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GENETIC RESOURCES OF SOYABEAN

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IBPGR Working Group on the Genetic Resources of *Glycine* Species

held at the International Soybean Program (INTSOY)
at the University of Illinois, Urbana, USA
9-11 August, 1982

R E P O R T

IBPGR Secretariat
Rome, Italy
1983

The International Board for Plant Genetic Resources (IBPGR) is an autonomous, international, scientific organization under the aegis of the Consultative Group on International Agricultural Research (CGIAR). The IBPGR, which was established by the CGIAR in 1974, is composed of its Chairman and 16 members; its Executive Secretariat is provided by the Food and Agriculture Organization of the United Nations. The basic function of the IBPGR, as defined by the Consultative Group, is to promote an international network of genetic resources centres to further the collection, conservation, documentation, evaluation and use of plant germplasm and thereby contribute to raising the standard of living and welfare of people throughout the world. The Consul- tative Group mobilizes financial support from its members to meet the budgetary requirements of the Board.

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INTRODUCTION

1. An ad hoc expert Working Group on the Genetic Resources of Glycine species was convened by the IBPGR. It met 9-11 August 1982 in Urbana, Ill., USA, and was co-sponsored by the International Soybean Program (INTSOY) at the University of Illinois, Urbana.

2. The following members attended: Drs. R.L. Bernard (USDA), A.H.D. Brown, (CSIRO, Australia), E.E. Hartwig (USDA), Q. Jones (IBPGR), H.E. Kauffman (INTSOY), S.H. Kwon (Korea), Q. Ng (IITA), S. Shanmugasundarum (AVRDC), I. Watanabe (ARC, Tsukuba, Japan) and J.T. Williams (IBPGR). In addition, a number of scientists associated with the U.S. programmes attended: Drs. C. Hittle (INTSOY), T. Hymowitz (University of Illinois), L.L. Nelson (USDA) and R. Palmer (Iowa State University). The following attended as observers: Messrs. D. Erickson (INTSOY), D. Holt (University of Urbana), Sun Huan (People's Republic of China) and M. Irwin (INTSOY). Full addresses are provided in Appendix I.

3. Participants were welcomed by Dr. Kauffman, Director of INTSOY. Dr. Williams, Executive Secretary of IBPGR, outlined the wishes of the Board to move forward on the practical work associated with Glycine species which rate a high global priority for genetic resources work. Dr. Q. Jones agreed to chair the meeting. The agenda, as modified, is shown in Appendix II

REPORT 1/

Review of Existing Collections

4. A number of countries hold major collections which, because of their scope, can be considered to be world collections. Nevertheless the Working Group noted that none of these are fully representative. The countries with details of their collections are listed below.

CHINA

During the 1950s a campaign was launched to collect soyabean germplasm. Within the country there were about 50,000 samples collected but there were many duplications. At present there are more than 6,000 samples which will be held in long-term storage in the genebank which is scheduled to be constructed at CAAS, Beijing. These include some

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1/ This report was endorsed in February 1983 by the Tenth meeting of the IBPGR and practical work recommended initiated soon afterwards.

material from neighbouring countries. At present each province holds its own material, the important ones being:

(i) Jilin Academy of Agricultural Sciences. 2,000 G. max (ca. 500 from the province, 900 from other provinces and 500 introductions); 1,000 wild species chiefly G. soja.

(ii) Oil Bearing Crops Institute, Wuhan, Hubei. 3,000 G. max and some wild material.

(iii) Shadong Academy of Agricultural Sciences, Jinan, Shadong 2,930 G. max and some wild relatives.

(iv) CAAS, Beijing 2,500 samples, mostly G. max.

(v) Jiang Su Academy of Agricultural Sciences, Nanking Details of samples not known.

(vi) Liaoning Academy of Agricultural Sciences, Harbin, Heilongjing 960 G. max and some wild material.

JAPAN

The National Institute of Agricultural Sciences (NIAS), Tsukuba, holds a total of 3,541 samples of which there is an estimate of 670 possible duplications. 2,528 are from Japan and 1,013 are introductions. Of the latter, 268 are from the USA collection, 143 from China (including 34 from Taiwan), 220 from the Socialist States of Europe, 55 from the Koreas, 60 from India, 28 from Nepal and Bhutan and 244 from other countries.

The base collection at NIAS links with two institutes for multiplication and evaluation: Tohobu National Agricultural Experiment Station and Kyushu National Agricultural Experiment Station, the former for early to medium varieties and the latter for late varieties. Material is stored for long-term conservation at -10°C and for medium-term conservation at -1°C.

The Working Group was informed that, to date, preliminary evaluation had only been carried out on 1,300 samples. In addition the Japanese collection does not include all the indigenous variability but probably 70-80% of it. G. soja was less well represented and more field work is projected for the immediate future.

USA

There has been introduction of material to the USA since 1898. From 1898-1923 these were at the rate of 40/year. In the period 1924-32 introduction was accelerated due to specific exploration programmes and 6,657 were introduced. Few were introduced from 1933-74 but in 1975 an active programme was designed. In total, to 1980, 9,343 samples make up the U.S. collection from the following countries:

Korea	3,041	Indonesia	28	Australia	31
China	1,228	Philippines	18	African countries	115
Japan	1,721	Pakistan	15		
India	230	Vietnam	5	USSR	1,647

Thailand	34	Other Asian countries	29	Other European countries	759
Nepal	30				
Malaysia	30			Central America and USA	80
				South America	65

Within the USA the collection is maintained in two parts: a northern collection at Urbana, Illinois; and a southern collection at Stoneville, Mississippi. These two locations act as active collections and base storage will be completed in the National Seed Storage Laboratory, Fort Collins, Colorado, USA.

Apart from G. max, the collection includes wild G. soja (especially from Siberia, China, Korea and Japan) and a limited number of wild perennials. Not all the samples have been characterized but limited data are available although not yet computerized. The latter is expected through assistance from the GRIN Program of the USDA.

USSR

The national programme centred on the N.I. Vavilov All-Union Institute of Plant Industry, Leningrad, maintains more than 3,000 samples of G. max from much of the range of the species and some samples of G. soja.

Samples are stored for long-term conservation at -10°C and for medium-term purposes at 4-5°C. Information is being computerized.

5. Other collections contain significant diversity, especially the following:

KOREA (Republic of)

There has been an active programme to collect indigenous material 1970-76. This is held at Kyung-Hee University, Seoul and the origin of 2,833 samples is:

Seoul	31
Gyeong-gi-Do	176
Gang-Weon-Do	368
Chungcheong-Bug-Do	183
Chuncheong-Nam-Do	355
Jeonra-Bug-Do	308
Jeonra-Nam-Do	372
Gyeongsang-Buk-Do	624
Gyeongsang-Nam-Do	400
Jeju-Do	16

All these samples are G. max of which there is no need for further collection. They have been scored for 24 characters (Kwon et al. 1978) as well as accession number, year of collection and year of testing. There is some need to collect G. soja but genetic erosion is not causing an emergency situation.

AVRDC, Taiwan, China

From 1973 AVRDC has collected through primary and secondary sources samples from all over the world. Currently 10,200 samples are being held including a duplicate of

the U.S. collection. The collection data are stored in IBM computer discs and sorted using SAS. The collection has been screened for important diseases and pests such as soyabean rust and beanflies and has also been screened for photoperiodic response. Breeding work relates to tropical and sub-tropical conditions. The germplasm is stored under 5° to 6°C and at 45% RH in Bally walk-in coolers. The moisture content of the seeds in storage is about 8%. The seeds are stored in both vacuum packed aluminium foil packets and in plastic bottles.

AUSTRALIA

A collection of about 500 accessions of wild perennials of the subgenus Glycine (G. latrobeana, G. clandestina, G. latifolia, G. canescens, G. tomentella, G. tabacina, G. falcata and G. sp. "curved pod") is held by CSIRO, Division of Plant Industry, Canberra. The collection consists of seed of about three-quarters of the accessions, and plants of the remainder. Seed multiplication is proceeding and samples of 198 accessions are now stored at sub-zero temperatures. However, the collection is not comprehensive in geographical representation. The wild perennials are indigenous to Australia although two of them extend their range into the S. Pacific and to S. China. The species are of interest for evolutionary studies and crossing barriers with cultivated annuals or closely related annuals may be overcome. Sterile hybrids have already been made - G. max x G. tomentella. The within species variation of the wild perennials is imperfectly understood. Dr. E. Hymowitz of the University of Illinois initiated the collection of seeds of wild glycines on a wide scale and has collaborated extensively with the Australians for collecting and 200 of the samples are duplicated in the U.S. collections.

INDONESIA

The National Biological Institute, Bogor holds more than 600 samples of local material, collected with IBPGR support. There is a need for further collecting.

INDIA

There are about 4,000 samples maintained at 16 research institutes and agricultural universities. The G.B. Pant University of Agriculture and Technology, Pantnagar, U.P. (ca. 3,000 samples) and the Regional Station of the National Bureau of Plant Genetic Resources, Akola (2,337 samples) hold sizeable collections.

The collections of Dr. B.B. Singh at Pantnagar and that of Dr. H.R. Chatia at Amravati (ca. 1,800 samples) are important. The National Bureau of Plant Genetic Resources should be asked if these have been safeguarded as well as other material entered into the NBPGR collection.

EUROPEAN COLLECTIONS

1. FRANCE. Dr. R.M. Ecochard, Toulouse maintains ca. 500 samples with significant diversity.

2. SWEDEN. The late Dr. S.A. Holmberg, Norrkoping maintained 1,200 samples, many from Siberia and the islands north of Japan. The Nordic Gene Bank should be asked to ensure the safety of this material.

3. ROMANIA, HUNGARY, POLAND, CZECHOSLOVAKIA, GERMAN DEMOCRATIC REPUBLIC. These hold small collections but there are many samples collected by Dr. Mueller in 1929-30 in

East Asia which formed the basis of cultivars in these countries prior to the introduction of U.S. material.

IITA (Nigeria)

1,300 accessions are held and originally these came from the U.S. and a U.K. programme in E. Africa. More African material is required from Zambia and South Africa. The collection at IITA is documented and significant for the tropics.

BRAZIL

Material with significant adaptation is held by CENARGEN/EMBRAPA, Brasilia.

6. Other germplasm collections (e.g. Canada) are duplicated in major collections listed above or are breeders' collections.

7. A discussion on the known contents of the existing collections led to the formulation of collecting priorities (see paras. 11-16 below).

8. The Working Group noted the very free distribution and exchange from many collections but also noted some reticence (but not any formal ban) from others. The Group concluded that the latter was due to the lack of good information systems and characterization so that requests could not easily be satisfied.

Designation of Base Collections

9. The Working Group recommends that the IBPGR designates the following as base collections for long-term conservation:

(i) CAAS, Beijing, People's Republic of China, (global collection) when facilities are available;

(ii) NSSL, Fort Collins, USA (global collection);

(iii) CSIRO, Canberra, Australia, (for wild perennials of subgenus Glycine);

(iv) NIAS, Tsukuba, Japan, as a "back-up" store (to hold small samples for security).

Priorities for Collecting

10. The Working Group recognized three types of material for primary collecting viz. G. max the cultivated species, related wild annual species, and perennial species. A sub-committee of Drs. Bernard, Shanmugasundaram, Kwon and Watanabe drafted the priorities for cultivated and wild annuals and another composed of Drs. Hymowitz and Brown drafted those for wild perennials. The priorities are listed in paras. 11-13 below.

Cultivated Soyabean

11. The following are listed in order of priority to make the major global collections (paras. 4, 5 and 9) more comprehensive. In areas of ancient cultivation there is also genetic erosion leading to rapid loss of landraces.

Priority 1 - China (south and west, the northeast has been adequately collected)

2 - Korea, Democratic Republic of

3 - Indonesia

4 - India, Nepal, Bhutan, Afghanistan, Pakistan (Northwest Frontier Province)

5 - Burma, Thailand (northern part), Viet Nam, Kampuchea, Lao

6 - Japan

7 - Local areas of Malaysia, Philippines and South Pacific especially where ethnic Chinese have been long settled.

8 - Other countries with a relatively long history of cultivation (to be acquired largely by exchange).

12. The IBPGR is asked to consider an action programme to complete this work in a five-year period. Action could be through (i) support to national programmes to encourage them and fund if necessary, or (ii) IBPGR-organized missions.

Wild Annual Species

13. Based on similar considerations to those itemized in para. 11 the priorities are:

Priority 1 - China

2 - Korea, Democratic Republic of

3 - Japan

4 - Korea, Republic of

5 - USSR

14. The Working Group suggests that the IBPGR should consider the provision of up to $60,000 for priority collecting of cultivated and wild annual species in the first three years of an action programme.

Wild Perennial Species

15. The priorities are in descending order:

Priority 1 - Central Queensland, Australia

2 - Mackay - Townsville coastline of Queensland and its offshore islands, Australia

3 - Western Australia

4 - Papua New Guinea

5 - Southern Victoria, Australia

6a - Islands of the South Pacific

6b - Southern coastal area of China

16. CSIRO Australia should be asked to carry out the work under priorities 1 and 5 and to help international work in association with IBPGR for priorities 2, 3, and 4 and 6a. The IBPGR should ask Chinese colleagues to cover priority 6b. The Working Group agreed that IBPGR funding (up to $25,000 in 1983-84) would be necessary and furthermore justified in view of the international interest in this material. Initial help would serve to catalyze Australian national efforts. In addition the Working Group noted the interest in surveying insect herbivores and plant viruses associated with perennial species in Australia as baseline data for future breeding programmes.

Descriptors

17. Dr. Shanmugasundaram had prepared a draft list of descriptors for *Glycine max*. This had been discussed with the IBPGR Secretariat and circulated to soyabean researchers around the world.

18. The Working Group agreed upon a minimal list incorporating the IBPGR format for passport data and characterization and preliminary evaluation (Appendix III). In addition a number of further evaluation descriptors were agreed and included.

19. The IBPGR is asked to recommend the use of this descriptor list by curators of collections and to print the list in English and Chinese.

Information Management and Conservation Requirements

20. A major task was identified. This is the need to inventory all collections to ascertain the real comprehensiveness of the major ones and to sort out duplications and thereby start to determine very specific gaps. If this were to be done internationally through the IBPGR a logical second step would be the completing of data bases according to the descriptor list which individual curators would then maintain and up-date as necessary. In addition useful information for breeders could be issued e.g. information on samples showing specific resistances (e.g. Tisselli *et al.*, 1980).

21. The IBPGR is asked to provide the services of a graduate technician as soon as possible to carry out this work. The Working Group recommends that he be located in Illinois for a 1-2 year period at an annual cost of $20,000. Although located in Illinois he would work closely with the IBPGR Secretariat and national programmes.

22. The attention of the IBPGR is drawn to the following needs of national programmes:

China	-	documentation management system
Republic of Korea	-	assistance with computerization and storage facilities (probably through deep-freeze chests) at Kyung-Hee University
Indonesia	-	training in evaluation and use of soyabean germplasm

23. The attention of the IBPGR is drawn to the needs of international centres:

AVRDC	-	part-time help on documentation and the upgrading of storage facilities
IITA	-	support to obtain material from certain African countries

and for characterization of the existing collection under tropical conditions

and to the continuing need for feed-back of information between IITA, AVRDC and the tropical part of the INTSOY Program.

24. The Working Group noted that the programme support to soyabean germplasm collections in Japan and the U.S. will need to be increased. In the immediate future the U.S. curators were informed that they will obtain computer facilities through USDA.

25. In view of the need to build up the collections of wild perennials the IBPGR is asked to encourage the exchange and despatch of samples from Australia for international transfer and that this might require the IBPGR to act as a catalyst by provision of up to $5,000, if required.

Rhizobia

26. The Working Group recognized that this subject would require further study and report. However it wished to record the value of the Beltsville collection. In addition it noted the IITA programme for screening for promiscuous nodulation.

27. It is recommended that, wherever feasible, Rhizobia are collected during exploration missions.

Closing

28. Participants expressed their thanks to INTSOY and the IBPGR for organizing a most useful and constructive meeting.

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APPENDIX I

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APPENDIX II

AGENDA

1. Welcome by INTSOY and IBPGR

2. Review of current germplasm programmes

   2.1 Assessment of variability included

   2.2 Reports on characterization, evaluation and documentation

3. Designations for base collections

4. Descriptors and descriptor states for germplasm collections

5. Recommendations on priorities

   5.1 Cultivated, wild annual and wild perennial collection targets

6. Recommendations concerning information management and germplasm maintenance

7. Rhizobia

APPENDIX III

DESCRIPTORS FOR GLYCINE MAX [1/]

PASSPORT DATA

1. ACCESSION DATA

1.1 ACCESSION NUMBER

This number serves as a unique identifier for accessions and is assigned by the curator when an accession is entered into his collection. Once assigned, this number should never be reassigned to another accession in the collection. Even if an accession is lost, its assigned number is still not available for re-use. Letters should occur before the number to identify the genebank or national system (e.g. MG indicates an accession comes from the genebank at Bari, Italy. PI indicates an accession within the USA system).

1.2 DONOR NAME

Name of institution or individual responsible for donating the germplasm

1.3 DONOR IDENTIFICATION NUMBER

Number assigned to accession by the donor

1.4 OTHER NUMBERS ASSOCIATED WITH THE ACCESSION (Other numbers can be added as 1.4.3 etc.)

Any other identification number known to exist in other collections for this accession, e.g. USDA Plant Inventory number (not collection number, see 2.1)

1.4.1 Other number 1

1.4.2 Other number 2

etc.

1.5 SCIENTIFIC NAME

1.5.1 Genus

1.5.2 Species

1.6 PEDIGREE/CULTIVAR NAME

Nomenclature and designations assigned to breeder's material

1/ Descriptors for further evaluation are not included here. They are to be found in a separate booklet issued by the IBPGR.

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APPENDIX III
(Continued)

1.6.1 Pedigree number

1.6.2 Cultivar name

1.7 ACQUISITION DATE

The month and year in which the accession entered the collection, expressed numerically, e.g. June = 06, 1981 = 81

1.7.1 Month

1.7.2 Year

1.8 DATE OF LAST REGENERATION OR MULTIPLICATION

The month and year expressed numerically, e.g. October = 10, 1978 = 78

1.8.1 Month

1.8.2 Year

1.9 ACCESSION SIZE

Approximate number of seeds or quantity in gm of accession in collection (if quantity is given specify 100 seed weight)

1.10 NUMBER OF TIMES ACCESSION REGENERATED

Number of regenerations or multiplications since original collection

2. COLLECTION DATA

2.1 COLLECTOR's NUMBER

Original number assigned by collector of the sample normally composed of the name or initials of the collector(s) followed by a number. This item is essential for identifying duplicates held in different collections and should always accompany sub-samples wherever they are sent

2.2 COLLECTING INSTITUTE

Institute or person collecting/sponsoring the original sample

2.3. DATE OF COLLECTION OF ORIGINAL SAMPLE

Expressed numerically, e.g. March = 03, 1980 = 80

2.3.1 Month

2.3.2 Year

APPENDIX III
(Continued)

2.4 COUNTRY OF COLLECTION OR COUNTRY WHERE CULTIVAR/VARIETY BRED

Use the three letter abbreviations supported by the Statistical Office of the United Nations. Copies of these abbreviations are available from the IBPGR Secretariat and have been published in the FAO/IBPGR Plant Genetic Resources Newsletter number 49.

2.5 PROVINCE/STATE

Name of the administrative subdivision of the country in which the sample was collected

2.6 LOCATION OR COLLECTION SITE

Number of kilometers and direction from nearest town, village or map grid reference (e.g. TIMBUKTU7S means 7 km South of Timbuktu)

2.7 LATITUDE OF COLLECTION SITE

Degrees and minutes followed by N (North) or S (South), e.g. 1030S

2.8 LONGITUDE OF COLLECTION SITE

Degrees and minutes followed by E (East) or W (West), e.g. 7625W

2.9 ALTITUDE OF COLLECTION SITE

Elevation above sea level in metres

2.10 COLLECTION SOURCE

1 Wild
2 Farm land
3 Farm store
4 Backyard
5 Village market
6 Commercial market
7 Institute
8 Others (specify in the NOTES descriptor, 11)

2.11 STATUS OF SAMPLE

1 Wild
2 Weedy
3 Breeders line
4 Primitive cultivar/landrace

APPENDIX III
(Continued)

5 Advanced cultivar (bred)

6 Others (specify in the NOTES descriptor, 11)

2.12 LOCAL/VERNACULAR NAME

Name given by farmer to cultivar/landrace/weed

2.13 NUMBER OF PLANTS SAMPLED

Approximate number of plants collected in the field to produce this accession

2.14 PHOTOGRAPH

Was a photograph taken of the accession of environment at collection?

0 No

+ Yes

2.15 OTHER NOTES FROM COLLECTOR

Collectors will record ecological information. For cultivated soyabeans, cultural practices used such as irrigation, season of sowing, etc. will be recorded

CHARACTERIZATION AND PRELIMINARY EVALUATION DATA

3. SITE DATA

3.1 COUNTRY OF CHARACTERIZATION AND PRELIMINARY EVALUATION

3.2 SITE (RESEARCH INSTITUTE)

3.3 NAME OF PERSON IN CHARGE OF CHARACTERIZATION

3.4 SOWING DATE

3.4.1 Day

3.4.2 Month

3.4.3 Year

3.5 HARVEST DATE

3.5.1 Day

3.5.2 Month

3.5.3 Year

APPENDIX III
(Continued)

4. PLANT DATA

4.1 VEGETATIVE

4.1.1 Stem determination

3 Determinate

5 Semi-determinate

7 Indeterminate

4.1.2 Number of leaflets

3 3

5 4-6

7 7 or more

4.1.3 Leaflet shape

Judged from the ratio of length/width of fully developed terminal leaflet on the middle part of main stems

3 Narrow (l/w 2.2 or more) = 'lanceolate'

5 Intermediate (l/w 1.9.2.1)

7 Broad (l/w 1.8 or less) = 'ovate'

4.1.4 Pubescence

0 Absent

\+ Present

4.1.5 Pubescence density

3 Sparse

5 Semi-sparse

7 Normal

9 Dense

4.1.6 Pubescence colour

1 Grey

2 Light brown

3 Brown = 'tawny'

4.1.7 Pubescence type

1 Erect

APPENDIX III
(Continued)

2 Semi-appressed

3 Appressed

4 Curly

5 Retrorse tip

4.2 INFLORESCENCE

4.2.1 Corolla colour

3 White

5 Purple throat

7 Purple

4.2.2. Mature pod colour

3 Tan

5 Brown

7 Black

4.3 SEED

4.3.1 Seed coat colour

1 Yellowish white

2 Yellow

3 Green

4 Buff

5 Reddish brown

6 Grey

7 Imperfect black (black shading to buff)

8 Black

4.3.2 Seed coat pattern

1 Light hilum

2 Dark hilum

3 Saddle

4 Striped

APPENDIX III
(Continued)

4.3.3 Hilum colour

1 Yellow
2 Buff
3 Brown
4 Green
5 Grey
6 Imperfect black (= black with buff outer ring)
7 Black
8 Others (specify in the NOTES, descriptor 11)

4.3.4 Seed coat surface lustre

3 Shiny
5 Intermediate
7 Dull
9 Heavy bloom

4.3.5 Strophiole at the hilum

0 Absent
+ Present

4.3.6 100 Seed weight

Absolute values in g normally measured at 13-15% moisture content

4.3.7 Cotyledon colour

1 Yellow
2 Green