

Wild *Arachis* Genetic Resources at ICRISAT

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Abstract

The conservation of Arachis germplasm is an urgent need. ICRISAT has been designated as a major repository of Arachis germplasm, with the objectives of collection, maintenance and evaluation of the genetic resources, and the documentation and distribution of material and information.

Wild species of Arachis are acquired through transfer from known genetic resource centers in India and abroad, and also by collecting expeditions. The accessions which reproduce by seed are multiplied by growing in the field. Currently the pods are stored at 4° C with 35% relative humidity. Long-term storage facilities are being built. The rhizomatous accessions are maintained by growing rooted cuttings in concrete containers. A series of descriptors suitable for the evaluation of wild species of Arachis is being developed; meanwhile the groundnut descriptors developed by IBPGR and ICRISAT are being used.

At ICRISAT, wild species are screened against diseases and pests. Those species with resistance are being utilized in the Groundnut Improvement Program. Arachis germplasm is available free of charge to all scientists who wish to use it. The current status of wild Arachis germplasm and the future program are presented.

Résumé

Ressources génétiques des espèces sauvages du genre Arachis à l'ICRISAT. La conservation du germplasm d' Arachis constitue un problème urgent. L'ICRISAT a été désigné comme le principal dépositaire de ce patrimoine avec pour objectif la collecte, la conservation et l'évaluation des ressources génétiques, la documentation, la distribution de matériel végétal et la diffusion d'informations.

Les espèces sauvages d' Arachis proviennent de transferts de centres de ressources génétiques connus en Inde et ailleurs et de missions de prospections. Les introductions qui se reproduisent par graines sont multipliées par culture au champ. Les gousses sont stockées à 4° C et 35% d'humidité relative. Des installations sont en cours de construction pour le stockage à long terme. Les introductions à reproduction végétative sont maintenues par culture de boutures racinées dans des conteneurs de béton. Une série de descripteurs pour l'évaluation des espèces sauvages d' Arachis est en cours d'élaboration; en attendant, ce sont les 'descripteurs pour l'arachide' du CIRPG et de l'ICRISAT qui sont utilisés.

A l'ICRISAT les espèces sauvages sont criblées pour la résistance aux ravageurs et aux maladies. Les espèces résistantes sont utilisées dans le Programme d'amélioration de l'arachide. Tous les chercheurs le désirant peuvent avoir accès gratuitement aux ressources génétiques du genre Arachis. La situation actuelle et le programme futur concernant le germplasm des espèces sauvages du genre Arachis sont présentés.

Introduction

Genetic resources of any crop are the base for crop improvement, and the significance of genetic resources of groundnut is very well understood.

Arachis genetic resources include all the cultivars and related wild species. The latter are discussed in this paper. The genus *Arachis* L., which is native to South America, has presently 22 described species, including the cultivated groundnut. A hypo-

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gaea L. However, recent collecting expeditions in the center of diversity have indicated that there may be 40 or more undescribed annual or perennial species (Gregory et al. 1980). All these constitute a wealth of groundnut germplasm. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), designated as a major world repository of groundnut germplasm, started assembling wild *Arachis* species in 1976, an activity that has become more aggressive since the formation of the Genetic Resources Unit in 1979 (Rao 1980). The following account describes the present status of wild *Arachis* germplasm at ICRISAT.

Collection and Assembly

Arachis germplasm at ICRISAT is mainly being assembled, through correspondence and transfer from known genetic resource centers. Already a number of wild *Arachis* species have been obtained from Tamil Nadu Agricultural University, Coimbatore, and the University of Agricultural Sciences, Dharwad in India, and North Carolina State University, Raleigh, Texas A&M University, Stephenville, and the Agricultural Research Service-United States Department of Agriculture (ARS-USDA), Tifton in the USA. The assembly to date is presented in Table 1 by section and series.

Table 1. *Arachis* species at ICRISAT, October 1983.

Section Series	Ploidy level	Species	No of accessions
<i>Arachis</i>			
<i>Annuae</i>	2x	<i>A. batizocoi</i> Krap et Greg	1
		<i>A. duranensis</i> Krap et Greg nom nud	1
<i>Perennes</i>	2x	<i>A. correntina</i> (Burkart) Krap et Greg nom nud	5
		<i>A. chacoense</i> Krap et Greg nom nud	1
		<i>A. cardenasii</i> Krap et Greg nom nud	1
		<i>A. diogo</i> Hoehne	1
		<i>A. helodes</i> Mart ex Krap et Rig	3
		<i>A. stenosperma</i> Krap et Greg nom nud	1
		<i>A. villosa</i> Benth	1
		Unidentified	6
<i>Amphioides</i>	4x	<i>A. monticola</i> Krap et Rig	3
Unidentified			6
Interspecific hybrids			2
<i>Caulorhizae</i>	2x	<i>A. repens</i> Handro	2
<i>Erectoides</i>			
<i>Tetrafoliolatae</i>	2x	<i>A. paraguayensis</i> Chod et Hassl.	1
		<i>A. apressipila</i> Krap et Greg nom nud	1
Unidentified			1
<i>Procumbensae</i>	2x	<i>A. rigonii</i> Krap et Greg	2
Unidentified			15
<i>Extranervosae</i>	2x	<i>A. villosulicarpa</i> Hoehne	2
<i>Rhizomatosae</i>			
<i>Prorhizomatosae</i>	2x	<i>A. burkartii</i> Handro	1
<i>Eurhizomatosae</i>	4x	<i>A. glabrata</i> Benth	13
		<i>A. hagenbeckii</i> Harms.	4
		Unidentified	28
Unidentified			32
<i>Triseminalae</i>	2x	<i>A. pusilla</i> Benth	1
Unidentified			46

Table 2. *Arachis* germplasm collected in expeditions involving ICRISAT scientists during 1982-83

State	Section	Species	No of accessions		Remarks
			As seeds or plants	Herbarium only	
Wild	<i>Erectoides</i>	<i>Arachis</i> species	1		<i>A. benthamii</i> Handro?
Wild	<i>Caulorhizae</i>	<i>A. repens</i> Handro		1	
Wild	<i>Rhizomatosae</i>	<i>A. glabrata</i> Benth		1	
Wild	<i>Rhizomatosae</i>	<i>A. burkartii</i> Handro	12	2	
Wild	<i>Extranervosae</i>	<i>A. lutescens</i> Krap et Rig	1		
Wild	<i>Extranervosae</i>	<i>A. prostrata</i> Benth	2	2	
Wild	<i>Extranervosae</i>	<i>A. burchellii</i> Krap et Greg nom nud	18	3	
Wild	<i>Extranervosae</i>	<i>A. sylvestris</i> Krap et Greg nom nud	2	1	
Wild	<i>Extranervosae</i>	<i>A. marginata</i> Gard	2		
Wild	<i>Extranervosae</i>	<i>Arachis</i> species	10		Close to <i>A. prostrata</i> Benth and <i>A. burchellii</i> Krap et Greg nom nud
Wild	<i>Ambinervosae</i>	<i>Arachis</i> species	1		New species?
Wild	<i>Arachis</i>	<i>Arachis</i> species	2		New species?
Wild	<i>Arachis</i>	<i>A. stenosperma</i> Krap et Greg nom nud	4		
Cultivated	<i>Arachis</i>	<i>A. hypogaea</i> L	22		Includes ten market samples

following Gregory et al. (1980). It must be noted that most of the names used are nomina nuda, since these have yet to be validly published (Stalker 1985).

ICRISAT scientists have participated in two collection expeditions which were jointly organized by ICRISAT and Centro Nacional de Recursos Genéticos (CENARGEN) of the Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Brazil in collaboration with the International Board for Plant Genetic Resources (IBPGR). The first expedition, in February-March, 1982, followed the Brasília-Belem road, with lateral diversions. The second, during May 1983, was from Curitiba to the east of Parana, São Paulo and Rio de Janeiro States. Details of the material collected are given in Table 2. These expeditions gave us first-hand information on the natural habitats of *Arachis* species, an estimate of the variability in the populations of some species, and an indication of the pest and disease situation at the center of origin of the genus. Collected material will come to ICRISAT via Texas A&M University.

All the material introduced to ICRISAT undergoes strict quarantine inspection by the Central Plant Protection Training Institute (CPPTI), Rajendranagar on behalf of the Government of India. Material that is exchanged as vegetative cuttings passes through the University of Reading, UK.

Seed material is first grown at CPPTI and then at ICRISAT and the resulting plants are examined through maturity jointly by a team of CPPTI and ICRISAT scientists to make sure that no pests and diseases are introduced.

Maintenance and Storage

The seed-producing wild species are space-planted in sandy soil on the ICRISAT farm. Seeds are germinated in small paper cups and then transferred to the field. The plants are protected from pests as and when necessary. Harvesting involves digging and sifting soil from around the plants in large sieves to collect the small pods. The pods are then dried and stored. Presently the wild species accessions are stored as unshelled pods in airtight plastic containers in our medium-term cold storage facility at 4°C and 35% relative humidity. They will be transferred to long-term storage (-18°C) when the facility becomes available.

The rhizomatous and non seed-producing accessions are maintained live in concrete rings to prevent contamination. Rejuvenation is carried out by rooting stem cuttings and rhizomes. Efforts are underway to prepare herbarium specimens, which will serve as voucher specimens, of all the available accessions.

Evaluation and Utilization

Wild *Arachis* species are considered important sources of many economically-important characters. A large number of new accessions and species have been collected in recent years, and are now becoming available at ICRISAT. This material has yet to be properly identified, described, and evaluated. Descriptors which were developed mainly for the cultivated groundnut (IBPGR and ICRISAT 1981), are presently used for morphological evaluation of wild *Arachis* species. However, we feel that these are inadequate to describe the wild species and efforts are in progress to develop and incorporate additional descriptors which will be more diagnostic.

Screening for various desirable attributes in the cultivated and wild groundnut germplasm accessions has been carried out at ICRISAT. ICRISAT pathologists and entomologists have screened wild species against important diseases and pests (Subrahmanyam et al. 1985; Amin 1985) and a number of species have shown immunity or high degrees of resistance to various diseases and pests.

Utilization of this valuable germplasm has already begun in our Groundnut Improvement Program. Resistances to diseases and pests, available in the species belonging to section *Arachis* are being exploited by ICRISAT cytogeneticists. It is possible that wild species may have different resistance mechanisms from those of *A. hypogaea*. This may help to broaden the genetic base and to develop stable resistance in the cultivated groundnut.

Documentation

Most of the passport and preliminary evaluation data on *Arachis* species have been computerized. Some of the storage information is also available on computer.

Distribution

Worldwide distribution of germplasm accessions to interested scientists is an important objective of the ICRISAT Genetic Resources Unit. At present the demand for wild species is not high; 62 samples have been distributed within India, and 16 abroad. However, as more information on the desirable attributes of wild species and the techniques for

successful interspecific hybridization, and transfer of desirable traits become available, we expect the demands to increase.

Future outlook

Accession of new material to the ICRISAT gene bank will continue. More material is to be collected in South America, since it is estimated that only about 60% of the wild species germplasm available there has so far been collected (Simpson 1982). We plan to participate in collection expeditions in collaboration with CENARGEN/EMBRAPA and IBPGR.

Rejuvenation and seed multiplication will be more streamlined. More information on dormancy and viability of wild species seed will be obtained. When the long-term storage facility becomes available, material presently in medium-term storage will be transferred.

Emphasis will be given to evaluation of wild species for various desirable attributes. We have been concentrating solely on resistance to major diseases and pests, but other characters such as oil content and quality, drought tolerance, and yield will also be evaluated.

Additional descriptors for wild species will be developed and incorporated in the Groundnut Descriptors, and documentation will be improved to facilitate exchange of information, and distribution of germplasm to interested scientists will increase.

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