GENETIC RESOURCES OF SWEET POTATO

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INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES

IBPGR Working Group on the Genetic Resources of Sweet Potato

Charleston, South Carolina, USA, 5-7 August 1980

REPORT

IBPGR SECRETARIAT
Rome, 1981

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 15 members; its 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 Consultative Group mobilizes financial support from its members to meet the budgetary requirements of the Board.

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INTRODUCTION

1. The International Board for Plant Genetic Resources (IBPGR), considering the expansion of its programme, agreed in its 7th Meeting to convene an *ad hoc* Working Group to discuss the genetic resources of sweet potato. This *ad hoc* Working Group in cooperation with the U.S. Vegetable Laboratory was convened at Charleston, South Carolina, USA, 5-7 August 1980.

2. Dr. A. Jones opened the meeting and welcomed all participants. A number of representatives from the USA participated in the meeting together with Dr. S.K. Hahn (IITA, Nigeria), Dr. Ruben L. Villareal (AVRDC, Taiwan) and Dr. Douglas E. Yen, presently employed in Australia. Invitations were also sent to Dr. Dalmo C. Giacometti (CENARGEN/EMBRAPA, Brazil), Dr. Satoshi Sakamoto (Japan) and Ing. A. Rodriguez Nodals (CEMSA, Cuba), but unfortunately they were all unable to attend. The IBPGR was represented by Dr. Quentin Jones and the IBPGR Secretariat by Ir. D.H van Sloten, who acted as technical secretary to the Working Group. For the list of participants see Appendix I. The agenda as adopted by the meeting is shown in Appendix II.

3. The reasons necessitating an international sweet potato germplasm system (including collection, maintenance and distribution) were outlined.

(i) Sweet potato is an important crop ranking seventh in terms of production worldwide with an average annual production of about 100 million metric tons.

(ii) Based on calory yields, nutritive value, adaptability, versatility, its tropical origin and vegetative reproduction, the sweet potato can potentially make a greater contribution to world agriculture in the future.

(iii) The risk of losing significant amounts of germplasm is already high and is expected to increase.

(iv) The establishment of an international repository for sweet potato germplasm is expected to greatly speed up the realization of the potential for this crop.

RECOMMENDATIONS

4. The major recommendations of the Meeting, which were endorsed by the IBPGR at its 8th Meeting, Rome, 17-20 February 1981, are described below.

4.1 Collecting activities should concentrate on Guatemala, Ecuador, Colombia and Peru. The following action is envisaged:

(i) a consultant should visit these countries during 1981 to explore the existing variability, to establish contacts with local authorities and to discuss the possibility of establishing temporary centres for vegetative collections in each of these four countries;

(ii) collecting should take place in these countries in 1982 - 1985;

(iii) planting of the collected material in the countries of collection where polycrosses should be made to obtain true seed. A consultant should visit these centres regularly to discuss the selection of material which should be maintained clonally.

4.2 Collecting in the secondary centres of variation (China, Southeast Asia and East Africa) should be encouraged.

4.3 The IBPGR will request the following centres[1/] to hold global collections of sweet potato and wild relatives:

(i) the International Institute for Tropical Agriculture (IITA), Nigeria (seed and clonal material);

(ii) the National Seed Storage Laboratory (NSSL), Fort Collins, Colorado, USA (seed);

(iii) the USA clonal repository for sweet potato (still to be designated by U.S. authorities).

4.4 The need for quarantine, during both collection and conservation was emphasized. It is recommended that:

(i) trained collectors be provided at the site of collection who can eliminate many potential pests and diseases through visual observation and pesticide treatment;

(ii) clonal material be cleaned-up through meristem-tip culture in the Netherlands (IPO) and the USA (Glendale) and that research on meristem culture be encouraged;

(iii) a virus-indexing system be utilized and improved in the initial stages of development of the repositories and as a permanent part of the maintenance programme.

4.5 A training course will be organized to familiarize scientists from Ecuador, Peru, Guatemala, Colombia and Africa with sweet potato collecting, evaluation, conservation (seed and clonal material, polycrosses) and quarantine (meristem culture).

1/ The IBPGR also agreed to include the NSSL, NIAS, Japan to hold seed collections.

REPORT

Review of major existing collections and identification of gaps

5. In a review of the major existing sweet potato collections the IBPGR Directory of Sweet Potato Germplasm Collections (AGP:IBPGR/80/49) was acknowledged as a good working document. It was noted, however, that the Directory cannot be considered complete. Therefore the IBPGR Secretariat requested collection information from 17 institutes which were suggested by the meeting. Other significant collections should be added as they are identified.

6. Discussions emphasized the comparatively narrow genetic base of the documented germplasm in storage. Great concern was expressed regarding the even smaller germplasm holdings of the closely allied species. These species of *Ipomoea* section *Batatas* are potential contributors of desirable traits to breeding programmes worldwide.

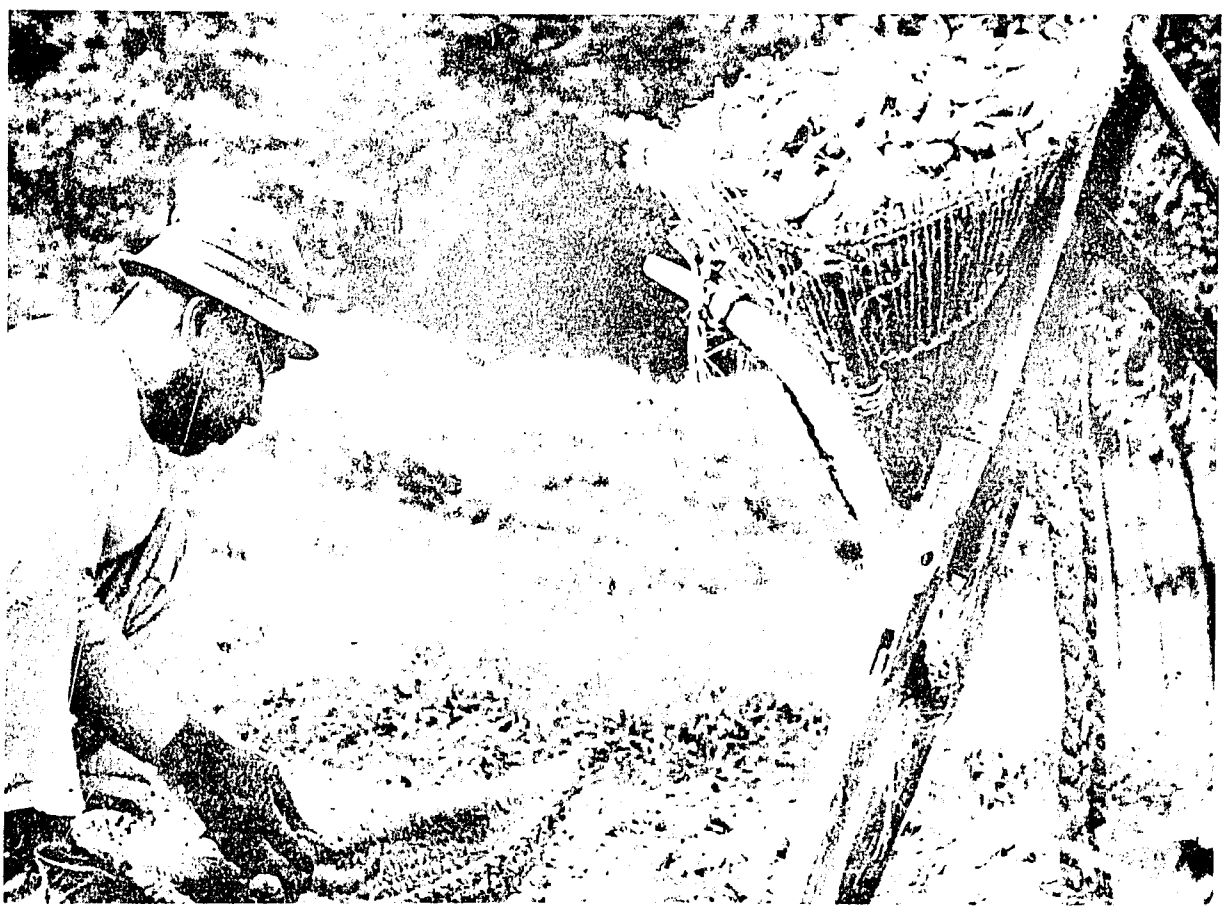

Fig. 1. A Korean farmer gathering his crop of sweet potatoes

Collecting and related activities

7. The history of global sweet potato distribution had some influence on the priorities that are assigned to collection activities. The area of northwest South America and the Mayan region of Central America has been attested as the origin of the species by independent research in cultivar variation and the role of wild species in cultigen formation. Thus initial concentration on Guatemala, Ecuador, Colombia and Peru for collection is proposed in order to preserve, as fully as possible, the germplasm of the cultigen species and the wild species that may further elucidate the biological origin of sweet potato and thereby contribute to future developments that may include interspecific hybridization in improvement programmes.

8. A second but none-the-less important priority is the varietal populations of sweet potato in the secondary centres of variation. The key regions are East Africa, the Philippines, China, Indonesia and Papua New Guinea. Effective collections are being made in some of these countries and their further development should be encouraged With the rapid post-Columbian adaptation of the crop in these areas, the possibilities of new variations arising from relatively restricted genepools (the original introductions) through mutation and genetic drift effects could provide useful breeding material in addition to the Central and South American collection.

9. The proposal for northwest South America and Central America consists of the following steps:

(i) make contact with the Ministries of Agriculture of Guatemala, Colombia, Ecuador and Peru to familiarize the appropriate officials and researchers with the objectives of this IBPGR project, and obtain not only their cooperation but also their participation commitment;

(ii) obtain information on the status of sweet potato (and wild relatives) collections in the countries concerned. When such collections exist, information is required on the varieties and sources of the material; and

(iii) where collecting is necessary, joint expeditions should be planned. As far as northwest South America is concerned, the broad ecological zones of the valleys of the altiplano, the coastal desert plain of Peru and the jungle selva should be collected. Probably the most important region for the project is the montana region, the interface between the altiplano and selva, in which diversity of both wild species and cultigens has been noted for Ecuador and Peru.

10. Collection of cultivated sweet potato would have first priority, followed by feral sweet potato and related species. For the geographic distribution of *Ipomoea* section *Batatas* and the taxonomic key to *Ipomoea* sp. please refer to Appendix III and IV respectively.

11. In view of the above points it is anticipated that a consultant must travel to Guatemala, Colombia, Ecuador and Peru in order to establish local contacts and make arrangements for collection trips into the more remote areas. Ideally this consultant should arrange a centre for vegetative collection in each of the four countries to be maintained temporarily where polycrosses can be made. Then true seed could be sent to the international repositories outlined in paras. 13 and 17. The above centres should be visited regularly to decide which material needs to be maintained clonally. This procedure will reduce to more manageable size the number of clonal lines needing meristem culture.

12. The IBPGR should encourage and coordinate the assembly of material for the international repositories from existing Asian and Pacific collections. In addition IITA should be requested to collect and assemble material from Africa.

13. True seed increases should be sent to IITA, to Fort Collins and to interested working collections. Clonal material should be forwarded to the Institute of Phytopathological Research (IPO), the Netherlands and to Glendale, USA to be freed of viruses by meristem culture technique prior to submission to the international repositories (for recommended repositories, see para. 17).

14. The eventual linkage of all the elements as discussed in paras. 7-13 will provide a worldwide representation of *Ipomoea batatas* and the wild relatives that will most likely contribute to future improvement programmes. The components of the collection would consist of:

(i) Seed Collection - forming a bank of sweet potato genes that may be drawn on a worldwide basis by plant breeders searching for genes outside of the range of their own material, e.g. resistances, and representing the full range within the species;

(ii) Clonal Materials - advanced (through breeding) and primitive cultivars that are gene combinations as more immediate breeding resources which have undergone the characterization and evaluation procedures described in Appendix V; and

(iii) Wild Species - held generally as seed and herbarium specimens as sources for further research in phylogeny of *I. batatas*, as well as the possible transfer of genes not present but desirable in the cultigen.

15. The overall effect would be the perpetuation of the variability of *I. batatas* at a time when the genetic base in highly developed countries is narrowing due to concentration on breeding specialized market types and while variation in developing countries may be eroded through economic development, i.e. the emphasis on industrialization and the de-emphasizing of subsistence farming in favour of more commercial forms. With the latter, the trend towards uniformity and bulk cropping can be predicted to follow a similar path - the effect of variation narrowing and consequently gene loss.

16. On the basis of the above discussion, the Meeting recommended that the IBPGR fund the following activities:

(i) a consultant to visit Peru, Colombia, Guatemala and Ecuador to explore the existing variability, to establish contacts with local authorities and to discuss the possibility of establishing temporary centres for vegetative collections in each of the four countries;

(ii) collecting activities in these four countries over a period of four years;

(iii) planting of the collected material in the country of collection, where polycrosses should be made to obtain true seed. A consultant should visit these centres regularly to discuss the selection of material which should be clonally maintained;

(iv) training of scientists from Ecuador, Peru, Guatemala, Colombia and Africa;

(v) collection of sweet potatoes in Asia and Africa should be encouraged by the IBPGR and existing collections should be duplicated in the international repositories; and

(vi) joint funding by the IBPGR, IITA and other organizations (such as U.S. Dept. of Agriculture, Science and Education Administration/Agricultural Research) should be encouraged.

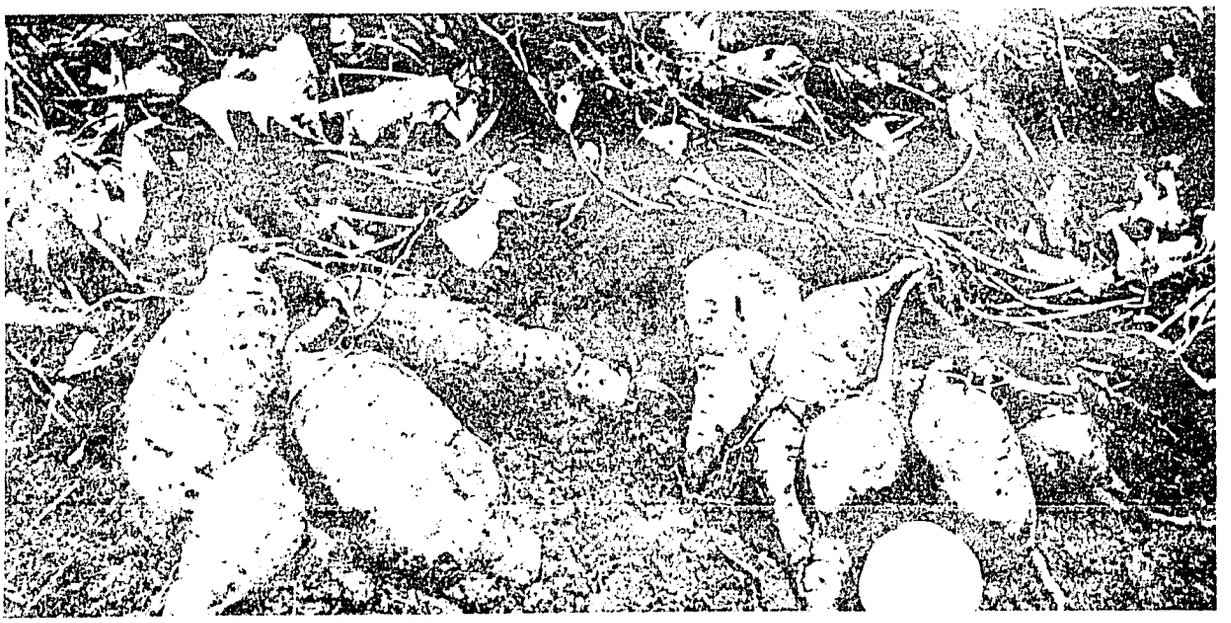

Fig. 2. Improved cultivars (photo by AVRDC)

Storage and maintenance

17. The Meeting recommended to the IBPGR to designate the following centres as global repositories:

(i) the International Institute for Tropical Agriculture (IITA), Nigeria (seed and clonal material);

(ii) the National Seed Storage Laboratory (NSSL), Fort Collins, Colorado, USA (seed); and

(iii) the USA clonal repository for sweet potato (still to be designated by U.S. authorities).

18. For storage and maintenance the following procedures should be followed:

(i) storage of seeds of sweet potato and its wild related species should be under standard conditions as recommended by the IBPGR. They can be expected to retain viability for at least 20 years;

(ii) standard seed regenetation procedures should be followed;

(iii) clonal plants should be meristem cultured by IPO (Institute for Phytopathological Research), the Netherlands and Glendale, USA to obtain virus-free material for exchange to users, and for the clonal repositories;

(iv) the clonal accessions should be grown in sufficiently large plots to retain cultivar integrity and to verify that plant characters correspond with the recorded descriptors as provided in Appendix V; and

(v) as techniques are improved, storage as plantlets in tissue culture may prove to be practical. In this respect it is recommended that research be stimulated.

Evaluation and documentation

19. For evaluation and documentation it is strongly recommended that the desciptor list as provided in Appendix V be used. The passport descriptors and any important observed character should be recorded by the collector(s). Characterization and preliminary evaluation should be undertaken by the temporary centres in Latin America, the active collections and the international clonal repositories.

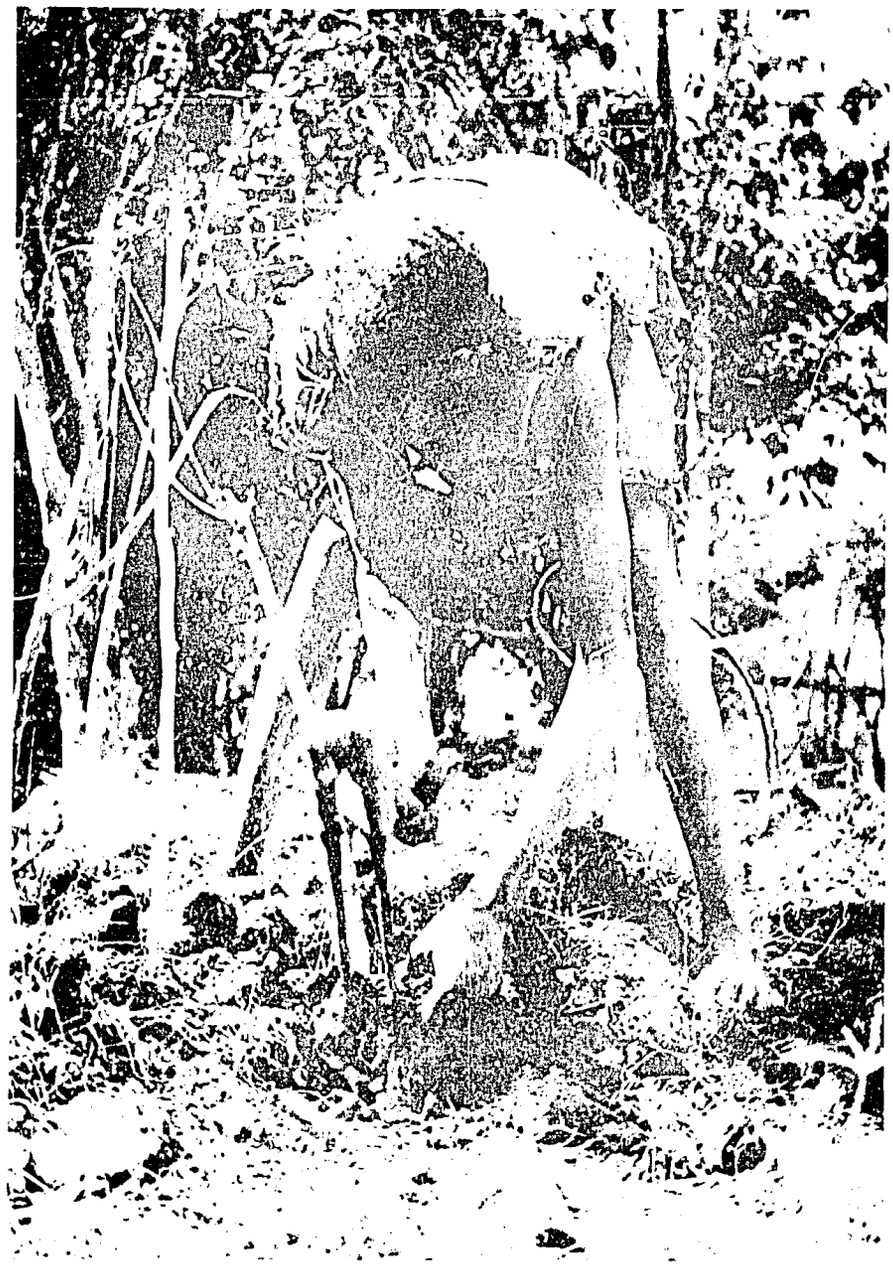

Fig. 3. A farmer in the highlands of Ethiopia digging sweet potato with a traditional double-pronged hoe

Quarantine

20. During the discussion reference was made to the IBPGR publication on "Plant Health and Quarantine in International Transfer of Genetic Resources". In the above publication a chapter is devoted to sweet potato 1/. Following is an updating of that information.

21. Most pathogens (fungal, bacterial and nematode) are detected by visual inspection at quarantine points of entry. However, one of the most persistant problems is the acquisition and maintenance of this material in a "healthy" state with respect to viruses. Many sweet potato disorders have been reported which have characteristics of diseases caused by viruses (e.g. virus-like symptoms, insect and graft transmissibility). These diseases result in a suppression of both yield and quality. Therefore, the effectiveness of sweet potato repositories will depend in part on a vigorous virus-indexing programme to prevent introduction and/or distribution of the viruses with the germplasm. Progress has been made only recently towards identifying sweet potato viruses, a requisite for establishing indexing procedures. Sweet potato feathery mottle virus (SPFMV) has recently been described and the agent partially characterized. In addition, strains of SPFMV have also been identified. Sweet potato mild mottle virus (SPMMV), a whitefly transmitted virus, has been described from Africa along with another aphid transmitted virus similar to SPFMV. Viruses, as well as mycoplasma-like diseases which are similarly transmitted, have been reported from virtually every region where sweet potatoes are grown. During recent isolations, a previously undescribed virus was discovered; in addition these viruses probably occur as complexes (Moyer, unpublished). Vegetatively propagated crops are frequently so completely infected with viruses that a healthy plant cannot be found. Meristem-tip culture has been used for many vegetatively propagated crops to free cultivars of known viruses and efforts have been made to eliminate viruses from sweet potato cultivars and breeding lines (for which healthy material is not available) using this technique. However, improved methods are needed. Factors such as regeneration time, predisposing factors, and percent healthy survivors, necessitate further investigation. In addition, it is known that passage through tissue culture techniques may lead to genetic variability in the resulting clones. Characters which tend to vary should be identified and external influences such as media on the phenomenon should be investigated. The establishment of sweet potato germplasm repositories will provide additional incentive for improvement of both virus-indexing and meristem-tip culture of sweet potatoes. It is advised that support be allocated for these two areas in the initial stages of development of the repository and that virus-indexing be a permanent part of the maintenance programme.

22. Worldwide there are thirty-six known species of insects and mites which are pests of sweet potato. These arthropods feed on the roots, seeds and vegetative plant parts as well as transmit important viruses. One important coleopteran problem of the sweet potato is a weevil which belongs to the genus *Cylas*. Species of this weevil present the greatest potential hazard in the transfer of germplasm as it is hidden and develops within the sweet potato root. Once established this weevil can spread almost 1.5 km per year under favourable conditions. Other potential root-feeding pests are flea beetle, wireworm, gruba, and *Diabrotica* species. There are

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1/ NIELSON, L.W. and TERRY, E.R. Sweet Potato (*Ipomoea batatas* L.). In Hewitt, W.B. & Chiarappa, L., eds. Plant Health and Quarantine in International Transfer of Genetic Resources. Cleveland, Ohio, CRC Press, 1977. p. 271-276

seed feeders which are bruchids that can multiply in storage to such high numbers that they completely destroy germplasm collections. The order homoptera represents foliage feeders such as aphids, leafhoppers and white flies which transmit viruses and mycoplasms. There is only cursory knowledge throughout most of the world of the arthropods associated with sweet potato plants grown in the field. Many of these arthropods are microscopic and cannot easily be detected when plants are collected and shipped to germplasm repositories. In reducing the pest risk potential from importation of germplasm it would be useful to:

(i) provide trained collectors at the site of origin who can eliminate many potential pest arthropods through visual observation and pesticide treatment; and

(ii) provide an effective quarantine programme that screens all exotic germplasm entering the country as well as the necessary procedures that exclude the contaminated material.

APPENDIX I

LIST OF PARTICIPANTS

Members of the Working Group

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APPENDIX II

AGENDA

1. Welcome - E.V. Wann

2. Need and reasons for a report on sweet potato genetic resources
   - John Bouwkamp, Philip Dukes and James Schalk

3. Review of major existing collections and identification of gaps in collections
   - sweet potato: Gilbert Lovell
   - species: Dan Austin

4. Consideration of general form of maintenance to be proposed (plants vs. tissue culture, true seed)
   - Jim Moyer and Alfred Jones

5. Site(s) to be designated by the IBPGR as major repositories; How many? Where? Why?
   - Quentin Jones

6. Quarantine problems affecting transfer of material
   - diseases: Jim Moyer
   - insects : James Schalk

7. Consideration of descriptors to be used to characterize accessions (A minimal list will be defined as the basis for documentation of collections and for use in exchange of samples)
   - sweet potato: John Bouwkamp
   - species: Dan Austin

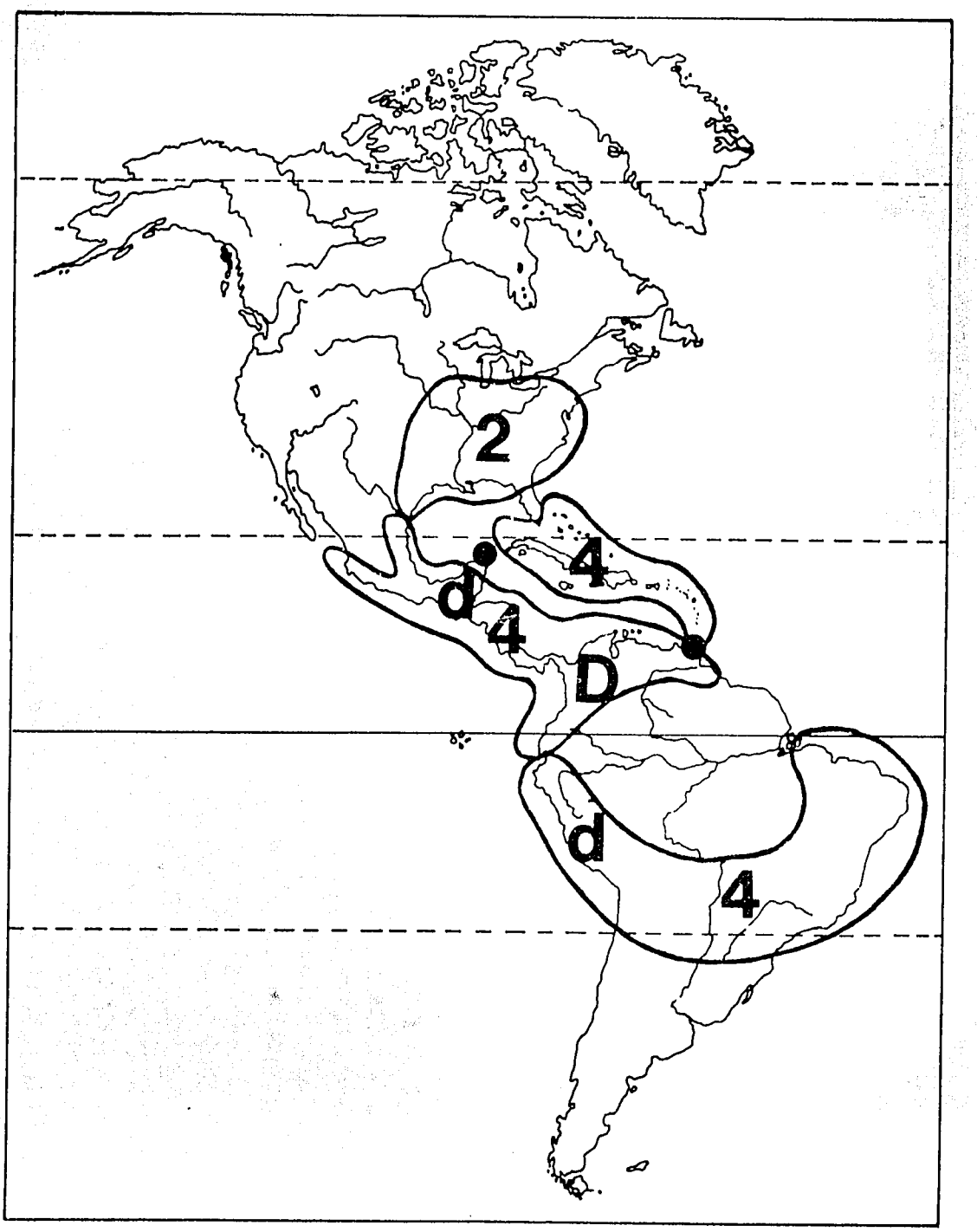
8. Identification of resources and expenditures (financing, manpower, etc)
   - Gilbert Lovell and Quentin Jones

9. Committee appointments and meetings to formulate recommendations of the various topics discussed
   - Alfred Jones

10. Summary recommendations to IBPGR (and to governments where necessary)
    - Alfred Jones

APPENDIX III

GEOGRAPHIC DISTRIBUTION *Ipomoea* SECTION *Batatas*



Composite geographic ranges of species allied with the sweet potato are mapped in the neotropical region. Four areas are recognized to have members of *Ipomoea* section *Batatas*, and within each of these are different species combinations. The three tropical subdivisions each contain four (4) taxa, while the temperate USA has two (2). Sweet potato probably originated somewhere between Yucatan and the mouth of the Orinoco River (black dots). Current knowledge of sweet potato suggests greatest variability (D) in northwest South America (Colombia, Ecuador and northern Peru), with secondary centres of high diversity in Guatemala (d) and southern Peru (d). (Data from a talk by D.F. Austin, 18th Annual Meeting of the Society for Economic Botany, June 1977).

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APPENDIX IV

KEY TO *Ipomoea* SPECIES[1/]

a. Outer sepals elliptic to obovate-mucronate, the apex acute to obtuse, mucronate to narrowly acuminate, with none or 1 large, raised central vein; sepals mostly cochleate, thin-membranaceous to chartaceous, glabrous to ciliate or pubescent with small, soft, appressed trichomes on back.

b. Outer two sepals obovate-mucronate.

c. Leaves distinctly thickened and fleshy even when dried, commonly lobed, occassionally subdentate; stamens pubescent on lower half; flowers 3.5-4.5 cm long ..... *I. littoralis* Blume

cc. Leaves thin and chartaceous, entire to trilobate; stamens pubescent only at base; flowers 1.3-2.5 cm long.

d. Leaves with uniformly distributed pubescence on the base, the trichomes less than 0.5 mm long, rarely glabrous; capsules ovoid, larger than the surrounding sepals; seeds 3.5-4 mm long; ovary and capsule usually hirsute at least on the apex..... ..... *I. cynanchifolia* Meisn.

dd. Leaves glabrous or with indument 0.8-1.5 mm long on the base or with short trichomes on the margins or on the nerves; capsules subglobose, depressed, not longer than the surrounding sepals; seeds 2.5-3 mm long; ovary and capsules glabrous ..... *I. ramosissima* (Poir.) Choisy

bb. Outer two sepals elliptic to ovate.

e. Outer two sepals markedly shorter than inner three; flowers 2.5-3 cm long; filaments pubescent only on base .... *I. trifida* (H.B.K.) Don

ee. Outer and inner sepals more or less the same length; flowers 3.5-4.5 cm long; filaments pubescent almost to apex ..... *I. tiliacea* (Willd.) Choisy

aa. Outer sepals lanceolate to oblong, the apex acuminate to obtuse-caudate, with 3 to 5 large, raised central veins; sepals rarely cochleate, sub-herbaceous, usually pubescent with large, stiff, suberect trichomes.

f. Corolla 2.5-7.0 cm long; lavender to purple-red (white in some cultivated forms of *I. batatas*).

g. Leaves sagittate, the basal lobes acute to acuminate; blades glabrous or pubescent.

h. Corolla 2.5-3.0 cm long; leaves usually evenly covered with trichomes on both surfaces; plants of S. Florida and the Greater Antilles ..... *I. tenuissima* Choisy

hh. Corolla 4.0-5.0 cm long; leaves glabrous or very sparsely covered with trichomes; plants known only from NE Australia ..... *I. gracilis* R. Br.

gg. Leaves cordate to 3-5 (-7) lobed, the base rounded; blades mostly glabrous.

i. Sepals oblong-caudate; corolla 4.0-7.0 cm long, campanulate-funnelform, abruptly enlarged at calyx summit, the lower half of the tube with almost parallel sides; stems fleshy and rooting at nodes in cultivated forms but not in some feral plants ..... *I. batatas* (L.) Lam.

ii. Sepals lanceolate-acuminate; corolla 2.8-5.5 cm long, funnelform, gradually enlarged at calyx summit, the lower half of the tube gradually increasing in diameter; stems not usually fleshy and rooting at nodes ..... *I. trichocarpa* Ell.

ff. Corolla 1.0-2.5 cm long; either white or lavender.

j. Sepals oblong-caudate, 5-6 mm long; corolla lavender, fruits 5-6 mm in diameter; tropical weeds found mostly on islands ..... *I. triloba* L.

jj. Sepals lanceolate-acuminate, (8-)10-13 mm long; corolla lavender or white; fruits 6-15 mm in diameter; temperate or subtropical mainland or island plants.

k. Corolla white (rarely rosy); sepals (8-)10-14 mm long; fruits 10-15 mm in diameter; temperate N. American plants ..... *I. lacunosa* L.

kk. Corolla lavender (rarely white); sepals 8-13 mm long; fruits 6-9 mm in diameter; widespread plants.

l. Sepals 8-11 mm long; plants of Brazil, Paraguay, Uruguay and Argentina .... *I.* X *grandifolia* (Dammer) O'Don.

ll. Sepals 10-13 mm long; plants of SE United States, Mexico, the Philippines, Hawaii, Columbia, Venezuela ..... *I.* X *leucantha* Jacq.

1/ By D.F. Austin

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APPENDIX V

DESCRIPTOR LIST FOR SWEET POTATO

The IBPGR now uses the following definitions in genetic resources documentation.

(i) passport data (accession identifiers and information recorded by collectors);

(ii) characterization (consists of recording those characters which are highly heritable, can be easily seen by the eye and are expressed in all environments);

(iii) preliminary evaluation (consists of recording a limited number of additional traits thought desirable by a consensus of users of the particular crop).

Characterization and preliminary evaluation will be the responsibility of the curators, while further evaluation should be carried out by the plant breeder. The data from further evaluation should be fed back to the curator who will maintain a data file.

Many descriptors which are continuously variable are recorded on a 1-9 scale. The authors of this list have sometimes described only a selection of the states, e.g. 3, 5 and 7 for such descriptors. Where this has occurred the full range of codes is available for use by extension of the codes given or by interpolation between them - e.g. MATURE LEAF SIZE (4.8) could also be coded as 1 Extremely small or 4 Small-to-medium.

The descriptor list for sweet potato specifies the growth stage in which certain descriptors should be recorded. The growth stages used are listed below:

1 Seedlings (from true seed)
2 Sprouts (from storage roots)
3 Vine cuttings
4 Established in field (beginning to grow)
5 Approximately 50% leaf canopy
6 Approximately 100% leaf canopy
7 One week to normal harvest
8 At harvest
9 Harvested roots

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APPENDIX V
(Continued)

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 when an accession is lost, its assigned number is still not available for re-use. Letters occur before the number to identify the genebank.

1.2 SCIENTIFIC NAME

1.2.1 Genus

1.2.2 Species

1.2.3 Subspecies

1.3 DATE OF LAST MULTIPLICATION OR REGENERATION

Year of last multiplication or regeneration

1.4 DONOR NAME

1.5 DONOR NUMBER

1.6 ANY OTHER NAMES OR NUMBERS ASSOCIATED WITH THE ACCESSION

E.g. USDA Plant Introduction number, common name etc.
(Not collection number, see 2.2)

1.7 TYPE OF MAINTENANCE

Advanced cultivars, primitive cultivars and breeding lines with valuable gene combinations should be maintained vegetatively

1 Vegetative
2 True seed
3 Both

1.8 REFERENCE TO PUBLICATIONS

2. COLLECTION DATA

2.1 COLLECTING INSTITUTE

Institute or person collecting the original sample

APPENDIX V
(Continued)

2.2 ORIGINAL NUMBER ASSIGNED BY COLLECTOR OF THE SAMPLE

2.3 DATE OF COLLECTION OF ORIGINAL SAMPLE

Expressed as day/month/year, e.g. 10 February 1981 as 100281

2.4 COUNTRY OF COLLECTION

Use the three letter abbreviations supported by the Statistical Office of the United Nations. Copies of these abbreviations are available from the IBPGR Secretariat

2.5 LATITUDE OF COLLECTION SITE

Degrees and minutes suffixed by N or S, e.g. 1030 S

2.6 LONGITUDE OF COLLECTION SITE

Degrees and minutes suffixed by E or W, e.g. 7625 W

2.7 LOCATION OF COLLECTION SITE

Number of kilometres and direction from nearest town, village or map reference point

2.8 ALTITUDE OF COLLECTION SITE

Elevation above sea level, in metres

2.9 COLLECTION SOURCE

1 Field
2 Market
3 Farm store
4 Agricultural institute

2.10 TYPE OF SAMPLE

1 Vegetative
2 True seed
3 Both

2.11 STATUS OF SAMPLE

1 Wild
2 Weedy
3 Breeders line
4 Primitive cultivar
5 Advanced cultivar

2.12 OTHER NOTES FROM COLLECTOR

Some collectors will record ecological and soil information, whether a cultivated crop was irrigated, season of sowing, topography of land, associated crops or wild plants, etc.

APPENDIX V
(Continued)

CHARACTERIZATION AND PRELIMINARY EVALUATION

3. GENERAL

3.1 SITE OF CHARACTERIZATION AND PRELIMINARY EVALUATION

3.2 YEAR OF CHARACTERIZATION AND PRELIMINARY EVALUATION

3.3 EVALUATOR(S) NAME AND ADDRESS

3.4 PLANTING DATE

Expressed as day/month/year, e.g. 5 March 1981 as 050381

3.5 HARVESTING DATE

Expressed as day/month/year, e.g. 10 September 1981 as 100981

4. CHARACTERIZATION	Growth stage
4.1 TWINING	5-7
0 Non-twining + Twining	
4.2 PLANT TYPE	5,6
3 Compact 7 Spreading	
4.3 VINE GROWTH RATE	5
3 Slow 5 Intermediate 7 Fast	
4.4 VINE INTERNODE LENGTH	6
3 Short 5 Intermediate 7 Long	
4.5 VINE PIGMENTATION	5-7
3 Green 5 Moderately purple 7 Purple	
4.6 VINE TIP PUBESCENCE	5-7
The apical ten centimetres of immature leaves	
0 None 3 Sparse 5 Moderate 7 Heavy	

APPENDIX V
(Continued)

		Growth stage
4.7	MATURE LEAF LOBING	7
	0 None	
	3 Slight	
	5 Moderate	
	7 Deep	
4.8	MATURE LEAF SIZE	7
	3 Small	
	5 Medium	
	7 Large	
4.9	MATURE LEAF COLOUR	5-7
	1 Yellow	
	2 Yellow-green	
	3 Green	
	4 Purplish-green	
	5 Purple	
4.10	IMMATURE LEAF COLOUR	5-7
	1 Yellow	
	2 Yellow-green	
	3 Green	
	4 Purplish-green	
	5 Purple	
4.11	ABAXIAL LEAF VEIN COLOUR	5-7
	1 Yellow	
	2 Green	
	3 Purple spotting	
	4 Half of main rib purple	
	5 Entire main rib purple	
	6 All veins purple	
4.12	PETIOLE LENGTH	6-7
	3 Short	
	5 Intermediate	
	7 Long	
4.13	PETIOLE PIGMENTATION	6-7
	1 Green	
	2 Moderately purple	
	3 Purple	
4.14	STORAGE ROOT SKIN COLOUR	8
	1 White	
	2 Yellow	
	3 Brown	
	4 Red	
	5 Purple	

APPENDIX V
(Continued)

	Growth stage
4.15 STORAGE ROOT SKIN COLOUR INTENSITY	8
3 Pale 5 Intermediate 7 Dark	
4.16 STORAGE ROOT FLESH COLOUR	8-9
1 White 2 Yellow 3 Orange 4 Purple	
4.17 STORAGE ROOT FLESH COLOUR INTENSITY	8-9
3 Pale 5 Intermediate 7 Dark	
4.18 FLOWERING HABIT	5,6
0 None 3 Sparse 5 Moderate 7 Profuse	
4.19 FLOWER COLOUR	5-7
1 White 2 White limb with purple throat 3 Purple 4 Other (specify)	
4.20 FLOWER LENGTH	5-7
Expressed in centimetres (see Fig. 1) Average of ten typical flowers	
4.21 FLOWER WIDTH	5-7
Expressed in centimetres (see Fig. 1) Average of ten typical flowers	
4.22 EQUALITY OF SEPAL LENGTH	5-7
1 Outer two shorter 2 Equal	
4.23 NUMBER OF SEPAL VEINS	5-7
1 0-1 2 2 3 3-5 4 >5	

		Growth stage
4.24	SEPAL SHAPE	5-7

See Fig. 2

1 Ovate
2 Elliptic
3 Obovate
4 Oblong
5 Lanceolate

4.25	SEPAL APEX	5-7

See Fig. 3

1 Acute
2 Obtuse
3 Acuminate
4 Caudate

4.26	SEED CAPSULE SET	6,7

0 None
3 Sparse
5 Moderate
7 Heavy

5. PRELIMINARY EVALUATION

The descriptors in this section should be recorded on commercial size storage roots

5.1	STORAGE ROOT LENGTH	8,9

Average length of ten storage roots in centimetres

5.2	STORAGE ROOT DIAMETER	8,9

Average of largest diameter of ten storage roots in centimetres

5.3	NUMBER OF STORAGE ROOTS PER PLANT	8,9

Average of ten plants (actual number)

5.4	STORAGE ROOT SHAPE VARIABILITY	8,9

1 Uniform
9 Highly variable

5.5	STORAGE ROOT SIZE VARIABILITY	8,9

1 Uniform
9 Highly variable

APPENDIX V
(Continued)

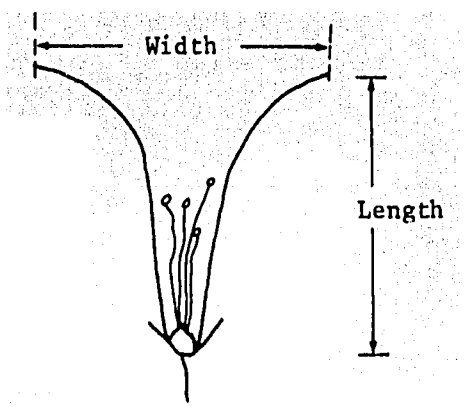

Figure 1. Flower Length and Width

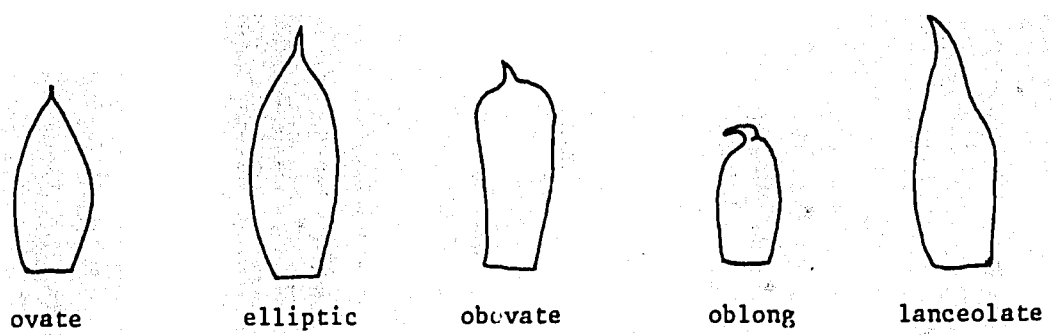

Figure 2. Sepal Shape

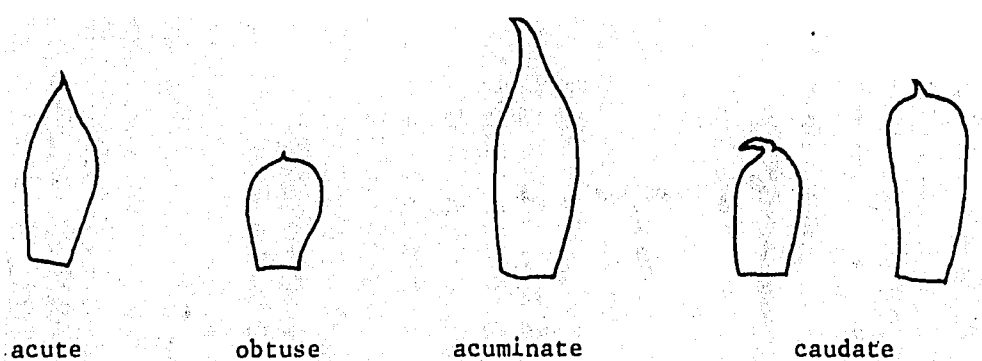

Figure 3. Sepal Apex

APPENDIX V
(Continued)

FURTHER EVALUATION

		Growth stage
6.	STORAGE ROOT DATA	
6.1	STORAGE ROOT DRY MATTER PERCENTAGE	9
6.2	STORAGE ROOT NITROGEN PERCENTAGE	9
6.3	STORAGE ROOT FIBRE PERCENTAGE	9
	American Official Analytical Chemistry on cooked roots of at least 3 cm diameter	
6.4	STORAGE ROOT STARCH PERCENTAGE	9
6.5	STORAGE ROOT WATER SOLUBLE SUGAR PERCENTAGE	9
6.6.	STORAGE ROOT CAROTENE CONTENT	9
	In milligramme per 100 g fresh weight	

6.7 KEEPING QUALITY OF STORAGE ROOTS

3 Poor
5 Medium
7 Good

6.8 SPROUTING ABILITY

3 Poor
5 Medium
7 Good

7. PEST REACTION

Coded on a 1-9 scale, where 3 = Resistant and 7 = Susceptible. Each pest needs a separate descriptor. The acronym of the institute supplying the information on a specific pest should be appended to the score of the pest reaction - e.g. if the International Institute of Tropical Agriculture scores an accession as Very Resistant to Tobacco wireworm then the code for descriptor 7.1.3 would be: 1 IITA

7.1 INSECT SUSCEPTIBILITY

7.1.1 Sweet potato weevil (*Cylas* spp.)

7.1.2 Southern potato wireworm (*Conoderus falli* Lan.)

7.1.3 Tobacco wireworm (*Conoderus vespertinus* Fabricius)

7.1.4 Wireworm (*Melanotus communis* Gyll)

7.1.5 Sweet potato flea beetle (*Chaetocnema confinis* Crotch.)

APPENDIX V
(Continued)

7.1.7 Spotted cucumber beetle (*Diabrotica undecimpunctata howardi* Barber)

7.1.8 Flea beetle (*Systena frontalis* Fabricius)

7.1.9 Pale-striped flea beetle (*Systena blanda* Melsheimer)

7.1.10 Elongate flea beetle (*Systena elongata* Fabricius)

7.1.11 Weevil (*Euscepes batatae* Waterhouse)

7.1.12 Grubworm (*Phyllophaga ephilida* Say)

7.1.13 Grubworm (*Plectris aliena* Chapin)

7.1.14 Other (specify)

8. DISEASE REACTION

Coded on a 1-9 scale

1 Immune
2 Resistant (Hypersensitive)
3 Resistant (High tolerance)
5 Resistant (Moderate tolerance)
7 Susceptible
9 Lethal

Each disease needs a separate descriptor. The acronym of the institute supplying the information on a specific disease should be appended to the score of the disease reaction - e.g. if the Asian Vegetable Research and Development Center scores an accession as Immune to Black Rot, then the code for descriptor 8.1.3. would be: 1 AVRDC

8.1 SUSCEPTIBILITY TO FUNGAL DISEASES

8.1.1 Fusarium Wilt or Stem Rot (*Fusarium oxysporum f. op. batatas* (Wr.) Synd. & Hans.)

8.1.2 Sclerotial Blight and Circular Spot (*Sclerotium rolfsii* Sacc.)

8.1.3 Black Rot (*Ceratocystis fimbriata* Ell. & Halst)

8.1.4 Surface Rot (Fusarium) (*Fusarium oxysporium* Schlect.)

8.1.5 Fusarium Root Rot (*Fusarium solani* (Mart.) Ap[illegible]l & Wr.)

8.1.6 Scurf (*Monilochaetes infuscans* Ell. & Halst. ex. Harter)

8.1.7 Soft Rot (*Rhizopus stolonifer* (Ehr. ex. Fr.) Lind.), other *Rhizopus* species

8.1.8 Java Black Rot (*Diplodia tubericola* (Ell. & Ev.) Taub.)

8.1.9 Diaporthe Dry Rot (*Diaporthe batatatis* Harter & Field)

APPENDIX V
(Continued)

8.1.10 Scab or Spot Anthracnose (*Elsinoë batatas* (Saw.) Viégas & Jenkins)

8.1.11 Phyllosticta Leaf Blight (*Phyllosticta batatas* (Thuem.) Cbe.)

8.1.12 Cercospora Leaf Spot (*Cercospora batatae* Zimm., other *Cercospora* species)

8.1.13 White Rust (*Albugo ipomoeae - panduratae* (Schw.) Swing.)

8.1.14 Foot Rot (*Plenodomus destruens* Harter)

8.1.15 Charcoal Rot (*Macrophomina phaseoli* (Maubl.) Ashby)

8.1.16 Septoria Leaf Spot (*Septoria bataticola* Taub.)

8.1.17 Other (specify)

8.2 SUSCEPTIBILITY TO BACTERIAL DISEASES

8.2.1 Pox or Soil Rot (*Streptomyces ipomoea* (Person & W.J. Martin) Waksm & Henrici)

8.2.2 Bacterial Stem and Root Rot (*Erwinia chrysanthemi* Dupes)

8.2.3 Other (specify)

8.3 SUSCEPTIBILITY TO VIRAL DISEASES

8.3.1 Feathery mottle - common strain

8.3.2 Feathery mottle - Russet crack strain

8.3.3 Feathery mottle - Internal cork strain

8.3.4 Mild mottle virus

8.3.5 Vein mottle virus

8.3.6 Sweet potato virus disease (SPVD complex)

8.3.7 Other (specify)

8.4 SUSCEPTIBILITY TO MYCOPLASMA DISEASES

8.4.1 Witches broom

8.4.2 Other (specify)

8.5 SUSCEPTIBILITY TO DISEASES CAUSED BY NEMATODES

8.5.1 Southern root-knot nematode (*Meloidogyne incognita* (Kofoid & White) Chitwood)

8.5.2 Javanese (Tropical) root-knot nematode (*Meloidogyne javanica* (Treub.) Chitwood)

APPENDIX V
(Continued)

8.5.3 Northern root-knot nematode (*Meloidogyne hapla* Chitwood)

8.5.4 Reniform nematode (*Rotylenchulus reniformis* Linford and Oliveira)

8.5.5 Sting nematode (*Belonolaimus longicaudatus* Rau)

8.5.6 Sting nematode (*B. gracilis* Steiner)

8.5.7 Brown Ring Rot (*Ditylenchus dipsaci* (Kühn) Filipjev)

8.5.8 Root lesion nematode (*Pratylenchus coffeae* (Zimmermann) Goodey)

8.5.9 Other (specify)