecting expedition in 1991. The objective was to explore the most remote and inaccessible high-altitude areas of the country along the eastern escarpment. It is here that there is the least overgrazing, and thus the best chance of finding relict populations of forage species. The summit of the Drakensberg in the vicinity of the eastern escarpment edge is grazed annually, but is reputedly not as densely populated as the lower areas west of the escarpment. Consequently, grazing pressure on the vegetation is not excessive. The vegetation on the summit of the Drakensberg has been observed to be in good condition, having a relatively high basal leaf cover and favourable species composition. For these reasons, this was the area targeted for collecting.

provided, with contact addresses and dates of their involvement. This should include temporary and *ad hoc* members of the team who helped out in a particular area. This often includes local extension workers. The role of community 'gatekeepers' must be acknowledged (Chapter 18). The advice and experience of guides and porters may also be useful to future collectors and their names and addresses should be recorded.

Box 29.2
Collecting forages in Lesotho: justification

The high-altitude rangelands of Lesotho are an unusual environment in southern Africa and in fact in Africa as a whole. As such, this ecosystem represents a valuable and unique reservoir of forage genetic resources. The specific factors of importance are detailed below.

1. The Afroalpine vegetation of Lesotho is adapted to withstand extreme cold (snow has been recorded from every month of the year), intense frost-heaving, severe physiological drought, high insolation levels, strong winds, considerable grazing pressure and leached, acid soils. Productive and palatable forage species and genotypes from these problem environments could be used in the rehabilitation of degraded parts of Lesotho, as well as in similar areas elsewhere in the world.
2. Genotypes growing in the higher areas of Lesotho are subjected to high levels of ultraviolet radiation. Adaptation to high UV is an important character. If levels of UV penetrating the atmosphere increase due to the hole in the ozone layer as some models predict, this feature will be increasingly sought after as a character to be transferred into forages and crops. Even slightly raised UV levels are expected to adversely affect the reproductive capacities of plants.
3. From a phytogeographical point of view, the high mountains of Lesotho can be viewed as an anomalous temperate 'island' surrounded by the very different vegetation of the nearby subtropical lowlands and plateau of southern Africa. The Afroalpine species which have evolved there have been effectively isolated, both geographically and genetically, for considerable periods. The species and genotypes from such islands are substantially different genetically from their nearest geographic or taxonomic relatives. They thus represent a unique and important genetic resource. Taxa of particular interest include: *Hordeum capense*; the genus *Poa*, which has a centre of diversity in temperate Europe; the genus *Trifolium*, which has a centre of diversity in the mountains of east and northeast Africa.
4. The effects of global warming cannot yet be accurately predicted, but it is possible that in southern Africa summer and winter temperatures may rise by up to 4°C in the next 30–50 years. Soil moisture may also decrease, and drought periods could be longer, more frequent and more severe. Because many of the alpine species are only found at the very tops of the mountains, even a small increase in temperatures could cause these species to disappear. It would certainly induce a genetic shift in the gene pool.
5. A number of forage genera have representatives in Lesotho. These include *Andropogon, Anthoxanthum, Brachiaria, Bromus, Chloris, Cynodon, Digitaria, Dolichos, Echinochloa, Ehrharta, Eleusine, Eragrostis, Festuca, Indigofera, Lotononis, Lolium, Medicago, Panicum, Paspalum, Pennisetum, Poa, Rhynchosia, Setaria, Themeda, Trifolium* and *Urochloa*. A well-planned collecting, characterization, selection and use programme may reveal genetic variants more suitable for harsh temperate environments than those currently available.
6. Lesotho represents a major centre of diversity for the genus *Lotononis*, and a secondary, outlying centre of diversity for *Trifolium*. Both are important forage genera.
7. Probably the greatest problem facing Lesotho is land degradation and erosion. Despite strict erosion control measures being applied in the last 50 years, soil erosion is taking place rapidly, as population pressure increases. Land degradation has resulted in genetic erosion so severe that a number of forage species recorded at the turn of the century appear to be no longer present.

Box 29.3
Collecting in the Etosha Pans, Namibia: physical and biotic environment

Namibia is a large country in southwestern Africa. It is bordered to the north by Angola, to the east by Botswana, to the south by the Republic of South Africa, and to the west by 1800 km of Atlantic coastline. Most of the country is made up of the arid and semiarid Namib and Kalahari deserts. Collecting was concentrated in the halophytic Etosha Pans system, which is located between these deserts.

The Etosha Pans are a system of highly halophytic salt-pans in the northern part of central Namibia, once a large, shallow lake, which has been drying up as a result of long-term climatic changes. The topography of the area is uniform, being flat and forming a slight depression relative to the surrounding regions. There is one very extensive main pan (4590 km^2), surrounded by numerous much smaller ones. These become seasonally flooded, and hold water for varying lengths of time depending on the extent of the rains. Average annual rainfall is 400–500 mm and occurs mostly in the form of convectional thunderstorms in November–March. Summer temperatures can be as high as 40°C, but winter temperatures are moderate.

Soil pH in the pans themselves is 8.5–10. The main pan is not vegetated, but many of the smaller ones are, the communities being dominated by salt-tolerant grasses. Surrounding areas support shrub veld and tree veld of various kinds, but usually dominated by *Colophospermum mopane*.

The entire pan area and surroundings are a game reserve, the Etosha National Park, one of the largest of its kind in the world, protected since 1907. It has been subject to large build-ups of various game species no longer able to migrate, and this has had a deleterious effect on the vegetation in some areas.

In describing the logistical arrangements for the mission it is important to state what expedition clearances and permits were required for travel to the target region, photography, plant collecting and the export of the germplasm samples, with details of the procedures that were followed to obtain them and the time involved. Such clearances will often be as necessary for national programmes as for outside collectors. All sources of information that were found useful should be specified. Information on the availability of vehicles and other forms of transport, such as boats or pack-animals, should be recorded and any special transport needs or expedition equipment should be pointed out.

Logistical problems encountered during the collecting expedition, either in exploring a region or in handling the germplasm samples, need to be reported. Any special arrangements made for the handling of the collected material should be described.

The extract in Box 29.4, taken from the report of the collecting trip in Lesotho, which is also quoted in Boxes 29.1 and 29.2, provides an illustration of the kind of logistical problems that may be encountered.

Box 29.4
Collecting in Lesotho: logistical problems

Most of this trip was undertaken on foot and horseback, using pack-animals to transport the equipment and seed samples. The mission was successful in so far as a number of populations of the more important forage species were located, frequently at significantly higher altitudes than on the previous two expeditions. However, there had been a severe drought, which meant that many species had not grown during that season, and those which were available had for the most part been so severely overgrazed that few or no seeds could be found. The drought was breaking at the time of the visit, and these late rains made it rather difficult to keep the seed samples dry while travelling on horseback. To avoid mould and further deterioration of the seeds, the trip along the eastern escarpment had to be shortened. This area, however, was less overgrazed than the rest of the country and yielded much interesting germplasm. Further visits to this area are recommended.

Scientific planning

Details should be provided in the mission report of the scientific preparations made for the mission. In particular, there should be reference to the people and other information sources that were consulted. If the collecting followed an in-depth ecogeographic survey, the results of the study should be summarized, as described in Chapter 14. If annotated checklists were developed during planning, and further elaborated in the field, these should be provided. For international missions, the report should mention if a preliminary visit was made to the country to consult local scientists, herbaria or other information sources and to draw up the collecting strategy and itinerary, or whether such preparations were made by correspondence. Herbaria in other countries may also have been visited, or relevant material requested from them.

In some cases the collecting expedition will have been preceded by a field survey to confirm plant maturity or to better plan the collecting. In the case of vegetatively propagated crops, it may have been necessary first to survey the plants when the aerial parts were mature, in order to better distinguish the different clones. There may have been preliminary diversity studies, or preparatory socioeconomic surveys of farmers. The mission report must include the findings of such survey missions.

Itinerary

A summary timetable for the mission should be included, giving the dates during which different areas were explored and the site numbers and collecting numbers from each area. A detailed itinerary giving a daily log of the places visited can be provided as an annex to the report. A sketch-map of the whole country should always be provided, showing the location of the target region. There should also be a rough map of the target region itself showing mission routes and at least some town names that appear on the generally available maps of the country. This will assist future users of the report, who may not be familiar with the areas concerned. An example is given in Fig. 29.1 (see also Mota *et al.*, 1983).

An example is given in Box 29.5 of the kind of itinerary information that would be suitable for appending to the report. It comes from an actual report on wild species collecting in Zambia. The summary table in the report itself just gave the dates during which collecting took place in different areas, and site and collectors' numbers, as in Table 29.1.

Sampling strategy and collecting techniques

The report must describe the approach used to sample the genetic diversity and the techniques employed to collect the germplasm. As discussed in earlier chapters, these methodologies will have been influenced by a number of factors: the biology of the target species, the environment in the target area, cultural and socioeconomic considerations, the logistics of the expedition and perhaps the eventual use of the material.

Mention should be made of any stratification imposed on the

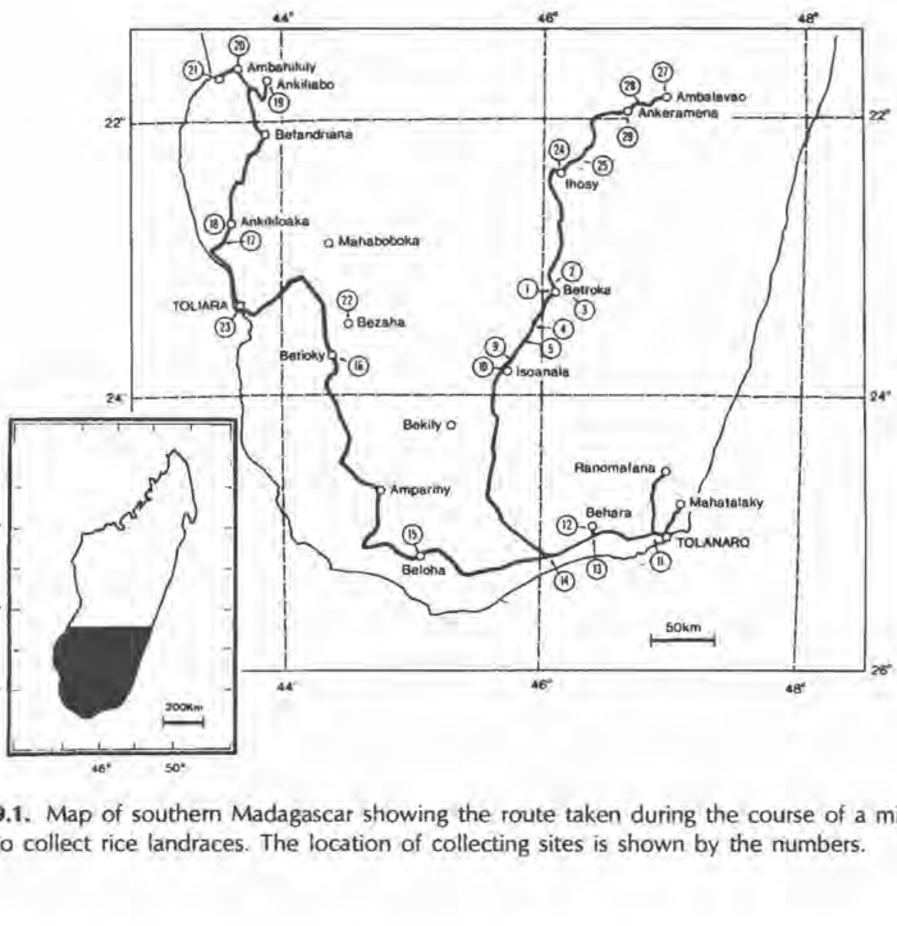

Fig. 29.1. Map of southern Madagascar showing the route taken during the course of a mission to collect rice landraces. The location of collecting sites is shown by the numbers.

Box 29.5
Collecting in Zambia: itinerary

5 June	Meeting with the Director of Agricultural Research to finalize logistical arrangements.
6 June	Collect in the Kafue Flats and flood plain.
7 June	Organize first leg of trip to Kasanka National Park. Buy supplies, etc.
8 June	Drive Lusaka–Kasanka.
9–13 June	Collect in Kasanka National Park. This area was selected because of its wide diversity of habitat types and its well-conserved and managed vegetation. The park rangers were very helpful collecting assistants.
13 June	Drive to the southern part of Bangweulu Swamps, and set up camp near Chikuni. Meeting with the local WWF [World Wide Fund for Nature] representative.
14–16 June	Collect in the southern part of Bangweulu Swamps, both in the flood plain and in the main river channels. Much work was done from dugout canoes.
17 June	Drive through Lavushi Manda National Park to Mkushi, collecting along the way. Obtain accommodation on a farm.
18 June	Collect on Mkushi Kachana Farm. Return to Lusaka.
19 June	Prepare for second leg of expedition to Western Province. Buy supplies, etc., and have repairs undertaken to vehicle.

Table 29.1. Summary of itinerary.

Area	Dates	Sites	Samples
Kafue Flats and flood plain	6 June	1–4	1–12
Kasanka National Park	9–13 June	5–19	13–23

sampling. For example, in crop collecting an attempt may have been made to sample all agroecological zones in a region and all ethnic groups within each zone. Indigenous knowledge (IK) may have been used to locate particular material. The strategies adopted to sample the genetic diversity within populations must also be explained, since it is important for future users of the germplasm to know how a sample relates to the original population. This information will have been recorded in detail on the collecting data forms but in the report there should be a description of the basic strategy adopted and any particular exceptions to it. Thus, the basic strategy might be one of random population sampling, but there may have been additional selective sampling of particular phenotypes in some cases.

Any specialized methods used (e.g. the details of an *in vitro* collecting technique) should be described in the report and any problems in applying them should be pointed out, with any tips on their use or suggestions for improvement.

In the case of multi-species collecting missions, the above information may best be incorporated into the separate sections dealing with each of the different species collected (see below).

Results

In presenting the findings of the mission, the report should bring together and summarize the information gathered in the field and from reference sources about the species collected and the environments in which they were found. Much of this information will have been recorded on the individual sample collecting forms, but a major function of the mission report is to synthesize the data and present an overview of the ecogeographic distributions of the target species. This helps build up the base of general knowledge on the species and gene pools, and can guide users in the evaluation and use of the collection.

The report should include lists of the germplasm collected. Full lists of the individual samples in collecting number order and in species order, with such additional basic collecting data descriptors as collecting date, locality and site number (in crop collecting, also the local names of landraces), can be an annex to the report. A summary table listing collecting numbers by landrace, species or gene pool should be presented in the text. Another table could list collecting numbers arranged by collecting area (administrative unit, vegetation type, soil type, agroecological zone). A two-way table combining the above information, listing collecting numbers by taxon (or landrace) and collecting area, is often useful. There should always be a table summarizing the total number of samples of each species.

Also important are maps showing in detail the locations of all collecting sites. These could be photocopies of the maps annotated in the field. Collecting sites should be labelled with the site number or collecting number(s). The former option is usually more convenient, especially if several samples are collected at each site. Usually, the base map used to show collecting site locations will be a topographic map. However, climatic, soil and vegetation maps may be used as appropriate to provide additional, easily visualized, information on the likely adaptation of material. Collecting site locations may be marked on an acetate transparency or transparent paper, which could then be superimposed on different base maps as necessary. Maps showing the location of samples of individual species could also be included. Different species may be shown using different symbols on the same map, or separate maps may be prepared for each species. All maps should include a scale and compass directions.

General observations on the germplasm samples (IK, morphology, phenology, threat of genetic erosion, etc.) and where they were found can be presented in the text of the report by agroecological zone and/ or by landrace, species or gene pool. Thus, the report on a general crop collecting programme in a country or region could have both of the following:

- general accounts of the physical environment, farming systems and cultural and socioeconomic situation in each agroecological zone sampled;
- overviews of each crop (and/or landrace), including descriptions of specific cultural practices.

Box 29.6 gives an example of the former taken from a report on crop collecting in Zimbabwe; the extract discusses one of the several provinces in which collecting was carried out. As an example of species overviews, Box 29.7 is an extract from a report on collecting forages in Botswana, which shows how information gathered in the field can be combined with published information on individual species to provide guidance to prospective users of the germplasm. Box 29.8 is an extract from a report on collecting in Madagascar, which provides a similar service for a cultivated species; a more specialized report might have had different sections on each landrace collected.

Information from local people and other sources on the changes that have been occurring in the target area, particularly regarding landraces that are no longer grown in particular areas, should be recorded in this section. Two examples are given. Box 29.9 is taken from a report on a collecting programme in southern Arabia involving three countries. Box 29.10 reproduces a more detailed report relating to finger millet on the Yemeni island of Socotra, which illustrates how ethnobotanical information may usefully be incorporated into a collecting mission report.

Whether the timing and duration of the mission coincided with maturity of the plants and the availability of ripe seeds or mature roots and tubers should be commented upon and this should be related to the weather during that particular year. Detailed climatic data for the year of the mission (rainfall, temperature, river levels), if available, and averages, can be provided in an appendix.

Brief summaries of the descriptive information on each site (e.g. altitude, soil type, pH, slope, aspect, habitat, etc.), together with the collecting numbers of all samples collected at each site, provide a useful addition to collecting reports. These can assist users who do not have ready access to the full passport data set in assessing whether particular material may be of interest to them. Photographs of germplasm and collecting sites can be included here.

Processing and distribution of the samples, data and reference specimens

The report must describe what was done on return from the field to prepare and distribute the germplasm and data. It is important for the recipients of such material to know what procedures were used to clean, dry, treat, pack or culture (in the case of *in vitro* material or *Rhizobium* samples) the samples. Advice on any modification of standard techniques that were found to be necessary will greatly help future collectors. Mention should be made of the plant health and quarantine procedures

Box 29.6
Collecting in Zimbabwe: results

Victoria Province

Of the 17 Communal Areas in this province, 12 were explored well. The coverage of Matibi No. 2, Sengwe and Chikwanda was superficial and the small areas of Denhere and Serima were not visited.

The soils are mainly light granite sands. There is an area of red sandy loams in the northern parts of Bikita and Ndanga and a tract of black, basaltic clay in the southwest, in Sengwe, Matibi No. 2 and Sangwe. The province falls within Natural Regions IV and V, with a small area stretching from Bikita to Lake Kyle, east of Nyanda, which is classified in Natural Region III. Rainfall was less than normal this year throughout the province. Not surprisingly, it is the Communal Areas in Natural Region V that have been affected the worst by the drought.

Sangwe, Matibi No. 2 and Sengwe in the extreme southeast of the country were severely hit by the drought. The black, basalt clay soil had deep, wide cracks. Red Swazi was the most common sorghum variety found. It had performed moderately well in spite of the drought. There were still some local landraces of sorghum in these areas. They constitute an important source of genetic diversity, especially in terms of drought tolerance. The basalt soils are heavy and alkaline and generally unsuitable for pearl millet. A few landraces were found on the red sandy loams in the northern part of Sangwe.

Although still badly drought-affected, it was possible to collect various crops from the other Communal Areas (Chibi, Matibi No. 1, Maranda) of Natural Region V. Sorghum diversity in Matibi No. 1 was high. A number of different pearl and finger millet landraces were collected from all three areas.

In the Communal Areas of Region IV (namely Zimbub, Chikwanda, Bikita, Ndanga, Victoria, Nyajena Mtilikwe and Gutu), maize, groundnut and sunflower were being grown as cash crops but on a limited scale. Maize was of hybrid seed origin, but often not first-generation seed. Improved groundnut varieties, such as Makulu Red, were present, but it was still possible to collect some local types. Although sorghum was mostly the commercial varieties Red Swazi and Fremida, various local landraces were still being grown. Matsai was especially rich in sorghum diversity. Finger millet was variable and widespread throughout these areas. *Eleusine africana* was a common weed.

Throughout the province, cowpeas, watermelons, pumpkins, melons and cucumbers were typically intercropped with maize, sorghum and pearl millet. Most farmers also grew bambara nut. A wide range of variation was encountered in all these traditional legume and vegetable crops. Surprisingly, gourds were not as common or as variable as in the other provinces visited. Okra was also infrequent and the local leaf rapes were not found at all. However, it was only in Victoria Province that pigeon pea was encountered, but it was only found as a backyard plant at two sites in Ndanga Communal Area.

High priority should be given to the further exploration of Sengwe and Matibi No. 2 for sorghum.

Box 29.7
Collecting wild species in Namibia and Botswana: results

Citrullus ecirrhosus. A perennial creeper with a somewhat thickened rootstock. Stems to 2 m long, prostrate. Fruits ovoid, mottled greenish/yellow, about 20 × 10 cm.

This is a little-known but close relative of the cultivated watermelon. It is of particular interest in that it is perennial and grows in extremely arid areas. The two populations sampled in Namibia, # 1407 and # 1428, had produced prolific quantities of fruit in areas of the Namib Desert which had received around 60 mm of rainfall that year, but which are normally even drier. # 1428 was very different in appearance from most other populations and may represent an unusual variant. The large fruits are sought by game.

Cenchrus ciliaris. A broad-leaved, profusely branched, tufted perennial. It is about 1 m high and normally geniculate. This widespread climax grass occurs on most soil types, but is particularly characteristic of alkaline soil. Palatability seems to vary. As a pasture species it can give an exceptionally good yield but requires heavy fertilization both for high productivity and for palatability.

It has a remarkable ability to remain green and productive long after the surrounding grasses have withered and died back in the dry season. It often occurs in favourable microenvironments such as sandy washes or rock crevices in areas that would otherwise appear to be too dry. It is particularly deep rooted. Even under the most harsh conditions, this species appears to be highly productive. Seed set under natural conditions generally tends to be poor, and the spikelets shatter with varying ease. This is a very variable species, with a number of different cultivars available commercially.

The Botswana genotypes were unusual in showing tolerance to low P levels, stoloniferous habit, tolerance of exceptionally high and low pH values, and drought tolerance. According to Skerman and Riveros (1990), this species shows a preference for soils high in P. The Botswana genotypes may differ in this requirement since the soils of the Kalahari are notoriously low in P. A very wide pH tolerance is exhibited in the genotypes from Botswana, 3.2–9.5 being the range encountered. The population sampled under # 743 appeared to be slightly stoloniferous, a character not known in this species. It was growing on a slight elevation in a salt-pan at pH 8. # 745 was growing in a similar site at a pH of 9.5. # 753 was also a stoloniferous variant, and was growing at a pH of 5.3. This population appeared to be susceptible to smut. # 832 was thriving in exceptionally acid soil (pH 3.2). This did not appear to affect its palatability, since it had been heavily selectively grazed. Seed set, however, was poor. This population was growing at around the 250 mm isohyet, and # 862 was found at around 150 mm. These latter two populations may thus be particularly hardy variants, surviving in rainfall regimes very much lower than the 375–750 mm suggested by Skerman and Riveros (1990) as being the norm for the species.

followed. Any data preparation carried out should be described, noting if verification of some information has been requested (e.g. taxonomic determination of voucher herbarium specimens or pest specimens).

Recipients of the germplasm need to know if the samples have been divided and where duplicates are held. The report should describe the sample splitting and distribution protocols followed by the collector, indicating whether this was for duplicate conservation, interim

Box 29.8
Collecting in southern Madagascar: results

Some 1200 traditional rice landraces are thought to be grown in Madagascar. Highest diversity is in the High Plateau areas. In this collecting trip, about 45 distinct local names of traditional landraces were encountered. The most common landraces were 'Makalioka' and 'Tsipala Fotsy'. While largely the same suite of landraces was found throughout most of the drier areas of the southwest (Areas 1, 2–5), a different set seemed to be grown in the Ihosy and Ankaramena–Ambalavao areas (Areas 6 and 7). Some landrace names reflect grain shape and size, pericarp colour and foliage coloration. Others are more fanciful. Translations are given in the passport data.

Because most of the samples were collected from farm stores, it was not possible to record observations on plant characters. However, based on pericarp shape, coloration and hairiness, some 15 classes may be recognized. It is instructive to check local names against such an admittedly crude classification. Thus, six of the samples of 'Tsipala Fotsy' fall in one class and two in another. All four of the 'Kianga' samples fall in a single class. Three of the 'Makalioka' samples are in one class, two in another and one in a third. There therefore seems to be some variation among samples given the same local name in different areas. Looking next at a single class, the case of the distinctive striped pericarp type is interesting. The four samples falling in this class, collected at sites 10, 18 and 19, all have different local names ('Taimbalala', 'Ambatondrazaka', 'Manga Fototra' and 'Masokibo'). Thus the classification based on pericarp features is, not surprisingly, not sufficient in differentiating among local landraces, though it is a useful start. Incidentally, there is another 'Manga Fototra' in the collection (the name refers to its dark foliage), collected at site 12, but this falls in another pericarp class.

The following landraces or samples were highlighted by farmers for particular characteristics or traits: *long cycle* – Tsitelovola; *short cycle* – Kianga, Vary Malaky, Kianga Makalioka, Tsiroavolana, Maroroka, # 1178 (Kely Mena); *drought tolerance* – Tsy Mataho Paosa; *consistency* – Tsy Matahotra Osy, Tsy Mikoty, Soalava, Laniera; *can be grown in either season* – Kely Mena, Tsy Matahotra Osy.

Some other samples should be highlighted. The name 'Mamambary Tsipala' may be translated as 'Better than Tsipala', and farmers confirmed that it was indeed the case that this landrace performed better than the standard, reference landrace 'Tsipala' in favourable years. The sample # 1196, for which, uniquely, no local name seemed to be used, was said by farmers to be 'better' than the reference landrace in the area, 'Angika', though exactly in what respect was not clear. Finally, the name 'Korintsa' seems to refer to the rattling noise made by the ripe inflorescence in the wind, and this is said to help keep birds off the crop.

Collecting sites fell into two main groups with respect to temperature: *Group A* – Areas 2–5; *Group B* – Areas 1, 6 and 7. Sites in Group A have a mean maximum temperature of the hottest month (i.e. at the sowing/transplanting stage) of about 31°C, those in Group B of about 27–28°C. It has already been alluded to that the suite of landraces grown in areas 6 and 7 is different from that grown in the rest of the region covered. This may partly reflect the temperature difference, though water availability will also differ. However, this should not obscure the point that factors relating to the cultural make-up of different areas will also be extremely important. Areas 1, 6 and 7 fall mainly in the region of the Bara people, whereas the rice-growing areas around Tolanaro are dominated by the Antanosy people. Both groups grow rice around Toliara, and there are of course some ethnically mixed areas. Cultural reasons may be as important in determining the landraces grown in a particular area as climate, if not more so.

Box 29.9
Collecting wheat in southern Arabia: genetic erosion

A drastic decline in the area sown to wheat in the Dhahirah region of Oman from the mid-1970s has been documented. This has mainly been due to increasing competition from Australian grain imported for processing at the Oman Flour Mill. An additional pressure on the local landraces has come from the release of Mexipak in the early 1970s and Sannine in the early 1980s. Two ICARDA [International Center for Agricultural Research in the Dry Areas] varieties were released in 1985. No seeds of modern varieties were made available to Omani farmers through extension centres until 1980, when some 4 t were distributed; in 1983, the figure was 11 t and the trend is still certainly upwards. Local landraces, in Oman as elsewhere, are preferred for their taste and drought resistance, but they are low-yielding, susceptible to lodging and for the most part lack rust and smut resistance. Probably more than 50% of wheat grown in Oman (on an area basis) is landraces.

The situation is somewhat different in Saudi Arabia, which thanks to government policy is self-sufficient in wheat. In 1986–87, however, commercial wheat-growing projects of the sort which have helped bring this about amounted to less than 100 ha in the Aseer administrative region, compared with over 7000 ha of wheat on traditional farms, which nevertheless represents a marked decline from the 1982–83 figure of almost 20,000 ha. Unlike in other areas of Saudi Arabia, then, where the threat to local landraces comes from commercial agricultural projects and the influx of modern varieties, in the Aseer the problem is one of gradual abandonment of subsistence agriculture, in favour of cash crops or urban living. Modern varieties are grown by traditional farmers, but on a very limited scale. Landraces are preferred, though the state flour mills will accept grain of only a small number of modern varieties.

Genetic erosion of wheat in northern Yemen is also occurring mainly through the abandonment of land and the increased growing of cash crops such as *Catha edulis*. The spread of modern varieties (Sonalika was introduced in the 1970s and several other varieties since) is also significant, but perhaps of less importance. The main reasons given for the abandonment of traditional agriculture are much the same throughout the region: high cost of labour, difficulty of mechanization on steeply terraced land, greater profitability of other work, easier access due to expanding road system. A clear example of genetic erosion in northern Yemen is *T. dicoccon* ('alas' in the local Arabic). This species is highly prized by farmers for bread-making, but is said to need more preparation and more favourable growing conditions than other wheats and is no longer sown anything like as extensively as formerly. A similar situation also obtains in Oman.

In the Wadi Hadramawt area of southern Yemen, 65% of the wheat area is now sown to modern varieties, mainly Kalyansona, though Ahgaf has recently been released. However, these cannot be grown where groundwater is very saline. Another factor protecting the local varieties is that wheat straw is almost as important economically as the grain, as it is needed in brick-making. Landraces are thus relatively safe because of their salt tolerance and tallness. In Shabwa, Sonalika was released in 1973, and seems to have made bigger inroads than Kalyansona in Wadi Hadramawt. Wheat cultivation seems to have declined markedly in the high-altitude areas of southern Yemen, due to the ready availability and comparatively low price of imported grain. It was difficult in 1989 to find landraces; five were said by farmers to be common up to ten years ago but only one ('Hargadi') seems to be used now, though seed samples of another two were eventually obtained.

Overall, it seems safe to suggest that the area sown to landraces in the region is more than half of the total wheat area. It is inevitable that this will decrease. There will be loss of genetic diversity as rarer types fall out of cultivation and as fewer farmers sow the

continued

Box 29.9 *Continued*

commoner types. Some areas are more at risk than others, however, as the situation in Wadi Hadramawt shows. Even in the Riyadh region of Saudi Arabia, where commercial wheat farming is predominant, some farmers still grow small fields of local landraces for home consumption.

multiplication, quarantine, etc. The destination of associated material such as *Rhizobium* samples and voucher specimens must also be recorded. Detailed sample-by-sample distribution lists can be included as an appendix.

Further exploration and research

Suggestions can be made in the report for further collecting or particular studies to be carried out on the germplasm. Areas that it was not possible to explore or that were inadequately covered should be identified. If it was not possible to sample certain populations or species because the plants were immature or their fruits had already shattered, the report should identify these for future collecting and include recommendations on more appropriate timing.

Observations in the field or information from farmers may have drawn attention to the likely presence of important characteristics in the material, such as disease resistance, drought tolerance or preferred cooking quality or taste. This information will have been recorded on the relevant collecting data forms. The report should highlight particularly noteworthy samples for early study and evaluation, including those found in unusual situations, for example at higher altitude than normal.

If the mission was part of an ongoing study on a particular gene pool or area, then the report should include a description of the research that will be conducted on the germplasm and indicate where this work will be done. This could include characterization and evaluation of the material collected. It is important that the report describes any observations or findings made during the mission that could be of significance to the planned research.

Summary

Lengthy reports should include a summary or abstract. This should highlight samples needing immediate multiplication or taxonomic verification. It should also include the dates of the mission, the areas visited, the numbers of samples collected of each species or genus and the distribution of the material.

Disseminating the findings

Distribution of the mission report

The report of a collecting trip must be distributed to all scientists and organizations participating in the expedition and to the sponsoring

Box 29.10
Finger millet on Socotra: cultural practices and genetic erosion

Finger millet, called 'bombeh' in the Socotri language, is now grown only in some villages in wadis (seasonal watercourses) draining the Haggier mountains. However, according to local people, it used to be much more widely cultivated in the mountains and was also to be found elsewhere, for example on the eastern plateau. Its cultivation is traditionally the work of women. It takes place on terraces called 'mutereh' enclosed with date-palm frond fencing provided with a wicker gate. Many of the new date-palm plantations now seen are on the site of old finger millet terraces, giving the mistaken impression that bombeh was not all that common formerly. A site enclosed by a family belongs to that family, unless left unworked for a period of years. In the Haggier mountains, former bombeh terraces are kept enclosed and natural grassland allowed to develop within them to be used as fodder.

The soil is prepared for finger millet cultivation by setting fire to piles of wood and animal dung and then spreading out the ash and mixing it with the soil. The wood of *Boswellia ameero*, an endemic frankincense tree, is particularly valued for this. Sowing occurs when the cool winds of the NE monsoon begin to blow, normally in November. Irrigation is usually by hand, the site having been chosen on the basis of the ready availability of water. Often, the terrace is divided up into small contiguous areas with small rocks, each area receiving one container-full of water. The small seedlings ('saabi') are watered daily until they reach hand-span height, some 20 days after germination. At this time, the plants, now called 'chaabir', are dug up and most of the greenery is twisted off. They are then divided into tillers and these are planted out again. Three months after sowing, the main tiller is harvested; secondary tillers are not harvested, though they set grain. The stalks are cut and either fed green to livestock or dried. Livestock manure the fields as they graze the straw.

The threshing of the heads (by treading) and the winnowing (with date-palm fronds) is done by men. The grain is sun-dried and then stored in clay pots, baskets or sacks. It can keep for several months. It is ground to make a sticky porridge with boiled water (rarely milk) called 'muqdeyreh'. The best grain is saved for sowing the following year.

Since what used to be the People's Democratic Republic of Yemen (this merged with its northern neighbour the Yemen Arab Republic in late 1990) gained its independence, cheap substitutes for finger millet, like wheat flour and rice, have become increasingly easily available. This is the main reason for the decline in finger millet cultivation on Socotra, always an extremely labour-intensive enterprise, especially for the women. The situation is a common one. A similar process is at work in the highlands of the Yemen mainland, where wheat cultivation seems to be decreasing due to the availability of cheap imported flour. The case of finger millet on Socotra is, however, particularly dramatic.

The crop now seems to be grown only by some older women who have better access to water, for example due to the recent acquisition of a pump, making the main labour of watering easier. These women continue the practice perhaps mainly out of sheer habit and nostalgia. However, other reasons were also given during interviews. There is a belief in the health-giving properties of the crop, for example, and the taste is much preferred to that of recent substitutes by the older generation. Older people also doubt the reliability of the supply of cheap imports of wheat flour and rice, and grow finger millet as a precaution. There is no evidence that the crop is being abandoned due to a general shortage of water on the island compared with 20 years ago.

agencies. It may be most appropriate for each participant to write a separate report. Alternatively, the team leader may be given the responsibility of producing a first draft of the report, which would then be sent to all participants for revision and finally officially distributed. The report must also be sent to all the gene banks, institutions and researchers receiving germplasm samples or associated specimens. It then becomes the responsibility of recipient institutions and scientists to ensure that a copy of the report accompanies any subsequent distribution of the germplasm that they undertake.

Publishing the findings

Publishing an account of collecting activities will aid potential users of the germplasm and others planning to collect the same gene pools or in the same region. A useful venue for publication of collecting mission reports is the *Plant Genetic Resources Newsletter*, which is widely read in the plant genetic resources community. Chapter 8 lists other possibilities for the reporting of collecting activities. Published articles on germplasm collecting should make reference to where the original report and the complete passport data can be obtained.

References

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