MOLDOVA:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

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Note by FAO

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CHAPTER 1
Introduction to Country and its Agricultural Sector

The Republic of Moldova is situated in the south-west of the East-European Plain between the latitude of 45 28'-48 29' North and the longitude of 26 30'-30 28' East and occupies an area of 33.76 thousand km^2, extending 350 km from north to south and 150 km from west to east. The country borders on Rumania along the river Prut and on the Ukraine in the north, south and east. In spite of its small territory, Moldova shows highly diversified and contrasting physico-geographical features. The relief is represented by alternating hills and deep river valleys and depressed plains. The highest elevation point lies at an altitude of 429.5 m.

The climate of Moldova is moderate continental, with short mild winters, long hot summers, and warm autumns. The average July temperature is 19.5° C in the north and 22° C in the south, and that of January is -5° C and -3° C, respectively. The temperature reaches an absolute maximum of 41° C and an absolute minimum of -34° C, -36° C. The average duration of the frost-free period is 170 days (in the north) and 190-200 days (in the south) and varies between years. Moldova lies in a low humidity zone. Precipitations here are largely of cyclonic origin. Mean annual precipitation is 500-550 mm in the north and as low as 350 mm in the south. The distribution of precipitation is non uniform, resulting in frequent droughts. In the past 110 years, no less than 43 were dry ones (out of these, 21 were extremely dry). Moisture deficit, along with late spring and early autumn frosts, are factors impeding successful growing of some crop plants.

Major type of forest in Moldova: broad-leaved forest of Mid-European type. Currently, about 8% of the territory of the Republic is under forest. The persisting forests are represented by small scattered areas which number in excess of 800 and are non-uniformly distributed over the territory. Most of these are concentrated in the central part of the country, the Kodry region. Major crops grown in Moldova are the same as those typical for European countries: cereals (winter wheat, barley, oats, triticale, maize, etc.), legumes (peas, soya, kidney beans), sunflower, sugar beet, fodder crops, grape, fruit crops. The major agricultural crop acreages are listed in Table 1.

Table 1: Acreages planted to some agricultural crops in Moldova (as averaged over the 1992-1994 period)

Crop	Planting acreage (thousand ha)
Wheat	350-400
Barley	40
Maize	350-400
Pea	50-60
Soya	20-25
Sugar Beet	100
Sunflower	140
Grape	180
Fruit Crops	200
Vegetable Crops	60-70
Fodder Crops	300

The crop acreage is about 2 million ha, with the total arable area, pasture and forested land included, being 3.5 million ha. Of this, 340 thousand ha is irrigated land. The agricultural sector is dominated by large collective farms (state and non-state) with land use area ranging from a few hundred hectares to 4-6 thousand ha. In recent years, small individual farms (0.5-2 ha, rarely 3 ha) began to emerge as part of the land reform carried out in the Republic. These currently number 30 to 50 thousand. Small land areas of individual farms pose problems for application of agricultural machinery and advanced technologies, resulting in these farms leaning heavily on manual labour and, hence, showing greatly reduced efficiency and profitability.

The state owns the bulk of the land resources. Land is expected to be rented starting in 2001. Recent trends in crop production are toward preserving the public sector, at least for the years immediately ahead. In the last few years, significant crop losses (sugar beet, maize, sunflower, some fruit crops) have occurred due to ecological stresses (frosts, drought, etc.), leading to heavy inputs by the government to make up for the losses.

CHAPTER 2
Indigenous Plant Genetic Resources

In the wild flora of Moldova, nearly 150 species of essential oil-bearing plants have been distinguished. The list of the most common of these is given below.

1. *Valeriana officinalis*
2. *Inula helenium*
3. *Melilotus officinalis*
4. *Calamintha nepeta*
5. *Origanum vulgare*
6. *Hypericum perforatum*
7. *Nepeta pannonica*
8. *N. cataria*
9. *N. parviflora*
10. *Daucus carota*
11. *Mentha aquatica*
12. *M. spicata*
13. *M. verticillata*
14. *M. arvensis*
15. *Tanacetum vulgare*
16. *Artemisia austrica*
17. *A. absinthium*
18. *A. annua*
19. *A. pontica*
20. *Matricaris chamomilla*
21. *Achillea millefolium*
22. *A. pannonica*
23. *Helichrysum arenarium*
24. *Thymus marschallianus*
25. *T. moldavicus*
26. *T. pannonicus*
27. *Salvia moldavica*
28. *S. aethiopis*

The indicated plant species are important sources of essential oil produce. However, many of them have not yet found extensive commercial application.

Owing to continuous decrease in area of natural habitat and to considerable anthropogenic pressure, a number of potentially valuable essential oil plant species are in danger of genetic erosion. Among these are: *Nepeta cataria*,

Helichrysum arenarium, *Thymus pannonicus*, *T. marschallianus*, *Calamintha nepeta*, *Hypericum perforatum*, and others.

Among the natural vegetation of Moldova, wild relatives of economically important plants occur which have never been utilized in the development or improvement of the cultivated varieties. Thus, it is advisable to involve in the breeding process such wild species as *Salvia moldavica* and *S. aethipis* with a view to enriching the gene pool of clear-eye (*Salvia sclarea*) and creating new genotypes showing enhanced frost, disease and pest resistance. The species *Mentha arvensis* and *M. spicata* can be used to improve *Mentha piperata* varieties and to breed increased drought resistance and higher essential oil yield into them.

In Moldova, nearly 200 species of medicinal plants have been recognized. The most important of these appear in the list below.

Major medicinal plant species in Moldova

1. *Achillea millefolium*
2. *Aconitum napellus*
3. *Acorus calamus*
4. *Adonis vernalis*
5. *Agrimonia supatoria*
6. *Agropyrum repens*
7. *Althaea officinalis*
8. *Angelica silvestris*
9 *Amygdalus communis*
10. *Arctium lappa*
11. *Artemisia absinthium*
12. *Asarum europaeum*
13. *Astragalus officinalis*
14. *Astragalus dasyanthus*
15. *Betonica officinalis*
16. *Berberis vulgaris*
17. *Bidens tripartita*
18. *Borago officinalis*
19. *Bryonia alba*
20. *Capsella bursa pastoris*
21. *Centaurea cyanis*
22. *Centaurea cyanus*
23. *Centaurium umbellatum*
24. *Chenopodium ambrosioides*
25. *Cichorium intybus*
26. *Convallaris majalis*

27. *Cornus mas*
28. *Crataegus monogyna*
29. *Datura stramonium*
30. *Digitalis lanata*
31. *Echinops ritro*
32. *Equisetum arvense*
33. *Erysimum canescens*
34. *Fragaria vesca*
35. *Fumaria officinalis*
36. *Galega officinalis*
37. *Gentiana cruciata*
38. *Helichrysum arenarium*
39. *Hippophae rhamnoides*
40. *Humulus lupulus*
41. *Hyperiucm perforatum*
42. *Inula helenium*
43. *Leonurus cardiaca*
44. *Lithospermum officinale*
45. *Matricaria chamomilla*
46. *Melilotus officinalis*
47. *Ononis arvensis*
48. *Origanum vulgare*
49. *Plantago major*
50. *Polemonium caeruleum*
51. *Polygonum aviculare*
52. *Polygonum bistorta*
53. *Primula officinalis*
54. *Pulmonaria officinalis*
55. *Rhamnus catharctica*
56. *Rosa canina*
57. *Sambucus nigra*
58. *Sanguisorba officinalis*
59. *Saponaria officinalis*
60. *Silybum marianum*
61. *Sinapis alba*
62. *Sophora japonica*
63. *Symphytum officinalis*
64. *Tanacetum vulgare*
65. *Taraxacum officinale*
66. *Tussilago farfara*

67. *Urtica dioica*
68. *Valeriana officinalis*
69. *Verbascum phlomoides*
70. *Veratrum nigrum*
71. *Viola tricolor*
72. *Viscum album*

Among the species appearing in the list, *Adonis vernalis*, *Inula helenium* and *Helichrysum arenarium* are candidates for economically important plants, but they have not yet been introduced into cultivation. *Digitalis lanata* and *Astragalus dasyanthus* are endangered species. Nearly all of the listed species have not been developed commercially, but they are important sources of plant products. They are sporadically harvested by local people.

Medicinal plants are also represented (180 species) in actively maintained collections of the Botanical Institute.

2.1 LANDRACES ("FARMERS' VARIETIES") AND CULTIVARS

Improved varieties and hybrids of crop plants account for the major portion of agricultural output in Moldova. Recognized varieties that have successfully passed all the preliminary testing stages are normally grown.

In growing some crops on farms or in home gardens, preference is given to old local varieties, because (1) there is a wide selection to pick from, and (2) traditional crops and plant varieties exhibit valuable traits (resistance to biotic and abiotic stresses, high quality products, etc.). Generally, these varieties do not meet the requirements of commercial growing techniques and cannot be used for large-scale growing. Among these, landraces of haricot and green bean, of flint maize, old varieties of sunflower, fancy varieties of tomato and other vegetables and of cucurbits, some varieties of grape and fruit crops are worth mentioning. The government neither encourages nor discourages the use of particular seed or planting material by farmers and local people. No assessment has been made of economic significance of growing traditional crops and plant varieties on farms or in home gardens.

Indigenous plant genetic resources are conserved by local people passively, i.e. solely with a view to meeting the household food needs, by setting aside a proportion of seeds for the next year's crop.

CHAPTER 3
National Conservation Activities

3.1 *IN SITU* CONSERVATION ACTIVITIES

There is no special programme or project for *in situ* conservation of PGR in Moldova. No one is engaged in conservation of landraces and traditional varieties in the field. Many wild species have been rescued from extinction thanks to the state network of reserved areas.

3.2 *EX SITU* CONSERVATION OF PLANT GENETIC RESOURCES

There is no national collection of plant genetic resources (PGR) in Moldova. Active collections of various crop plants are maintained at seven Research Institutes, at the State Agrarian University and in Biological and other related Institutes of the Academy of Sciences of Moldova. Nearly all of these institutions lack proper conditions for seed preservation. In 1991, a Laboratory for Genetic Resources was established at the Institute of Genetics of the Academy of Sciences, which pioneered the creation of a national genebank with a view to conserving genetic resources of the major crop plants and wild species; studying and introducing new crops into cultivation in various regions of Moldova. The funding of the Laboratory comes from the Institute of Genetics budget and is too low to support the whole range of its essential activities. There has been no special decision by the government assigning the Laboratory for Genetic Resources to the task of establishing and running a national genebank.

At present, the collection maintained by the indicated laboratory comprises over 6 thousand samples of plants represented by local varieties, by samples from adjacent countries, from genetic diversity centres, and from other parts of the world. Since nearly 60% of the samples come from other genebanks, they are available there. A portion of the collection is unique and the samples comprising it are not to be found in any other institution world-wide.

The most important material in the collection is, in our view, as follows: (a) identified (marker) accessions; (b) wild relatives of cultivated plants carrying blocks of co-adapted useful genes; (c) local highly adapted

populations. Among the tomato accessions, for example, samples carrying marker genes ls, rin, nor, pat, etc.; *Lycopersicon hirsutum*, *L. peruvianum*, *Solanum pennellii* and other species carrying resistances to abiotic and biotic stresses are of considerable interest to those involved in research on and practical breeding of this crop. Of some interest are also local varieties of maize and kidney bean showing resistances to drought, head smut, bacteriosis, as well as high quality seeds. The indicated samples, like other accessions, are stored
at 4° C.

No more than 2-3% of the total number of samples are used annually. The principal users are breeders at national institutions and scientists in research laboratories. A small portion of the material is supplied, on request or as an exchange, to institutions in other countries.

In view of the fact that the Laboratory for Genetic Resources is in initial stage of its activity, material accumulation prevails over its transfer to other countries. The material import/export ratio is 40-50:1. The material from other collections came from the following sources: VIR (Russia), Institut fur Pflanzenbau, Braunschweig (Germany), Instituto del Germoplasma, Bari (Italy), ICRISAT (India), Cenargen (Brazil), Western Reg. Pl. Introd. St., Washington (USA), and other genebanks.

The existing collection is not indicative of the country's needs and cannot boast of the adequate diversity of plant resources. The international standards are not fully observed in storing and handling the currently available material (the moisture content of seeds cannot be maintained at an appropriate constant level). Owing to financial problems, no special PGR collecting expeditions have been carried out yet. Local varieties of some crops have been obtained from farmers in various parts of the country or purchased at markets. A portion of the collection was transferred to the Laboratory by VIR (All-Union Institute of Plant Breeding, Leningrad). These local samples ended up in the VIR collection 40-45 years ago as accessions chosen at the time.

The question of transferring the material to other places for storage or exchanging it for some other material has not been on the agenda so far. The Laboratory for Genetic Resources is prepared to co-operate with genebanks in other countries. This mutually advantageous co-operation is envisaged as material exchanges and collection replenishment and expansion on agreed terms.

3.3 STORAGE FACILITIES

The collection has been stored in a room with the temperature maintained at a constant level of 4° C. Seeds are kept in glass vessels of various sizes, depending on the seed size. To comply with internationally recommended standards, there is a need for appliances used in preparing seed for preservation (seed drying, cleaning, and viability testing) and for equipment required for setting up a chamber where a temperature of 15° C to 20° C will be maintained.

There is a "base collection" stored as described above. Some samples in the collection are duplicated in other genebanks. No information is available on viability testing and regeneration of the material.

The priorities for processing the incoming material depend on the time of the material arrival at the Laboratory (autumn or spring). Following the preliminary characterization and cleaning, the seeds are prepared for sowing in the field. The processing time varies between a few weeks and a few months. No special procedures for processing short longevity seeds are available. No special assistance is needed in carrying out this work. The material to be processed is stored either at room temperature or at 4° C.

The existing storage facility is 40% full and is expected to meet our requirements for 3 to 4 years. No material is stored for other genebanks.

A national genebank can be established on the basis of the Laboratory for Genetic Resources at the Institute of Genetics, provided the latter is entrusted with the task by a governmental decision. Given a positive decision and proper international assistance, the genebank activities could be expanded in terms of long-term storage of material and fitted out with sophisticated equipment.

3.4 DOCUMENTATION

Work has begun on creating a computerized data base. At present, the bulk of the information is contained in registers (registers of recent accessions, field registers for material characterization, etc.). No complete catalogue of samples is available. However, there is a published catalogue of mutant tomato samples maintained in the genebank.

The information accompanying the samples includes passport data, morphological description and evaluation of characters of breeding value.

More than 75% of samples are fully documented (in registers). Lack of a complete, computerized data base prevents the available material from being effectively used. As things now stand, information is made available to users in the form of individual computer print-outs and by allowing users to come and consult members of the Laboratory staff and registers. The programme for the computerized data base on genetic resources has been compiled at the Institute of Genetics. Whether it is compatible with other data bases is not known. No network is available enabling exchange of data with other genebanks.

In documenting samples of some wild relatives a need arises for more taxonomic expertise. The documentation records are not fully duplicated.

3.5 EVALUATION AND CHARACTERIZATION

The question of distinction between the processes of characterization and evaluation of PGR samples has not been addressed in this country. Characterization of PGR samples is performed using VIR descriptors. No internationally recommended descriptor lists, e.g. the IBPGR descriptors, are available in Moldova. This makes comparison with data from other genebanks difficult in some cases. Farmers are not involved in the evaluation of collections.

Sixty per cent of the samples in the collection have been characterized using the VIR descriptors. The characterization is performed by staff members of the Laboratory for Genetic Resources during material propagation and incorporates, in addition to phonologic features, evidence on resistance to diseases and to pests, as well as on the breeding value of the samples. Moreover, for some crops (tomato, maize, and soya) the degree of marker character expression is registered or individual genes identified.

Most of the available characterization and evaluation data are not published, but they are accessible to potential users of the samples.

There is a counterflow to the genebank of data from evaluations by users of the samples, but this is a limited one. We do not make the provision of such data a condition for supplying material to users. Other genebanks are provided with the information they are interested in on agreed terms.

Some experience in work with a limited number of PGR samples does not make it possible to judge about the cost-effectiveness or practicability of systematic evaluation of all material in the world's genebanks. We believe, however, that the costs involved are justified, since this kind of work enables an integrated "passport" to be generated for the samples of interest, thereby increasing the chances of success in choosing the proper subject of study in basic research, or in practical breeding.

International collaboration, undoubtedly, will help the parties involved in these activities to achieve better results. This, in addition to traditional forms (material and information exchange), should also include more extensive contacts (exchange of specialists visiting the host country for a defined period of time, delivering of reports by leading scientists, international conferences (symposia) on relevant problems, joint ventures, etc.).

The national genebank will be open for co-operation at various levels.

3.6 REGENERATION

Regeneration of samples is carried out in test fields at intervals taking account of the seed storage time. Normally, a certain proportion of samples of each species are regenerated annually. Cross-pollinated crops pose difficulties since they require adequate isolation by space, resulting in a significantly lower number of the samples regenerated.

As things now stand, only a small proportion of samples whose regeneration proves difficult will be stored. In future, the possibility of regenerating such samples elsewhere will be explored.

No difficulties are encountered in maintaining the genetic character of the original samples or avoiding their contamination, provided the appropriate regeneration procedures are used.

Regeneration is carried out under continuous supervision and with participation of qualified breeders and geneticists. The labour force involved in regeneration of samples is insufficient to overcome the difficulties which are liable to occur.

Generally, precautions are taken to avoid genetic drift and other negative genetic effects in the populations studied. The genebank being still in its

infancy, the question of maintaining more than one generation of the same accession has not been addressed.

CHAPTER 4
In-Country Uses of Plant Genetic Resources

The plant genetic resources of Moldova are utilized in (i) breeding programmes with a view to produce parent stock for various crop plants, (ii) genetic, physiological, biochemical and biotechnology studies. A small proportion of the material maintained in the genebank is annually requested for the purpose. Every plant breeding institution in this country has direct contacts with similar institutions in other countries and, by a mutual agreement, exchanges plant genetic resources samples with them. In recent years, the plant genetic resources samples most frequently used by national scientists and professionals have been those of soya, tomato, maize, kidney bean and pea. Genetic resources of these crops have been used by 15 plant geneticists and breeders. The number of requests is expected to increase in the coming years in view of the fact that some of the foreign institutions are reluctant to provide the germplasm requested.

Farmers have access to a fraction of genetic resources, but the percentage of such farms being low and the farmers having no proper training in plant genetic resources utilization, no requests came from them for any samples.

4.1 CROP IMPROVEMENT PROGRAMMES AND SEED DISTRIBUTION

National plant breeding programmes are aimed at developing high-yielding, disease-, pest- and environmental stress-resistant varieties and hybrids of cultivated, essential oil-bearing, medicinal and other plants for various edaphic-climatic zones of the country. To this end, various breeding techniques are applied among which intra-specific and inter-specific (sometimes inter-generic) hybridization are the leading ones. In some cases (e.g. nut crop breeding), selections from local populations are used.

The ultimate objective of these plant breeding programmes is the production of high-yielding, highly adaptive genotypes which would, through sustained yields, help meet national food needs and provide increasing export opportunities.

Scientific plant breeding currently in progress in the country is aimed at meeting national needs and supplying the agricultural sector with a wide variety of plant products.

Plant breeding activities are primarily conducted by government-funded programmes. Farmers have access to all the recognized varieties, but they are not involved in plant breeding and variety evaluation activities.

4.2 BENEFITS DERIVED FROM THE USED OF PLANT GENETIC RESOURCES

Scientific collaboration with plant breeders in other countries involves exchange of material (indigenous plant genetic resources, modern varieties, etc.) which undergoes evaluation and is approved for use in plant breeding programmes. Contacts like these are mutually advantageous to the parties involved.

4.3 IMPROVING PLANT GENETIC RESOURCES UTILIZATION

Since there is no national plant genetic resources conservation system, it is impossible to outline its achievements and ties with plant breeding and seed production systems.

Plant genetic resources are of great value to the country. In the future, their importance will continue to increase due to the potential increase of genetic erosion, the need to use fundamentally new gene sources (donors), etc. For plant genetic resources to be adequately used, efforts should be made to improve the efficiency of work with them (improving the plant genetic resources evaluation and characterization procedure), to ensure closer integration of the genebank with other (agricultural, forestry, etc.) facilities and better national and international coordination.

To improve the use of, and to add value to the national plant genetic resources, assistance is needed, both technical (equipment, facilities) and intellectual (training of specialists, access to the relevant information).

CHAPTER 5
National Goals, Policies, Programmes and Legislation

There is no single, integrated, government-funded "National Programme" for plant genetic resources in Moldova. Six of the departmental programmes of the Ministry of Agriculture for plant breeding have sections concerned with gene pool studies but these have largely been compiled with plant breeding objectives in mind. These, with the exception of maize and sorghum programmes (which are self-supporting), are government-funded programmes.

Nor is there a national committee overseeing or giving direction to activities and policies in PGR conservation. A law on "Plant Variety Protection" has been drafted which, *inter alia*, ensures protection of breeders' and geneticists' rights. It was brought in conformity with UPOV. A Law on Seeds has been elaborated where seeds are viewed from various standpoints: as a commercial product, as seed material, and as a gene pool.

5.1 TRAINING

Work with plant gene pools is performed by trained personnel: specialists with university background in genetics or botany, or specialists in agriculture (with university and college degrees). No special plant genetic resources training is available in the country.

5.2 NATIONAL LEGISLATION

The quarantine laws acting in Moldova do not differ from those in other countries and are no barrier to import or export of PGR accessions. There are quarantine control nurseries where the material is checked. The laws allow the international transfer and exchange of *in vitro* materials, but the quarantine service does not seem to be familiar with the techniques for evaluating such material. Specialists believe there is a need for more stringent quarantine controls.

National laws do not restrict the planting out of imported genetic resources.

The Intellectual Property Rights legislation is in development stage and has not been adopted yet. There is a need for assistance on legal matters concerning plant genetic resources.

There is no defined policy on exchange of plant genetic resources. Nor are there any restrictions on foreign collecting missions; a bilateral agreement on the terms between the interested parties is sufficient.

5.3 OTHER POLICIES

According to the currently acting legislation, the authors (originators) of new varieties/cultivars or hybrids have up to 15% share of the returns resulting from industrial application of their inventions (material). This is a spur in their efforts to introduce novel genotypes. The Law on the Rural Development Priorities ensures that the owner of a variety is exempted from the tax on returns if these are used by him/her to introduce new varieties.

CHAPTER 6
International Collaboration

Moldova has no experience with international PGR conservation systems (United Nations initiatives, International Agricultural Research Centres and others). In relations on gene pool exchanges, the Department of Agricultural Sciences in the Academy of Sciences of Moldova has bilateral agreements with Ministries of Agriculture of CIS countries. There is a similar agreement with Bulgaria. Collaboration along these lines with Hungary is currently being negotiated.

Work with genetic resources of different crops is carried out by specialists at the respective scientific institutions in collaboration with their colleagues from other countries within the framework of Scientific Collaboration Agreements.

CHAPTER 7
National Needs and Opportunities

Needs

1. The development, by an appropriate decision of state bodies, of a national, government-funded programme for plant genetic resources involving scientific institutions and scientific and production associations.
2. The establishment of a national genebank of plant genetic resources located at the Laboratory for Genetic Resources at the Institute of Genetics of the Academy of Sciences of Moldova (Chisinau).
3. There is also need for additional equipment: an apparatus for drying seeds and maintaining their moisture content at 3-7%, for cleaning seeds and testing their viability; a micro-seeder for sowing limited amounts of seeds of the collection samples; additional compressors to maintain the temperature at 4 and -15° C; a computer to establish an adequate database; a photocopying machine; a device for evacuation of air from seed packages; containers for storing germplasm samples (plastic or glass jars, bags for the distribution of seeds to other genebanks).
4. Training of specialists in all aspects of PGR conservation and utilization, for examples courses attendance (including the one-year courses in Birmingham, United Kingdom).
5. Assistance in obtaining methodological expertise (descriptors, literature on different PGR matters, including periodicals and technical manuals).

Opportunities

1. There are suitable rooms (chambers) and some equipment for setting up storage facilities with controlled temperature conditions (-15/ C/-20/ C). At present, the Institute of Genetics has some ten climatized chambers which can be re-equipped for this purpose.
2. The National Institute of Grape and Wine has the potential to carry out the work relative to the conservation of the *Vitis* genus germplasm by *in vitro* techniques. The Institute has developed an appropriate procedure for this purpose. The Institute has contacted the World Bank asking for funds in order to purchase the biotechnology equipment needed for

microclonal propagation of grape which can also be used for the conservation of germplasm of this crop.

The Institute has the capacity to conserve the *Vitis* germplasm for other countries as well (e.g. Bulgaria, the Czech Republic, Georgia, Hungary, Romania, Russia, Ukraine and others).

3. The organization of international missions to collect wild species and indigenous varieties of fruit, grape, grain legume, forest, medicinal and essential oil-bearing plants.

CHAPTER 8
Proposals for a Global Plan of Action

- There is a need for unifying the international laws on PGR exchange, particularly for modern commercial varieties and for those patented in various countries of the world.
- It is proposed that programmes and computerized databases for plant genetic resources be unified with a view to facilitating exchange and utilization of information at the international level.

ANNEX 1
Forest Genetic Resources

Compiled by:

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CHAPTER 1

In Moldova, the main types of forest are composed of broad-leaved tree species. In the central part of the country, the occurrence of forests is mostly limited by river streams and slopes. They are mainly represented by oak forests, with fewer beech forests. The most common forest types are: hornbeam - durmast oak forests, hornbeam - oak forests, lime-ash - oak forests, and wig-tree oak forests.

In the North of Moldova, the dominant forest type is represented by sweet cherry (*Cerasus avium*) - oak forests. In the south, blackthorn - oak (*Quercus ruber*) forests and forests of pubescent oak (*Q. pubescens*) prevail. Forest types that occupy small areas are found at the boundary of species distribution range:

- Birch-oak forest
- Hornbeam-oak forest
- Beech-oak forest

Forest stands of willow, poplar and oak have persisted in river valleys.

CHAPTER 2 FOREST GENETIC RESOURCES

In the Moldovan forests, 43 tree species and 60 species of shrubs can be found. Only a small proportion of these are predominant, i.e. forest-forming species or edificators.
European beech (*Fagus sylvatica*) is found at the eastern boundary of a vast west European range and is adapted to a specific, comparatively narrow range of ecological conditions in Moldova.

English oak (*Quercus robur*) is a common forest tree species and predominates in the northern Moldovan forests. In the central part of the country, it can be found in lowlands.

Durmast oak (*Quercus petraea*) is found in the eastern part of Moldova. It has a well-defined ecological range (niche) and is confined to heights from 200 meters to 430 meters above sea level. Its principal geographic range is Central Moldova.

Pubescent oak (*Quercus pubescens*) is a sub-Mediterranean species. In Moldova it can be found at the north-eastern part of its geographic range. It is a principal tree species of South Moldova forests.

Natural forests occupy about 7% of the territory of Moldova. In order to preserve indigenous natural forests of Central Moldova (the Central European type), two forest reserves have been established: (i) the Kodry reserve (5,177 ha) and (ii) the Plaiul Fagului reserve (5,665 ha). Most of the area in these forest reserves is occupied by beech and oak forests (*Quercus petraea*). In order to preserve lowland willow and poplar forests, two reserves have been established in the river Prut floodplains: (i) the reserve "Prutul de Jos" (1,691 ha), and (ii) the reserve Padurea Domneasca (6,032 ha). It is necessary to define preserved or protected areas and conservation measures for the pubescent oak forests and other forests, which are also typical in terms of phytocenological, silvicultural and species composition aspects.

At species level, the following forest tree species are endangered:

- Oleaster pear (*Pyrus elaegnifolia* Pal.). This species is in the Moldova Red data book. Two specimens have been found in the Hyrbovets forest.
- Pubescent oak (*Quercus pubescens*). Notwithstanding the fact that this species is predominant in the southern forests, it has not been producing abundant fruit and has shown virtually no regeneration from seeds in the past few decades.
- European beech (*Fagus sylvatica*). Nearly the same situation as with pubescent oak.
- Alder (*Alnus glutinosa*, *A. incana*).

A number of areas of rare forest types are threatened:

- birch-oak forests - represented by two natural forest areas in the north of Moldova;

- oriental hornbeam-oak forests - oak forest with oriental hornbeam (*Carpinus orientalis*) trees. There is only one strip (600 ha) of this type of forest;
- hyrnets forests of pubescent oak (*Q. pubescens*);
- beech forests.

Threatened regions

An area of 8,000 ha of oak forests in the north of Moldova is threatened. Here, *Quercus robur* has not been producing abundant fruit for the past 25 years. Natural seed reproduction does not occur. Because of the changing canopy structure, weeds such as nettle, catchweed, bedstraw, etc. have been observed to replace herbaceous plants typical of these forests.

Wild forest species representing valuable genetic resources for fruit crop breeding

Sweet cherry (*Cerasus avium* (L.) Moench) as an accompanying species can be found almost in any type of forests. Forest sweet cherry has been found to show high polymorphism in fruit shape, colour and taste. This is particularly true in the north of Moldova.

Cornelian cherry (*Cornus* mas. L.) - a shrub that can be found in oak forests. In the forests of Central Moldova, it exhibits a considerable degree of fruit shape and colour polymorphism.

A number of other species are found in Moldova forests which are potentially important in terms of genetic resources:

- pear (*Pyrus pyraster*)
- apple (*Malus sylvestris*)
- ground cherry (*Cerasus fruticosa*)
- Mahaleb cherry (*Cerasus mahaleb*)
- cherry (*Padus avium*)
- blackthorn (*Prunus spinosa*)
- 18 species of brier, 9 species of hawthorn, etc.

CHAPTER 3 CONSERVATION OF FOREST GENETIC RESOURCES

Information on programmes and activities aimed at the exploration of the natural distribution of the main native forest species:

(a) In Moldova, floristic collecting missions have been carried out for nearly 100 years. The collected material was used to establish and maintain the Herbarium collections of the Republic of Moldova at the Botanical Institute (Chisinau). On the basis of the herbarium material and geobotanical studies, evidence has been accumulated on potential forest species distribution in Moldova.

(b) Forest site mapping was carried out in Moldova during 1965-1972. There is evidence on the distribution of forest types in Moldova.

(c) Special measures have been undertaken to establish reserves of some native forest species: ramson, dogwood, etc.

Intra-specific diversity of the main forest tree species (beech, oak, sweet cherry, dogwood, etc.) has been documented and described.

CHAPTER 4 USE OF FOREST GENETIC RESOURCES

In Moldova, there is a national programme for production and supply of the reproductive material of the main forest tree species and several accompanying tree species (lime, ash, acacia, etc.). Seeds are harvested annually in amounts corresponding to the needs of forestry districts. The seeds are grown in nurseries and seedlings are used for the establishment of new forest plantations. Seeds are harvested in forest seed production plots and in reserves.

Benefits derived from the use of forest genetic resources

Given a proper system of seed production for the main forest tree species in Moldova, the Republic of Moldova would be capable of increasing the output of forest production by about 20%, thus promoting conservation of forest genetic resources of forest trees, shrubs and herbaceous plants. Attention should be given to solve this problem.

APPENDIX 1
Germplasm Collections of Research Institutions in Moldova

Institutions	Species	Number of accessions
Institute of Genetics Academy of Sciences Chsinau	*Triticum aestivum*	300
	Secale cereale	30
	Triticum durum	200
	Triticale	400
	Zea mays	2000
	Phaseolus	750
	Ilycine max	600
	Pisum sativum	280
	Cicer arietinum	220
	Lens culinaris	200
	Lycopersicon	1400
	Capsicum	120
	Physalis	60
	Abelmoschus esculentus	10
	Medicago sativa	6
	Carthamus tinctorius	7
	Ocimum basilicum	2
Botanical Institute Academy of Sciences Chisinau		
Research Institute of Crop Plants (Belitze)	*Triticum aestivum*	400
	Hordeum vulgare	
	Phaseolus vulgaris	
	Pisum sativum	
	Helianthus annuus	
	Ilycine max	
	Medicago sativa	
	Vicia narbenensis	
	Beta vulgaris	
Research Institute of Maize and Sorgo (Tashkany)	*Zea mays*	6000 (?)
	Sorghum	

Institutions	Species	Number of accessions
Research Institute for Breeding Techniques in Horticulture (Chisinau)	*Malus domestica* *Pyrus communis* *Cydonia oblonga* *Persica vulgaris* *Prunus domestica* *Cerasus avium* *Cerasus vulgaris* *Armeniaca vulgaris* *Juglans regia* *Amygdalus communis* *Cornus maas* *Zizyphus jujuba*	750 600 50 167 123 150 98 90 200 100 50 36
National Institute of Grape and Wine Industry (Chisinau)	*Vitis (*27 species*)*	3000
Experimental Station for oil Bearing Plants (Chisinau)	39 species	190
Research Institute of Tobacco	*Nicotina tabacum*	
Agricultural University (Chisinau)	*Ilycyne max* *Triticum*	
Institute of agriculture (Tiraspol)	*Lycopersicon esculentum* *Capsicum annuum* *Solanum tuberosum* *Solanum melongena* *Brassica oleracea* *Cucumis sativus* *Allium cepa* *Allium sativum* *Daucus carota var. sativa* *Raphanus sativus* *Pisum sativum* *Cucurbita pepo var. giraumontia*	