NPGS

National Plant Germplasm System

Nineteenth Meeting Report
January 9, 2007

Sunflower Crop Germplasm Committee

SUNFLOWER CROP GERMPLASM COMMITTEE MEMBERS (2007)

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The Sunflower Crop Germplasm Committee (CGC) met for the nineteenth time on January 9, 2007, at Fargo, ND. Committee members present were: Gerald Seiler, USDA-ARS, Fargo, ND (Chair); Tom Gulya, USDA-ARS, Fargo, ND (Vice Chair); Larry Charlet, USDA-ARS, Fargo, ND; Charlie Block, USDA-ARS, Ames, IA; Kathy Grady, SDSU, Brookings, SD; Florin Stoenescu, Advanta NA, Fargo, ND; Jim Gerdes, Mycogen Seeds, Breckenridge, MN; Pat Duhigg, Seeds 2000, Breckenridge, MN; Rob Aiken, KSU, Colby, KS; Laura Marek, ISU, Ames, IA (Ex-Officio, Curator); and Khalid Rashid, Agric. & Agri-Food Canada, Morden, MB (Ex-Officio). Observers present were: Brady Vick, USDA-ARS, Fargo, ND; and Irvin Larsen, USDA-ARS, Ames, IA.

AGENDA

1. Nomination and Election of New Committee Members

Nominations were accepted from the Committee members to fill several positions expiring in 2007, and 2008. Members elected for the 2007-2010 term were: Dr. Charlie Block, USDA-ARS, Ames, IA; Dr. Pat Duhigg, Seeds 2000, Breckenridge, MN; and Dr. David Baltensperger, Texas A & M, College Station, TX. Members elected for the 2008-2011 term were: Dr. Larry Charlet, USDA-ARS, Fargo, ND; Dr. Jim Gerdes, Mycogen Seeds, Breckenridge, MN; and Dr. Rob Aiken, Kansas State University, Colby, KS. The Committee would like to thank those members who have served terms and those who have agreed to serve additional terms as members of the Sunflower CGC.

2. Sunflower Evaluation

Disease Evaluation: Dr. Tom Gulya USDA-ARS, Fargo, ND updated the Committee on the progress of disease evaluation of cultivated and wild accessions (**APPENDIX 1**). Few cultivated accessions have been evaluated since 2005 due to the low number of new accessions. When sufficient new accessions become available, they will be evaluated for downy mildew and rust races, Sclerotinia stalk and head rot, and Phomopsis stem canker.

Dr. Gulya has evaluated all accessions (available in 2005) of annual *Helianthus* species (excluding wild *H. annuus*) in greenhouse trials with three separate races of downy mildew, with the most resistant accessions tested with the most virulent phenotype designated as 777. Resistance to race 777 was found in 15 of the 17 species examined. *Helianthus argophyllus* and *H*. *debilis* ssp. *debilis* and ssp. *cucumerifolius* had the most resistant accessions. Twelve accessions had >90% of the plants immune to race 777, and two accessions had all plants immune.

All currently available accessions of annual *Helianthus* species (333) are being tested in the greenhouse for resistance to the most virulent race of rust, designated 777. As of January, 2007, 215 accessions have been evaluated. As noted for downy mildew evaluations, *Helianthus argophyllus* and subspecies of *H*. *debilis* display the highest rust resistance, as well as some accessions of *H*. *exilis*.

In conjunction with Dr. Charlie Block, USDA-ARS, Ames, IA, Dr. Tom Gulya is developing a Sclerotinia stalk rot greenhouse test for evaluating wild annual *Helianthus* accessions funded by the USDA-ARS Sclerotinia Initiative.

Insect Evaluation: Dr. Larry Charlet, USDA-ARS, Fargo, ND briefly reported on the screening of interspecific and PI accessions for resistance to stem and seed insect pests in

the northern and central Great Plains. This is a cooperative effort between Dr. Rob Aiken, KSU, Colby, KS, Dr. Kathy Grady, SDSU, Brookings, SD, and Drs. Jerry Miller and Gerald Seiler, USDA-ARS, Fargo, ND. Encouraging progress is being made in the search for resistance to the stem weevil, sunflower head moth, seed weevil, and banded sunflower moth.

Oil and Oil Quality Evaluation: Dr. Gerald Seiler evaluated 138 accessions of wild species for oil content and fatty acid composition. These represent the accessions collected in the recent explorations. This data is being entered into the GRIN database.

The Committee would like to thank all the cooperators who have provided evaluation data for the many descriptors. Dr. Laura Marek, Curator, coordinates the transfer of the data into GRIN. The GRIN database for sunflower has one of the highest frequencies of descriptors per accession of any crop in the GRIN system.

3. Curator's Report with Status of the Sunflower Collection

Dr. Laura Fredrick Marek has been Oilseeds Curator since February 23, 2004. Dr. Marek presented a report on the sunflower collection **(APPENDIX 2)**. In 2005, 43 *Helianthus annuus* cultivated accessions were regenerated. Thirty wild annual *Helianthus* accessions and 146 wild perennial accessions were caged and seed harvested. One hundred forty-six wild perennial accessions were caged, with 68 newly established populations and 78 which had been established in the field prior to 2005. Dr. Marek harvested distributable seed from 132 accessions. In 2006, 44 *Helianthus annuus* cultivated accessions were regenerated. The 2006 harvest has been threshed and is in process of being cleaned before being stored at which time accessions with enough seed will become available through GRIN. Thirty-five wild annual *Helianthus* accessions were caged and seed harvested from 31 accessions. In 2006, 130 perennial accessions were caged, 56 of which were previously established field populations. The 74 new accessions represented 68% of the attempted wild perennials. Sufficient seed was harvested from 82 accessions.

Since the last CGC meeting in January, 2005, 160 *Helianthus* accessions (138 wild *Helianthus* accessions and 22 cultivated accessions) have been received and logged into National Plant Germplasm Systems' (NPGS) Germplasm Resources Information Network (GRIN) database.

Dr. Marek reported that in 2005, 67 requests were made from international and domestic sources for cultivated sunflower germplasm, which was distributed to 46 recipients, and in 2006, 56 requests were distributed to 44 recipients. The 2,103 seed packets represented 1,135 unique accessions. In 2005, 61 requests were made from international and domestic sources for wild *Helianthus* germplasm, which was distributed to 46 recipients, and in 2006, 53 requests were distributed to 48 recipients. The distributions represented 2,128 packets of 1431 unique accessions. The five-year trend in *Helianthus* germplasm requests shows a relatively constant demand for cultivated germplasm with the exception of 2005 when EMBRAPA, Brazil requested all available germplasm. There has been an increase of about 20% in wild germplasm distribution during the last five years. The number of requestors of wild germplasm also increased about 20% during that time period.

Observations of plant and seed characters are recorded during the regeneration process and loaded into GRIN. The NCRPIS oilseeds project is in the final stages of standardizing

image file names and protocols. Sunflower seed, plant and flower image loading will begin early in 2007.

For a number of years the NPGS has been looking for an alternate regeneration location for difficult-to-regenerate accessions. Dr. Marek has been working with NPGS Parlier, CA personnel to increase taxa that require longer growing seasons than are reliably obtained in Ames as well as for cold-sensitive wild *Helianthus* taxa. The Parlier location has 40 sunflower cages, purchased by NCRPIS, and can grow up to 40 sunflower accessions per year. The association with the Parlier group has evolved into a very successful program. In 2005, the following protocol was implemented: Seeds are germinated in Ames and live seedlings are shipped to Parlier, to be received no later than the first week of April. The Parlier staff transplant seedlings and manage plant growth. As in Ames, plots are caged before blooming, pollinator insects are introduced during flowering, and plants are harvested as seed heads mature. Seed heads are shipped to Ames for threshing and processing. In 2005, seedlings for 18 accessions were sent to Parlier. Two accessions were represented by fewer than ten low-quality seedlings and these did not survive transplant. Eleven perennial populations established in 2004 were re-screened in 2005. Twenty-seven accessions were harvested with seed available from 25 for distribution. No 2005 populations were carried over to 2006. In 2006, seedlings were sent for 31 accessions all of which were successfully harvested. The 2006 harvested material arrived in Ames on January 4, 2007 and is being processed. Accession availability will be dependent of amount and quality of the seed. Through mid-November 2006, the program at Parlier was curated by Dr. Maria Jenderek with the primary assistance of Jerry Serimian. Dr. Jenderek has moved to a position at the National Center for Genetic Resources Preservation in Ft Collins, CO. Mr. Serimian remains associated with Parlier and will continue the sunflower increase program. Parlier is under the umbrella of the NPGS Pullman, WA location. The Pullman Research Leader position is in the process of being filled following the retirement of Dr. Rich Hannan in 2006. After a new research leader is established in Pullman, the Parlier curator position will be addressed.

The Committee **strongly supports the activities** of the Parlier site and hopes that cooperation with this location will help alleviate the backlog of sunflower accessions waiting to be regenerated because of specific requirements not being able to be met at the present regeneration site at Ames.

The Committee had a discussion about requiring requestors to provide more feedback about the use and usefulness of the requested germplasm. There was a concern that the accessions distributed to various researchers who do not provide feedback should have some obligation to provide at least minimal information about the performance of the requested accessions. The Committee strongly urges the NCRPIS to become more proactive in this area and to implement a survey mechanism when distributing germplasm to monitor its use to provide more information about the germplasm for the general user community.

FUTURE PLANS: Dr. Marek has made significant progress towards the long-term goal of making all *Helianthus* maintenance groups at least 90% available and having accessions

available for all *Helianthus* taxa represented in the NPGS collection. Currently 89% have at least one available accession (55 of 64), an increase of 34% over the previous reporting period. An additional long-term goal is to make accessions available for all *Helianthus* taxa and to have broad geographical/ecological representation of all taxa.

As a means to assess the genetic diversity within the collection and as a tool to determine if additional collection for specific taxa is warranted, Dr. Marek intends to begin molecular profiling of specific segments of the *Helianthus* collection during the next reporting period. Ideally, these analyses would intersect work being done with marker-assisted selection. She expects the work to be managed both in house and in partnership with other research groups. Dr. Marek would appreciate receiving input from the Committee in formulating research questions and strategies to address genetic characterization/profiling of the *Helianthus* collection.

4. Status of *Helianthus* germplasm— Vulnerability, Needs, and Recommendations

The Committee discussed the status of sunflower germplasm in the US and crop vulnerability. A crop vulnerability statement has been produced as requested by the National Plant Recovery System mandated by the Department of Homeland Security. The Secretary of Agriculture in cooperation with other federal departments and agencies was directed to accelerate and expand development of current and new countermeasures against the international introduction or natural occurrence of catastrophic animal, plant, or zoonotic diseases. A copy of the updated sunflower status, vulnerability, needs and recommendations report is included in **APPENDIX 3**.

5. Status of the National Plant Resources Laboratory, including the Plant Exploration Office and the Germplasm Resources Network (GRIN) System

A report was provided by the National Plant Resources Laboratory outlining their recent activities. The Plant Exploration Office (PEO) report can be found in **APPENDIX 4.** The activities of the Data Management Unit (GRIN) can be found in **APPENDIX 5.**

The PEO supports the collection of germplasm for the NPGS through the management of a Plant Exploration and Exchange Grant Program. Plant explorations involve field collection of germplasm not available in any germplasm collections, while plant exchanges are expeditions to arrange exchange of germplasm already conserved in foreign genebanks. In 2005, PEO assisted with the distribution of 35,590 items to 60 countries. PEO also assisted with importing 81 shipments containing 3,105 items from 34 countries. In 2005 PEO funded 14 plant explorations (two for sunflower) and in 2006, 13 explorations were funded with one sunflower exploration.

The mission of the Database Management Unit (DBMU) is to develop and maintain information systems for the National Genetics Resources Program comprising plants, animals, microbes, and invertebrates. Over 80,000 taxonomic names (including synonyms), 470,946 accessions representing 11,839 species and 1,916 genera, 1,543,563 inventory

records, 1,235,671 germination records, 6,313,140 characteristics /evaluation records, and over 106,000 images are in the GRIN system, the database management system for this information.

In September of 2005, the program review for Genetic Resources began its second cycle with a stakeholders meeting held near Baltimore. Two major issues regarding GRIN were identified including: 1) GRIN needs to handle molecular data being generated on NPGS accessions and needs to interact better with the plant genome databases, and 2) The GRIN public web interface and software need to be rewritten in order to meet users needs. To address these issues a subcommittee of NPGS curators has been developed to advise us on how to incorporate molecular data into GRIN. They have already laid out the structures that need to be added to GRIN and the DBMU has begun to create the new tables and software to manage and display the data to the user community.

6. CGC Chairs Meeting

The tenth biennial CGC Chairs meeting was held June 6-8, 2006 at Ames, IA. Numerous topics relating to the NPGS and genetic resources management were discussed. These included an overview of the National Plant Germplasm System, roles and expectations of CGC Committees, funding and germplasm evaluation and exploration, assessment of NPGS acquisition needs and priorities, phytosanitary certificates, international issues impacting access to and exchange of germplasm, and intellectual property rights issues relative to USDA Genetic Resources collections.

7. Sunflower Explorations and Future Needs

The NPGS Plant Exchange Office (PEO) sponsored one collection trip in 2006 to the southeast **(APPENDIX 6).** The PEO sponsored two trips in 2005, southwestern AZ and southeastern CA (**APPENDIX 7**), and Colorado/Wyoming (**APPENDIX 8**), plus there were two independently funded trips that year as well (WA/OR; northern CA, NV) **(APPENDIX 9).** The five trips encompassed the eleven states of Arizona, California, Nevada, Washington, Oregon, Colorado, Wyoming, Florida, Georgia, Alabama, and Mississippi, over 33 days, and covered 9,100 miles.

Drs. Tom Gulya, Gerald Seiler, and Laura Marek made three PEO-sponsored and two other trips during the past two years and, with the additional aid of some other researchers, succeeded in adding a total of 115 accessions of 14 species to the wild *Helianthus* germplasm collection. Specifically, the following numbers of accessions were added: *H. annuus* (2), *H. argophyllus* (1), *H. carnosus* (1), *H. cusickii* (18), *H. debilis* ssp. *cucumerifolius* (1), *H. deserticola* (13), *H. floridanus* (2), *H. longifolius* (2), *H. nuttallii* (1), *H. niveus* ssp. *canescens* (4), *H. niveus* ssp. *tephrodes* (5), *H. pumilus* (47), *H. resinosus* (13), and *H. smithii* (3). Two additional accessions are in the process of being identified to species.

There are three ongoing nonformal collection activities coordinated by Dr. Tom Gulya. **(APPENDIX 10).** These activities are related to the collection of seeds from species that

have a low seed set and require multiple collections to obtain enough seed for distribution.

More details about each trip follow can be found in the respective trip reports available from the authors or the Plant Exchange Office.

Future Plans:

An additional long-term goal is to make accessions available for all *Helianthus* taxa and to have broad geographical/ecological representation of all taxa. This strategy is expected to capture maximum genetic diversity. Four taxa are not represented in the NPGS collection (*H. niveus* ssp. *niveus*, *H. laciniatus*, *H. nuttallii* ssp. *parishii* and *H.* x*multiflorus*) with an additional seven taxa having no accessions for distribution. Five taxa are represented by fewer than five populations. Principal issues associated with achieving full representation of the genetic diversity of *Helianthus* in the collection are the continued funding of germplasm collection trips, availability of critical personnel, and the success of negotiations with Mexico to allow the collection and unencumbered distribution of any collected germplasm (*H. niveus* ssp *niveu*s is endemic to Baja California, Mexico). Two of the un-represented taxa may not be collectible from the wild: *H. nuttallii* ssp. *parishii* is likely extinct and *H. xmultiflorus* is a sterile triploid represented only by cultivated forms propagated by vegetative means.

There are two proposals pending at the PEO for *Helianthus* collection trips in 2007: a trip to Australia to collect naturalized introduced wild taxa and a trip to the southwest to collect *H. laciniatus*, *H. ciliaris*, and *H. arizonensis* (**APPEMDIX 11)**. A proposal will be submited to the PEO to sponsor a collecting trip in 2008; target species will depend in part on the outcome of the 2007 collection proposals. Specific disease issues suggest targeting specific taxa such as *H. resinosus*, which has been suggested to have resistance to *Sclerotinia*. *Helianthus resinosus* grows in at least six states in the SE; collections of populations in MS and AL were made in 2006. Additional populations reported in coastal and central SC and into NC are a possible target for a 2008 trip.

8. Location and Date of Next Meeting

The CGC Committee is scheduled to hold a biennial meeting in conjunction with the winter meeting of the National Sunflower Association in January 2008. An interim meeting could be held between the scheduled meetings if it is deemed necessary.

APPENDIX 1

Disease Evaluation Activities on Wild and Cultivated Sunflowers 2005 – 2007

Tom Gulya and Scott Radi
Sunflower Research Unit
USDA-ARS Northern Crop Science Lab

1. *Downy mildew:* All accessions (available in 2005) of annual *Helianthus* species (excluding *H*. *annuus*) were tested in greenhouse trials with three separate races of downy mildew, and the most resistant ones tested with a mixture yielding the most virulent phenotype available, designated as "777." Resistance to the mixture of downy mildew races was found in 15 of the 17 species examined. *Helianthus argophyllus* and *H. debilis* ssp*. debilis a*nd ssp. *cucumerifolius* were the species with the most resistant accessions. Twelve accessions had >90% plants immune to the 777 downy mildew mixture, and two accessions had all plants immune. Results are summarized at: *http://www.sunflowernsa.com/research/research-workshop/documents/Gulya_WildHelianthus_studies_05.pdf*

2. *Rust:* All currently available accessions (333) of annual *Helianthus* species are being tested in greenhouse trials for resistance to the most virulent race of rust (*Puccinia helianthi*), designated as race 777. As of January, 2007, 215 accessions have been evaluated, and the remainder will be done by late February, 2007. As noted in downy mildew evaluations, *H. argophyllus* and several subspecies of *H. debilis* display the highest rust resistance, as well as some accessions of *H. exilis.*

3. *Sclerotinia greenhouse test*: Being done in conjunction with Charlie Block, the PI on a USDA Sclerotinia Initiative grant whose main objective is to (1) develop a greenhouse inoculation/evaluation method, and (2) to begin evaluations on wild annual *Helianthus* accessions.

APPENDIX 2

REPORT TO THE SUNFLOWER CGC

From the North Central Regional Plant Introduction Station, USDA-ARS/Iowa State University, Ames, IA

For the period: January 1, 2005 -- December 31, 2006

Submitted by: Dr. Laura Fredrick Marek, Curator III

January 9, 2007

Personnel

The oilseeds collection at the NCRPIS is managed by Dr. Laura Marek with the assistance of Mr. Irvin Larsen and Dr. Barbara Bingaman. Dr. Marek has responsibility for *Helianthus* accessions held at NCRPIS as well as Brassicaceae, *Cuphea*, *Linum*, *Euphorbia* and a group of miscellaneous Asteraceae accessions.

The Collection

Acquisitions:

Since the last CGC meeting in January 2005, 160 *Helianthus* accessions (138 wild *Helianthus* accessions and 22 cultivated accessions) have been received at the NCRPIS. New accessions are described in detail in Table 1. The new accessions have been entered into the National Plant Germplasm System's (NPGS) Germplasm Resources Information Network (GRIN) database.

Regeneration and Maintenance:

The current status of the *Helianthus* collection is summarized in Table 2A. The "available accession numbers" do not reflect the Ames and Parlier 2006 harvests which are still being processed (we expect ~70 newly available accessions). The 2006 new collections have been accessioned and are reflected in the "number of accessions" data but they have not been inventoried and those that will become available are not reflected in the "available accession numbers" (~16 newly available). For comparison, Table 2B describes the status of the collection at the time of the last CGC meeting (January 2005). Collection availability has increased in all categories; overall availability of the collection increased 13%. The absolute number of accessions reflects increases in accession numbers from new collections and decreases due to inactivations. Increased availability is due both to new collections and successful increases in Ames and Parlier.

I am working to eliminate all inviable accessions from the collection. In 2006, 327 *Helianthus* accessions were inactivated. These accessions included five *H. annuus* cultivars or cultivated accessions, wild annual (190), primarily wild *H. annuus* (136) and wild perennial (132) accessions. An accession was inactivated if it had one or no seeds or if it had fewer than 10 seeds and more than one failed germination attempt. At least 97% of the inactivated accessions were collected in the 1970s or early to mid-1980s and had never been successfully increased. Over the next two cycles of increase attempts, we should identify and inactivate most of the remaining inviable accessions.

In 2005, we regenerated 43 *Helianthus annuus* cultivated accessions. All but two of the increases generated enough seed to allow distribution of the accessions. We established and caged 30 wild annual *Helianthus* accessions and harvested distributable seed from 28. We caged 146 wild perennial accessions, 68 newly established populations and 78 that had been established in the field prior to 2005. We harvested distributable seed from 132 accessions. The 68 new accessions represented 65% of the attempted wild perennials.

In 2006 we regenerated 44 *Helianthus annuus* cultivated accessions. The 2006 harvest has been threshed and is in process of being cleaned before being stored at which time accessions with enough seed will become available through GRIN. We caged 35 wild annual *Helianthus* accessions and harvested seed from 31 accessions. We caged 130 perennial accessions in 2006, 56 of which were previously established field populations. The 74 new accessions represented 68% of the attempted wild perennials. We harvested distributable seed from 82 accessions. Twenty *H. tuberosus* accessions established in the field mid-season, flowered well but the seed was infested with larvae and not salvageable. Earlier caging possibly combined with pesticide treatment should eliminate the infestation problem in 2007.

Four cultivated accessions that did not set seed under Ames field conditions were grown in the greenhouse during winter 2004-2005. Two of these increases produced enough seed to allow distribution. 2006-2007 winter greenhouse regenerations of three accessions are in progress. We increase three to six cultivated accessions in the greenhouse each winter season, as space allows.

Our focus on making 90% or more of the wild *Helianthus* germplasm available for distribution has some challenges. Increases had never been attempted for most wild accessions; 65% of the original perennial seed and 85% of the original wild annual seed has been stored for 19 years or longer. We have found that an extended cold pre-treatment (six weeks or longer) of the imbibing seed before a warm incubation improves germination as does clipping the non-embryo end of the seed. One of our biggest challenges is controlling the growth of various pathogens that are associated with the seed after imbibition. An initial rinse of the seed with dilute hydrogen peroxide followed by periodic rinsing with cool, running tap water and transfer to clean germination paper is helpful for many accessions.

Alternate increase location (Parlier, CA):

We are working with NPGS Parlier personnel to increase of taxa that require longer growing seasons than are reliably obtained in Ames as well as cold sensitive wild *Helianthus* taxa. The Parlier location has 40 sunflower cages, purchased by NCRPIS, and can grow up to 40 sunflower accessions per year. Our association with the Parlier group has evolved into a very successful program. In 2005 we implemented the following protocol: Seeds are germinated in Ames and live seedlings are shipped to Parlier, to be received no later than the first week of April. The Parlier staff transplant seedlings and manage plant growth. As in Ames, plots are caged before blooming, pollinator insects are introduced during flowering, and plants are harvested as seed heads mature. Seed heads are shipped to Ames for threshing and processing.

In 2005, we sent Parlier seedlings for 18 accessions. Two accessions were represented by fewer

than ten low quality seedlings and these did not survive transplant. Eleven perennial populations established in 2004 were re-screened in 2005. We received harvest from 27 accessions of which 25 became available for distribution. No 2005 populations were carried over to 2006. In 2006 we sent seedlings for 31 accessions all of which were successfully harvested. The 2006 harvested material arrived in Ames on January 4, 2007 and is being processed. Accession availability will be dependent of amount and quality of the seed.

The Parlier group records basic field data (date transplanted, date of first flowering, dates of harvest) but they do not have the staff to record descriptor data (for example: ray and disc flower color, plant height, branching status, others) or to take images. Because some accessions represent taxa which we never see growing in Ames, it is important that these observation data be captured. In October 2006, Mr. Larsen and I traveled to Parlier to take images and record descriptor information; this will be an annual effort.

Through mid-November 2006, the program at Parlier was curated by Dr. Maria Jenderek with the primary assistance of Jerry Serimian. Dr. Jenderek has moved to a position at the National Center for Genetic Resources Preservation in Ft Collins, CO. Mr. Serimian remains associated with Parlier and will continue the sunflower increase program. Parlier is under the umbrella of the NPGS Pullman, WA location. The Pullman Research Leader position is in the process of being filled following the retirement of Dr. Rich Hannan in 2006. After a new research leader is established in Pullman, the Parlier curator position will be addressed.

Distribution:

2005 and 2006 distributions are detailed in Table 3.

The five-year trend in *Helianthus* germplasm requests shows a relatively constant demand for cultivated germplasm with the exception of 2005 when EMBRAPA, Brazil requested all available germplasm. There has been an increase of about 20% in wild germplasm distribution during the last five years. The number of requestors of wild germplasm also increased about 20% during that time period.

Characterization:

Observations of plant and seed characters are recorded during the regeneration process and loaded into GRIN. The NCRPIS oilseeds project is in the final stages of standardizing image file names and protocols. Sunflower seed, plant and flower image loading will begin early in 2007.

Evaluation and research uses:

Helianthus accessions were distributed during the current reporting period for evaluation of resistance to sunflower moth, banded sunflower moth, stem weevil, red sunflower seed weevil, multiple races of rust, downy mildew, Verticillium, and the Sclerotinia disease complex. Accessions were also sent to co-operators to study salt and drought tolerance, to screen for Orobanche resistance and to use in phytoremediation research. Other accessions were requested to study the genetics of flowering time and photoperiod regulation. Several research groups requested accessions to

investigate biomass production and allocation. One project requested accessions to use for the study of the efficacy of fumigants to kill weed seeds in grain shipments to Australia.

Future plans

Acquisitions:

We have made progress towards our long term goal of making all *Helianthus* maintenance groups (see Table 1) at least 90% available and having accessions available for all *Helianthus* taxa represented in the NPGS collection. Currently 89% have at least one available accession (55 of 64), an increase of 34% over the previous reporting period. An additional long-term goal is to make accessions available for all *Helianthus* taxa and to have broad geographical/ecological representation of all taxa. This strategy is expected to capture maximum genetic diversity. Four taxa are not represented in the NPGS collection (*H. niveus* ssp. *niveus*, *H. laciniatus*, *H. nuttallii* ssp. *parishii* and *H.* x*multiflorus*) and an additional seven taxa have no distributable accessions. Five taxa are represented by fewer than five populations. Principal issues associated with achieving full representation of the genetic diversity of *Helianthus* in the collection are the continued funding of germplasm collection trips, availability of critical personnel, and the success of negotiations with Mexico to allow the collection and unencumbered distribution of any collected germplasm (*H. niveus* ssp. *niveu*s is endemic to Baja California, Mexico). Two of the un-represented taxa may not be wild collectible: *H. nuttallii* ssp *parishii* is likely extinct and *H.* x*multiflorus* is a sterile triploid represented only by cultivated forms propagated by vegetative means.

Helianthus is being actively collected. The NPGS Plant Exchange Office (PEO) sponsored one collection trip in 2006 to the southeast US. The PEO sponsored two trips in 2005 (southwestern AZ/southeastern CA and Colorado/Wyoming), and there were two independently funded trips that year as well (WA/OR; northern CA, NV). There are two proposals pending at the PEO for *Helianthus* collection trips in 2007: a trip to Australia to collect naturalized introduced wild taxa and a trip to the southwest to collect *H. laciniatus*, *H. ciliaris* and *H. arizonensis*. I will submit a proposal to the PEO to sponsor a collecting trip in 2008, target species will depend in part on the outcome of the 2007 collection proposals. Specific disease issues suggest targeting specific taxa such as *H. resinosus*, which has been suggested to have resistance to *Sclerotinia*. *H. resinosus* grows in at least six states in the SE; collections of populations in MS and AL were made in 2006. Additional populations reported in coastal and central SC and into NC are a possible target for a 2008 trip.

The goal of recent collection trips has been to obtain enough seed from collected populations to make the accessions available without increase whenever possible. This strategy works well for domestic distributions. However, *Helianthus* seed sent to most international locations requires disease and/or infestation declarations that are only possible to meet if the seeds are derived from an increase at the NCRPIS or a similarly controlled site. Therefore, to be able to make wild accessions available to the international community, we must continue with an aggressive increase strategy.

Regeneration and Maintenance:

A primary goal is to complete the inactivation of all inviable accessions. As discussed above, this should be mostly completed during the next reporting period. With inviable accessions eliminated, I will begin working towards the secondary goal of converting all Ames numbered accessions to PI numbers. I should make significant progress towards fulfilling this goal during the next reporting period.

Characterization:

As a means to assess the genetic diversity within the collection and as a tool to determine if additional collection for specific taxa is warranted, we intend to begin molecular profiling of specific segments of the *Helianthus* collection during the next reporting period. Ideally, these analyses would intersect work being done with marker-assisted selection. We expect the work to be managed both in house and in partnership with other research groups. I would appreciate receiving input from this group in formulating research questions and strategies to address genetic characterization/profiling of the *Helianthus* collection.

Table 1. New *Helianthus* accessions received at the NCRPIS since January 1, 2005.

year	donor or collector*	source	species	# of accessions
2005	JM, TG	ND	*H. annuus* , cultivated	3
	JM, TG, BV	ND	*H. annuus* , cultivated	6
	CB	IA	*H. annuus* , wild, developed	2
	LFM, GS, TG	CA	*H. niveus* ssp. *tephrodes*	5
	LFM, GS, TG	AZ	*H. niveus* ssp. *canescens*	3
	LFM, GS, TG	AZ	*H. niveus*	1
	LFM, GS, TG	CA, WY	*H. annuus* , wild	2
	LFM, GS, TG	CO	*H. nuttallii* ssp *nuttallii*	1
	LFM, GS, TG	CO, WY	*H. pumilus*	45
	CE	CO	*H. pumilus*	1
	MD, RD	CO	*H. pumilus*	2
	LFM, JMc	WA,OR	*H. cusickii*	9
	TG, KG	NV, CA	*H. cusickii*	9
	TG, KG	NV	*H. deserticola*	6
	DT	NV	*H. deserticola*	7
	CP, DTh	FL	*H. carnosus*	1
	(LFM)	(IA)	*H. petiolaris* ssp *petiolaris* **	1
2006	JM	ND	*H. annuus* , cultivated	12
	PH-B	IA	*H. annuus* , cultivated	1
	LFM, IL	CA	*H. annuus* , wild	2
	LFM, GS, TG	GA	*H. floridanus*	2
	LFM, GS, TG	AL, GA	*H. longifolius*	2
	LFM, GS, TG	AL, MS	*H. resinosus*	11
	LFM, GS, TG	AL	*H. smithii*	3
	LFM, GS, TG	GA, MS	*H. sp*	2
	LFM, GS, TG	GA	*H. debilis* ssp *cucumerifolius*	1
	RS	AL	*H. longifolius*	1
	CP, CC	FL	*H. carnosus*	1
	RG, OPGC	OH	*H. divaricatus*	3
	RG, OPGC	OH	*H. giganteus*	2
	DB	OH	*H. giganteus*	1
	DB	OH	*H. grosseserratus*	1
	DB	OH	*H. hirsutus*	1
	RG, OPGC	OH	*H. hirsutus*	2
	DB	OH	*H. microcephalus*	1
	DB	OH	*H. mollis*	1
	GM	OH	*H. mollis*	1
	RG, OPGC	OH	*H. occidentalis* ssp *occidentalis*	2
	RG, OPGC	OH	*H. sp*	1
	RG, OPGC	OH	*H. strumosus*	1
	DB	OH	*H. strumosus*	1

*JM = Jerry Miller TG = Thomas Gulya BV = Brady Vick CB = Charlie Block LFM = Laura Fredrick Marek
GS = Gerald Seiler CE = Carol English MD = Mark Dahmer RD = Rachel Dahmer JMc = Joe-Ann McCoy
KG = Katy Gulya DT = Dean Tonenna CP = Cheryl Peterson DTh = Debi Tharp PH-B = Pioneer Hi-Bred
IL = Irv Larsen RS = Robert Stack CC = Cindy Campbell RG = Rick Gardner OPGE = Ohio Plant
Germplasm Center staff: Susan Stieve, Jennifer Ehrengerger, Art Wells, Eric Renze, and David Tay
DB = Don Beam GM = Gordon Mitchell

**This accession was a separation from PI 506446, Levisticum officinale, collected as a market sample in Kishinev, Moldova in 1986. When the sample was grown out for increase, 19 sunflower plants germinated in addition to the lovage. The sunflower accession was increased and field identified during summer 2006.

Table 2A. Status of the *Helianthus* germplasm collection, December 31, 2006. New collections have been accessioned but not inventoried. 2006 increases have also not been inventoried; therefore, neither is reflected in the available accession data.

		available accessions		accessions duplicated at NCGRP**		accessions with PI numbers	
maintenance group	# of accessions	#	%	#	%	#	%
cultivated (includes 51 CSR)	1687	1532	91	1607	95	1091	65
wild *H. annuus**	874	841	96	842	96	792	91
wild non-*H. annuus* annual*	427	329	77	347	81	339	79
wild perennial*	739	370	50	396	54	421	57
wild, misc	10	5	50	5	50	5	50
total collection	3737	3076	84	3114	85	2567	70

*There are 23 wild annual taxa and 43 wild perennial taxa.
**NCGRP = National Center for Genetic Resources Preservation, Ft. Collins, CO

Table 2B. Status of the *Helianthus* germplasm collection, December 31, 2004.

		available accessions		accessions duplicated at NCGRP**		accessions with PI numbers	
maintenance group	# of accessions	#	%	#	%	#	%
cultivated (includes 74 CSR)	1681	1493	89	1575	94	1068	62
wild *H. annuus**	1005	826	82	827	82	830	83
wild non-*H. annuus* annual*	444	292	66	307	69	365	82
wild perennial*	749	148	20	234	31	488	60
wild, misc	24	12	50	13	54	15	63
total collection	3903	2771	71	2956	76	2766	71

*There are 23 wild annual taxa and 43 wild perennial taxa.
**NCGRP = National Center for Genetic Resources Preservation, Ft. Collins, CO

Table 3. Distributions of *Helianthus* germplasm, 2005 and 2006.

	cultivated				wild annual including *H. annuus*				wild perennial			
year	seed packets	unique accns	# of orders	# of requesters	seed packets	unique accns	# of orders	# of requesters	seed packets	unique accns	# of orders	# of requesters
2005	1635	789	62	46	799	626	40	30	257	157	21	16
2006	468	346	56	44	921	565	35	32	151	83	18	16

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1-2007

REPORT ON THE STATUS OF SUNFLOWER GERMPLASM IN THE U.S.

Sunflower is one of the four most important annual oilseed crops grown for edible oil. It is also the second largest hybrid crop grown in the world. US production in 2003 was estimated at 2.4 million acres with an estimated total economic impact of $1.8 billion. The ultimate goal of the entire sunflower germplasm effort is the enhancement and development of superior germplasm for the producer to ensure a continued and viable industry.

PRESENT GERMPLASM ACTIVITIES

The North Central Regional Plant Introduction Station, Ames, Iowa has the responsibility for the maintenance and distribution of the sunflower germplasm collection. Evaluation of the collection is being conducted by the Plant Introduction Station, the Agricultural Research Service (ARS), State Universities/Experiment Stations, and various cooperators around the world depending on the expertise and environments needed to evaluate various characteristics.

STATUS OF CROP VULNERABILITY

Sunflower hybrids grown in the U.S. are based on a single male-sterile cytoplasm derived from wild *Helianthus petiolaris,* which makes them extremely vulnerable to many insect and disease pests. One of the potential threats to the sunflower crop could be the introduction of new races of pathogens. Rust (*Puccinia helianthi*), and downy mildew (*Plasmopara halstedii*) are pathogens that have evolved with the crop in the US. New races are continually evolving in the US and other countries, so the impact of the introduction of new races from outside of the US is unknown, but would be expected to be just as destructive and to have similar infection mechanisms resulting in the destruction of plants. Broomrape [*Orobanche cumana* (*cernua*)] is a parasitic weed that attacks sunflower in parts of Europe and Asia. This would probably be one of the greatest potential threats to the US sunflower crop. The parasite has been present in other parts of the world for a number of decades, but has not been found in the US. Its impact on the US sunflower industry is unknown. The parasite is of concern, but at the present time we do not understand the infection mechanism and why it is not present in the US. There have not been any extraordinary precautions taken to prevent this parasite from being introduced into the US. The seeds are very small (almost like dust) and could easily be transported with many different types of seeds traded in commerce. Other species of *Orobanche* exist in the US, but do not attack sunflower. Albugo rust (white rust) is another pathogen which has existed in sunflower production areas, especially in South America, Australia, and South Africa, but has not been a problem in the US. It occurs on wild *Helianthus* species in the US. These could be a potential source of genes for resistance.

The possibility exists that genetically modified organisms (GMOs) with negative human health effects could be released that could potentially contaminate sunflower production fields. This would most likely be in the area of allergens, which generally have an effect on a selected portion of the human population. GMOs with various traits from other species could also be a potential threat to the sunflower crop.

In a more general sense, weedy species of plants could be introduced as invasive weeds which could overcome native species in agricultural systems. On a global basis, there are probably herbicides that would control most weeds. As with the pathogens, insects evolved with the wild and cultivated sunflower crop in the US. This has resulted in large pest complex for the cultivated sunflower crop in the US. There are very few countries outside of the US that have severe insect

problems. The likelihood that insects could be introduced into the US exists, but it is unlikely they would have a significant impact since we already have the major sunflower insect pests.

The diversity of the wild species is an invaluable resource for genes to protect the cultivated crop. Since most of the wild species are native to US, destruction of the many populations spread all over the US is highly unlikely. The present gene bank contains a good representation of the available genetic diversity. However, many of the accessions have not been evaluated for specific traits, but could be mobilized with a substantial effort. Several interspecific and elite germplasms are available from USDA-ARS sunflower projects as the need arises. The use of biotechnology to move genes from other species into sunflower could be another source of germplasm to protect the crop against various pests. Use of the OX-OX gene from cereals to improve *Sclerotinia* tolerance, incorporation of antifungal proteins for resistance to the major diseases, and the use of BT or similar genes for insect protection are a few examples.

STATUS OF CROP SECURITY

The sunflower germplasm collections, both cultivated and wild species, represent a wealth of genetic diversity for improving and protecting the cultivated sunflower. With heightened awareness of security threats, the germplasm in the gene banks and at other locations is restricted in access and protected.

GERMPLASM NEEDS: COLLECTION

Sunflower is unique in that it is one of the four crop species which has its progenitor species native to the US. The genus *Helianthus* contains 51 species and 15 subspecies which offer genetic diversity for many agronomic characteristics for the improvement and expansion of cultivated sunflower. The present germplasm collection is representative of all extant species and subspecies, but does not come close to adequately representing the potentially available genetic diversity that needs to be conserved. Continued efforts are needed to strive toward collecting as many populations of all species as are feasible. Since Mexico has not been systematically collected, this area represents a wealth of genetic variation and should be collected as soon as possible. Due to the persistent *Sclerotinia* disease complex, emphasis will be put on collecting selected perennial species in the US. Herbicide resistance, especially to the imidazolinone chemistry, is more prevalent in the wild *H. annuus* populations than previously thought. Collection of wild *H. annuus* and screening to currently used herbicides (particularly triazine and glyphosate chemistry) could have a major impact on the sunflower industry. With the advent of several glyphosate-resistant crops, the potential for resistance of wild sunflower species to these herbicide chemistries increases. Collection of wild annual species from these areas may be a source of useful herbicide tolerance genes in the future.

GERMPLASM NEEDS: MAINTENANCE

The seed multiplication program is the most valuable link of the *Helianthus* germplasm program. There is a critical need to regenerate and replenish wild *Helianthus* seed stocks. The number of accessions waiting to be regenerated is large. Until accessions are regenerated, this produces a bottleneck in the evaluation process. Due to the large number of wild perennial accessions waiting to be regenerated, and the difficulty in obtaining an adequate number of plants for regeneration, in situ conservation should be considered as a maintenance option.

GERMPLASM NEEDS: EVALUATION

An evaluation plan for disease and insect pests listing priorities for evaluation is in place. Evaluation information obtained to date has been a valuable addition to the GRIN system in characterizing the value of germplasm accessions. There is a continuing need to evaluate more accessions as pest races change and to evaluate additional species populations and accessions. Priority descriptors of the accessions of the wild species continue to be collected in an effort to make the information available in the GRIN system. There is a particular need for additional funds

to evaluate the wild perennial species for *Sclerotinia* stem and stalk rots, and to screen wild species for *Rhizopus* head rot resistance, a persistent and increasing problem in the High Plains. Evaluation of wild species for glyphosate resistance could provide a potential source of herbicide tolerance genes. Also, the wild species have not been systematically screened for tocopherol content and concentration.

GERMPLASM NEEDS: ENHANCEMENT

Increasing genetic variability of cultivated sunflower is critical for ensuring survival of the crop. An enhancement plan is in place for the inclusion of wild *Helianthus* species into a domesticated background utilizing embryo rescue and other techniques. The plan includes interspecific gene transfer, germplasm pool development, and development of cytoplasmic male-sterility and fertility restoration programs. Based on current needs, crossing wild perennial species into the cultivated background is necessary since many of the perennial species have shown promise as potential sources of genes for resistance to some of the persistent pests. There is a critical need to utilize the molecular characterization techniques available to facilitate the difficult task of transferring genes from the wild perennial species into cultivated sunflower. There is a need to apply molecular characterization techniques, such as molecular profiling, to assessments of the genetic diversity in the sunflower collection both within and between accessions and taxa. The information obtained would have two applications: first, it will allow us to determine need for additional collection of specific taxa and secondly, identification of maximum diversity would be used to select material that should be moved into the germplasm enhancement program for cultivated sunflower. Germplasm enhancement applications would intersect with work being done to identify specific trait-associated markers in the marker-assisted selection program.

RECOMMENDATIONS

The priority needs and actions for the *Helianthus* germplasm collection are as follows:

1. Fund an exploration to explore the wealth of genetic variability in the wild species of the US and continue to explore opportunities to collect wild species in Mexico.

2. Provide funding to the Plant Introduction Station to build a greenhouse complex to increase the number of accession regenerations that require special conditions.

7. Provide $100,000 of permanent funding for evaluation of wild annual and perennial species, interspecific, and exotic germplasm for resistance to diseases such as *Rhizopus* head rot and *Sclerotinia* and insect resistance.

8. Provide $100,000 of permanent funding for molecular evaluation of wild sunflower germplasm to generate information to better assess diversity and need for collection and to determine sources of genetic variability for improvement of cultivated sunflower.

9. The Committee strongly supports the activities of the NPGS site at Parlier, CA as an alternate grow-out site and encourages the continued cooperation utilizing it as an alternate site for difficult-to-regenerate sunflower accessions.

6. The Committee recommends exploring the opportunity and the possibilities of integrating existing databases into one “unified” database. Of particular interest are the bioinformatics databases, and how and if they could be interfaced with the GRIN database.

APPENDIX 4

NGRL/PEO Report to PGOC, RTACs and CGCs 2006

The National Germplasm Resources Laboratory (NGRL), located in the Plant Sciences Institute at the Henry A. Wallace Agricultural Research Center in Beltsville, MD, supports the acquisition, introduction, documentation, evaluation, and distribution of germplasm by the National Plant Germplasm System (NPGS) and other components of the U.S. National Genetic Resources Program (NGRP). The Laboratory is comprises the Germplasm Resources Information Network/Database Management Unit (GRIN/DBMU), the Plant Exchange Office (PEO) and the Plant Disease Research Unit (PDRU) whose functions and procedures are provided below. The Laboratory also facilitates the activities of the Crop Germplasm Committees that advise components of the NPGS on a variety of matters.

Plant Exploration and Exchange Program

The PEO supports the collection of germplasm for the NPGS through the management of a Plant Exploration and Exchange Grant Program. Plant explorations involve field collection of germplasm not available in any germplasm collections, while plant exchanges are expeditions to arrange exchange of germplasm already conserved in foreign genebanks. Annual guidelines for developing plant exploration and exchange proposals are prepared by the PEO and distributed to researchers.

An extensive review procedure is used to assess the relevance of the proposals to the NPGS needs and the likelihood that the proposed explorations or exchanges will accomplish their stated objectives. Before submission, proposals are reviewed by the appropriate CGC or other crop experts. After submission to the PEO, proposals are reviewed by a subcommittee of the NPGS Plant Germplasm Operations Committee (PGOC). The PEO then evaluates the proposals and the PGOC reviews and makes recommendations on funding to the ARS National Program Staff (NPS).

All foreign explorations supported by PEO comply with the provisions of the Convention on Biological Diversity on access and benefit sharing related to genetic resources. Prior informed consent to collect genetic resources is obtained from the appropriate host country authorities before the exploration takes place. The permission includes agreement on the benefits to the host country associated with access to genetic resources. The PEO is involved in most requests to foreign governments for permission for collecting and negotiates the terms of agreements when necessary. Foreign explorations are always conducted in cooperation with scientists from the host country and cooperation with the national genetic resources programs is strongly encouraged. Germplasm obtained on explorations is shared by the NPGS and the host country.

(Attachments: FY 05 and 06 Plant Explorations and Exchanges)

Facilitation of Germplasm Exchange

The PEO assists NPGS personnel and other scientists in acquiring germplasm from scientists and private citizens, foreign national and international genebanks, domestic and foreign explorations, and special projects and agreements. The PEO also helps to expedite the distribution of germplasm from the NPGS to scientists and other genebanks.

In FY 05, PEO assisted with the distribution of 35,590 items to 60 countries. PEO also assisted with importing 81 shipments containing 3,105 items from 34 countries.

PI Documentation

Since 1898, Plant Introduction (PI) numbers have been used as unique identifiers for accessions incorporated into the NPGS. In earlier times, PI numbers were automatically assigned to all material received by the Plant Introduction Office, a predecessor of the PEO. Currently, before PI numbers are assigned, NPGS curators first evaluate the passport data, and grow and observe new accessions to verify uniqueness and rationale for preservation in the NPGS. For this reason, curators usually assign a local identifying number to an accession until a decision is made to assign a PI number. When a decision is reached to assign a PI number to an accession, the curators are now requested to contact Mark Bohning for assignment of the next sequential number(s).

In addition, ARS and the Crop Science Society of America (CSSA) have an agreement that all released cultivars, germplasm, parental lines, genetic stocks, and genetic mapping populations registered by the CSSA be preserved in the NPGS and assigned a PI number.

The NGRL also assigns PI numbers to plants that have received Plant Variety Protection (PVP) from the Plant Variety Protection Office.

International Collaboration to Support Conservation and Exchange of Plant Genetic Resources

PEO works with other US and international programs to support plant germplasm conservation and exchange worldwide.

During the past year, PEO continued to collaborate with the National Department of Genetic Resources and Biotechnology (DENAREF) of the National Institute of Agricultural Research (INIAP) in Ecuador, the Organization of Farmers and Indigenous Peoples of Cotacachi (UNORCAC), and the USDA/FAS on a P.L. 480 – funded project to support complementary (*ex situ* and on-farm) conservation and increased utilization of agro-biodiversity in native farming communities in Cotacachi, Ecuador.

The PEO also collaborated with USDA/FAS and USDA/ARS/OIRP to develop joint germplasm collection, conservation and maintenance programs in Jordan, Morocco, Tunisia, Peru, Bangladesh, Sri Lanka, Uzbekistan, Pakistan, Kazakhstan, Guyana, Georgia and Azerbaijan using US Food for Peace and other programs.

Since 2002, PEO has been collaborating with the plant genetic resources programs of the eight Central Asia and the Caucasus countries: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Armenia, Georgia and Azerbaijan. This program is organized by ICARDA (International Center for Research in the Dry Areas) and the focus is on development of national plant inventories, staff training, and plant exploration.

PEO is collaborating with the International Center for Tropical Agriculture (CIAT) to develop Geographical Information System (GIS) technology to guide the collection of germplasm on plant explorations. Projects are planned in Guatemala and Paraguay.

Contact Information

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NPGS Plant Explorations/Exchanges Undertaken in FY 2005

Target Crop	Country	Principal Contacts
Butternut	United States (MN, WI, OH, IN, KY)	M. Ostry, K. Woeste
Saltgrass	United States (CA, OR, NV)	J. Harrington, S. Reid
Woody landscape plants	United States (PR)	T. Ayala-Silva, A. Meerow
Sunflower	United States (CO, WY)	T. Gulya, G. Seiler, L. Marek
Sunflower	United States (CA)	T. Gulya, G. Seiler, L. Marek
Tomato	Chile	R. Chelelat, R. Pertuzé, L. Faundez
Herbaceous ornamentals	Republic of Georgia	M. Mosulishvili
Cotton	Mexico	M. Ulloa, J. Stewart, S. Acosta Nunez
Beet	Greece	R. Hannan, B. Hellier, L. Frese, S. Samaras
Breadfruit (exchange)	Tahiti	D. Ragone, D. Lorence
Wheat and barley	Turkey	B. Steffenson, H. Bilgic, T. Akar
Cereals and legumes	Armenia	N. Rukhkyan, C. Francis, I. Arevshatyan, K. Street
Potato	United States (AZ)	J. Bamberg, C. Fernandez, A. del Rio
Lesquerella	United States (TX)	A. Salywon

NPGS Plant Explorations/Exchanges Planned for FY 2006

Target Crop	Country	Principal Contacts
Walnut	Guatemala	D. Stone, P. Manos, A. de MacVean
Guayule	United States (AZ, NM, TX)	D. Stout, T. Coffelt, M. Foster
Sunflower	United States (AL, FL, GA, MS, LA, SC)	T. Gulya, G. Seiler, L. Marek
Poa spp.	Italy, Germany, Czech Republic	R. Johnson, D. Huff, M. Romani, L. Pecetti, R. Paoletti, M. Sarno, E. Willner, M. Ševčíková
Soybean	South Korea	G. Chung, T. Shin
Fruits and nuts	Armenia and Republic of Georgia	J. Postman, E. Stover, A. Charchoglian, N. Rukhkyan, S. Gasparyan, M. Mosulishvili
Grapes	United States (AL, TX, LA, OK, AR)	L. Goertzen, J. Kamas, H. Schwaninger
Grasses	Kyrgyzstan	D. Johnson, R. Soreng, K. Samsaliev, V. Chapurin, S. Shuvalov
Vaccinium spp.	United States (FL)	K. Hummer, P. Lyrene
Woody ornamentals	Azerbaijan	K. Conrad, M. Byrne, I. Shahmardan
Cereals, legumes, and grasses	Tajikistan	B. Hellier, K. Street
Turfgrass	China (Inner Mongolia)	D. Johnson, M. Majerus, G. Anlin
Potato	United States (AZ)	J. Bamberg, C. Fernandez, A. del Rio

APPENDIX 5

The Germplasm Resources Information Network

The mission of the Database Management Unit (DBMU) is to develop and maintain information systems for the National Genetics Resources Program comprising plants, animals, microbes, and invertebrates. We have completed the development of a new interface for the plant database and will continue to enhance that system when specific needs arise. The first version of the National Animal Germplasm Program system has been completed and is currently being used in a production mode. The DBMU has now begun developing a requirements document for version two.

Recent statistics for data in the plant database include: Over 80,000 taxonomic names (including synonyms), 470,946 accessions representing 11,839 species and 1,916 genera, 1,543,563 inventory records, 1,235,671 germination records, 6,313,140 characteristics/evaluation records, and over 106,000 images.

Germplasm accessions acquired by the National Plant Germplasm System (NPGS) since the effective date of the Convention on Biological Diversity continue to be flagged in the database with appropriate disclaimers and MTA's. These agreements are displayed with accession passport data and automatically printed on GRIN generated packing slips when accessions are distributed. During the past year, the DBMU continued to provide support to NPGS site personnel and assisted NPGS sites in loading passport data, evaluation data, distribution information and images into the database.

GRIN was demonstrated at several Crop Germplasm Committees and commodity meetings along with scientists visiting NGRL throughout the year. The Directory of NPGS Personnel and Crop Germplasm Committees continues to be maintained on the GRIN Web page in a PDF format.

A GRIN site meeting will be held in September in Geneva, NY. Many issues will be discussed about the GRIN site software and the public system. Recommendations from that meeting will be incorporated into the system.

In September of 2005 the NP301 began its second cycle and a stakeholders meeting was held near Baltimore. Two major issues regarding GRIN were identified including:

1.) GRIN needs to handle molecular data being generated on NPGS accessions and needs to interact better with the plant genome databases

2.) The GRIN public web interface and software need to be rewritten in order to meet users needs

To address these issues a subcommittee of NPGS curators has been developed to advise us on how to incorporate molecular data into GRIN. They have already laid out the structures that need to be added to GRIN and the DBMU has begun to create the new tables and software to manage and display the data to the user community.

A public interface committee has also been established and will consist of NPGS personnel to advise the DBMU on improving the public interface to GRIN. The committee will solicit input from the CGCs and other stakeholders of the system.

The DBMU is also working with the international community to make the GRIN data available through a biodiversity portal which will allow users to search multiple databases at the same time.

The GRIN system was available 98% of the time on a 24 hour a day and 7 day a week schedule. Access to the database through the web pages continues at a brisk pace. Over the last year, there were 154,570 unique host computers that accessed the GRIN database. This accounted for 544,043 visits to the data. We always encourage users to send any comments on the public interface by email to dbmu@ars-grin.gov .

The current version of pcGRIN will continue to be supported by the DBMU. Any new pcGRIN software will be a version of the national GRIN system that can operate on a personal computer utilizing the same Database Management System and development tools to reduce maintenance costs.

Two Sun Microsystem computers were replaced in 2001, one that supports the web server and site users and one that is used specifically for the databases. The databases reside on a separate computer to provide additional security. We also purchased two additional small Sun Microsystems workstations that are used for database development and for testing new operating systems prior to release to the user community. Additionally, one terabyte of disk space was purchased to ensure adequate space is available for increases in characteristic, evaluation, and image data.

Security for the computer and databases is always being reviewed and monitored for intrusion by those who may attempt to corrupt web pages or to destroy data. The system is protected by a firewall and all data are backed up at onsite and offsite locations. We keep backups at several local offsite locations and one at Ft. Collins, CO, for long-term storage. The computer system has an Uninterruptible Power Supply for short-term power outages and a diesel generator for long term power outages. The building is now locked with access permitted by either a building security person or a card key. The computers are in a locked room that is monitored for temperature on a 24 hour, 7 days a week schedule.

Crop Germplasm Committees

Since January 1, 2005, over thirty of the 40 Crop Germplasm Committees (CGC) have met. An NGRL representative was present at most of the meetings to help facilitate their activities. Summaries of each meeting are prepared and distributed to appropriate National Program Leaders, NGRL staff and other NPGS personnel. The committees continue to provide advice on all aspects of the NPGS including identifying gaps and duplications in the collections, germplasm maintenance and evaluation, quarantine issues and maintaining updated versions of the crop vulnerability reports. The 10th biennial meeting of the CGC Chairs will be held in Ames, IA June 6-7, 2006. This will be in conjunction with the Regional Technical Advisory Committees and the Plant Germplasm Operations Committee.

This meeting provides an opportunity for Chairs to hear presentations on the status of NPGS sites, plant germplasm exchange, international issues, preservation and utilization, the molecular characterization of accessions, interactions between curators and CGCs and plant quarantine issues. It also allows the Chairs to meet and interact with each other, NPGS managers and curators, and invited guests from ARS, other government agencies, and non-government organizations.

Plant Disease Research Unit

Effective October 1, 2005, the responsibilities for the quarantine indexing and distribution of prohibited genera germplasm that were performed by the USDA-ARS, Plant Germplasm Quarantine Office (PGQO) in Beltsville, MD were transferred to the USDA Animal and Plant Health Inspection Service-Plant Health Programs (APHIS-PHP). Three scientists from PGQO and their support staff have established the Plant Disease Research Unit within NGRL (NGRL-PDRU). The mission of NGRL-PDRU is to investigate pathogens and diseases of quarantine significance that occur in clonal plant germplasm that must enter the US through federal quarantine programs. The objectives are focused on determining the causal agents responsible for diseases that prevent germplasm from entering the country, and developing tools to effectively detect and eliminate them. These research efforts provide support to the APHIS quarantine program and help facilitate the safe introduction and international exchange of valuable plant germplasm.

NGRL-PDRU is glad to discuss potential collaborations with pathologists and stakeholders who have interest in clonally propagated, prohibited genera crops that are handled by the USDA quarantine program.

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APPENDIX 6

PLANT EXPLORATION TO SOUTHEASTERN UNITED STATES (AL, FL, GA, MS) TO COLLECT ENDEMIC *HELIANTHUS* SPECIES

Helianthus floridanus

Helianthus radula

Helianthus longifolius

Gerald Seiler collecting *Helianthus resinosus*

GERMPLASM EXPLORATION TRIP REPORT
Southeastern U.S.A. for Endemic *Helianthus* species

Participants:

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515-294-3519 email: lmarek@iastate.edu

Countries visited: Alabama, Florida, Georgia, Mississippi, United States

Dates of Travel: 18 to 29 September 2006.

Objectives: To collect *Helianthus* species endemic to southeastern U.S.A.

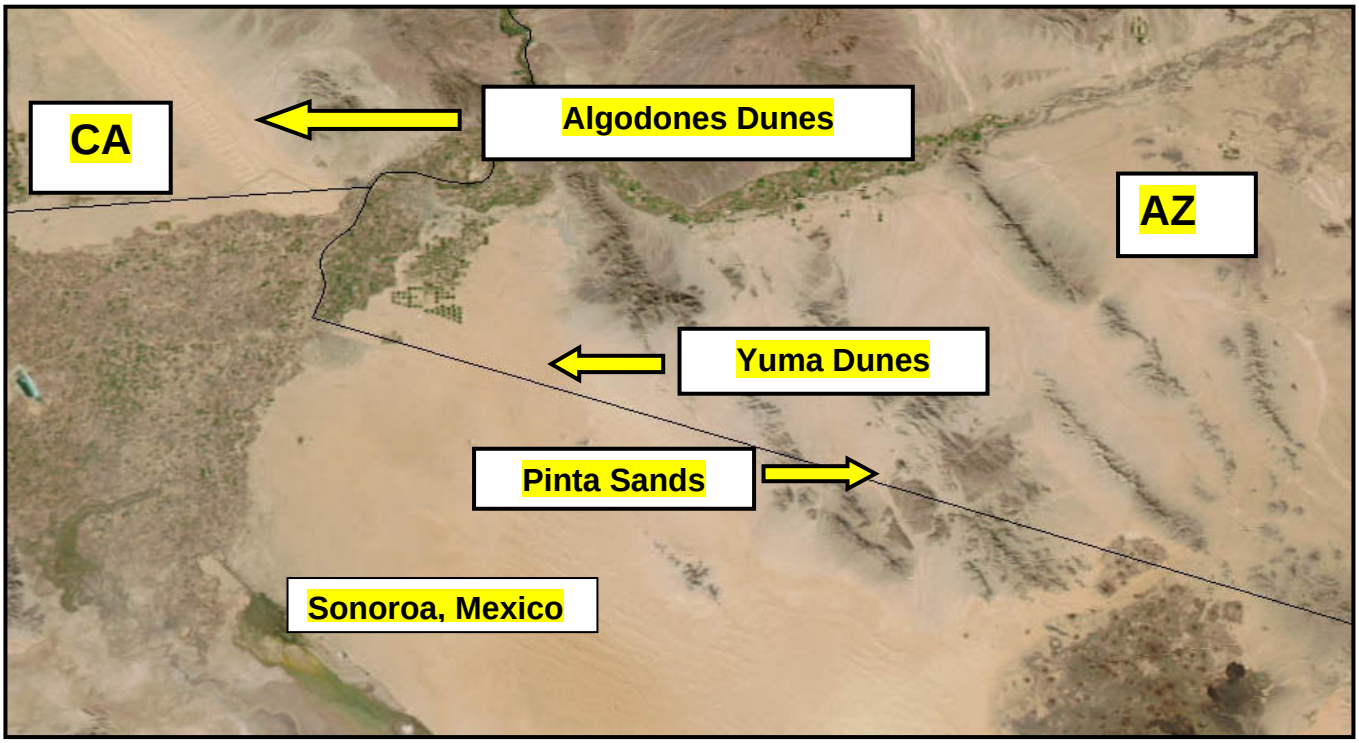
Accomplishments: During twelve days in four southeastern states (Florida, Alabama, Georgia, Mississippi), the three-member team collected 24 populations of six *Helianthus* species while covering ~ 3600 miles. Species collected included *H. argophyllus* (1), *H. debilis ssp. cucumerifolius* (1), *H. floridanus* (2), *H. longifolius* (2) , *H. resinosus* (13) and *H. smithii* (3). Two additional collections are in the process of being identified to species. Many additional species were noted during the trip, but the populations were either too small to warrant collecting, or, most often, were just beginning to flower and thus had no mature seed. These species included: *H. agrestis, H. angustifolius*, *H. atrorubens*, *H. carnosus*, *H. divaricatus*, *H. radula*, *H. occidentalis* ssp. *occidentalis*, *H. strumosus*, and *H. tuberosus*, bringing the total number of species observed to fifteen. A botanist with the Bok Sanctuary (Lake Wales, FL) was contracted to collect seeds from *H. carnosus,* Florida-listed as endangered. Future exploration trips for the later species would best be done in mid to late October. Further recommendations to collect southeastern *Helianthus* species are detailed in the report. Four local botanists were enlisted to collect seeds from some of the late-blooming species, specifically *H. agrestis*, *H. longifolius*, *H. radula*, and *H. smithii.* They succeeded in collecting minimal amounts of seed from the latter three species, bringing the total number of accessions from this year's efforts to 27. Seeds from the collections have been cleaned and inventoried, and eleven of the 27 have sufficient seed to be immediately available for distribution. The accessions are also currently being evaluated for oil and fatty acid composition, and for resistance to virulent races of rust and downy mildew.

APPENDIX 7

PLANT EXPLORATION TO CALIFORNIA and ARIZONA TO COLLECT *HELIANTHUS NIVEUS* ssp. *TEPHRODES* GERMPLASM FOR SUNFLOWER IMPROVEMENT

Submitted by: Dr. Tom Gulya, Sunflower Research Unit,
USDA Northern Crop Science Laboratory, Fargo, ND 58105

Helianthus niveus* ssp. *tephrodes



Plant Exploration Report
Submitted to the USDA-ARS Plant Exchange Office, April 2005

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Countries visited: California and Arizona, United States

Dates of Travel: 26 Februrary to 5 March, 2005

Objectives: To collect *Helianthus niveus* ssp. *tephrodes,* endemic to active sand dune habitats in southern California and Arizona, and the closely related *H. niveus* ssp. *canescens.*

Accomplishments: During the seven days in southern California and adjacent Arizona, the three-member team collected five populations of *Helianthus niveus* ssp. *tephrodes* (HENIT) from the Algodones Dunes in California, four populations of *Helianthus niveus* (species to be determined) from Yuma and the Cabeza Prieta National Wildlife Refuge, and one population of *H. annuus* from Holtville, CA. Herbarium specimens, digital images of plants and habitats, and sand samples were made at each of the ten collection sites. The five populations of HENIT from the Algodones Dunes encompassed the northern and southern extremes of the 40-mile long dune system. Two of the collections were made with the aid of BLM wildlife biologist Chris Knauf (and a dune buggy), with the remaining three sites visited on foot. The Yuma collection site was on restricted land of the Yuma Marine Air Corps Station, and we were driven to the area by a MACS Range Warden. The Cabeza Prieta NWR collections were all from the Pinta Sands area, which is the northernmost extension of the Gran Desierto of Sonora, Mexico. A 4wd vehicle is necessary to access this area, about 60 miles from Ajo, AZ, and the vehicle was generously supplied by the NWR. The Arizona populations were all annual plants, in contrast to the perennial HENIT plants in the Algodones Dunes. Morphological characters from these populations are being compared with herbarium specimens of HENIT and *H. niveus* ssp. *canescens* (HENIC) obtained from herbaria in CA, AZ, NM and TX (across the entire geographic range of HENIC). Additionally, Dr. Marek collected DNA samples from all populations, which also will aid us in species delineation. Seed amounts collected were lower than anticipated (based on the number of heads collected per site). The Algodones Dunes HENIT collections netted from 100 to 550 seeds, while the HENIT/HENIC populations from southern AZ netted from 800 to 3500 seeds. The single *H. annuus* collection, which is the "earliest collected specimen" of this species, netted 4900 seeds.

APPENDIX 8

PLANT EXPLORATION TO COLORADO AND WYOMING, U.S.A TO COLLECT *HELIANTHUS PUMILUS* GERMPLASM FOR SUNFLOWER IMPROVEMENT

Dr. Tom Gulya & Dr. Gerald Seiler, Sunflower Research Unit,
USDA-ARS, Northern Crop Science Laboratory, Fargo, ND 58105

Dr. Laura Marek,
USDA North Central Regional Plant Introduction Station
Ames, IA 50011

Helianthus pumilus at a roadside site near the Colorado/Wyoming border, with Chimney Rock in the background.

Plant Exploration Summary Report

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Countries visited: Colorado and Wyoming, United States
Dates of Travel: 7 August to 19 August, 2005

Objectives: To collect *Helianthus pumilus,* endemic to the Front Range of Colorado and Wyoming.

Accomplishments: During eleven days in Colorado and Wyoming, the three-member team collected 44 populations of *Helianthus pumilus* (*HEPUM*) from southern Colorado to northern Wyoming. Additionally, we collected one accession each of *Helianthus annuus* and *Helianthus nuttallii*. With the help of Mark Dahmer and Carol English, botanists in the Denver area, three additional seed collections of *H. pumilus* were made making a total of 47 *HEPUM* collections. Voucher specimens, digital images of plants and habitats, and soil samples were taken were at each site. Our objective was to sample *H. pumilus* across its entire geographic range. In the course of our 3200 mile trip (5150 km; 760 km north to south and 240 km east to west), we collected at sites ranging from 4870 to 8900 ft (1480-2700 m) in elevation. The *HEPUM* populations varied in size from ~ 35 to several thousand plants. Most populations were generally past flowering, but seed retention was good. After cleaning, the HEPUM collections averaged ~ 9000 seeds/site, with only two collections below the 2000 seed threshold. During the winter season 2005-2006, we will do oil content and fatty acid analyses and greenhouse disease resistance tests. Prior to this trip, there were five accessions of *HEPUM* in the USDA based National Plant Germplasm System (NPGS), with only one accession with sufficient seed for distribution. The 47 additional *HEPUM* populations collected on this trip (with 45 immediately available) will be a representative source of *HEPUM* germplasm for domestic and foreign scientists to study this species, which has received little research attention. Maps of daily itineraries are found in the complete report. Individual *HEPUM* site maps are presented in the appendix of the report. Photographs of the habitat, of *HEPUM* plants, and associated vegetation at each site can also be found in the complete report.

APPENDIX 9

Exploration Trip for *Helianthus cusickii* and *Helianthus deserticola* in California and Nevada

Helianthus deserticola, a quick growing annual species, in west central Nevada, with glove for relative size reference

Helianthus cusickii, "parsnip root sunflower," in a typical rocky habitat in the Black Rock Desert area of northeastern Nevada.

Plant Exploration Report

(trip funded by USDA Sunflower Unit operating funds and not by PEO funds)

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Countries visited: California and Nevada, United States

Dates of Travel: June 20 to 25, and July 25 to August 18, 2005

Objectives: To collect *Helianthus deserticola* in west central Nevada and *H. cusickii* across two areas (NV-CA and WA-OR).

Accomplishments: Dr. Gulya and his wife spent five days in northwestern CA and west central Nevada (Jun 20 – 25) and collected 7 populations of *H. deserticola* and nine populations (5 from NV and 4 from CA) of *H. cusickii.* Dr. Marek collected nine populations of *H. cusickii* (2 from WA and 7 from OR). Dean Tonnena, a BLM naturalist, was very obliging, and collected seven additional populations of *H. deserticola* between 25 July and 18 August, all from west central Nevada, bringing the total number of *H. deserticola* collections in 2005 to 13. All but one of the 13 *H. deserticola* collections netted > 2000 seeds, with an average per collection of ~ 5000 seeds. There was a considerable difference in seed numbers of *H. cusickii* between the northern states (WA – OR) and the southern states (CA – NV). The nine *H. cusickii* populations collected by Dr. Marek in WA – OR averaged 1800 seeds/site, with 4 of the nine collections having > 2000 seeds. The CA – NV *H. cusickii* collections, in comparison, netted an average of 9000 seeds/sites and all nine sites had > 2000 seeds. The lower seed numbers from WA – OR were thought to be due to insect predation and the fact that the northern populations were less mature than those sampled from CA – NV. In all, there were 18 collections of *H. cusickii.*

APPENDIX 10

2006-7 NONFORMAL SEED COLLECTION ACTIVITIES

Tom Gulya
Sunflower Research Unit
USDA-ARS Northern Crop Science Lab

1. ***H. carnosus:*** Discussions with Cheryl Peterson, Bok Sanctuary (central FL) to obtain state permit and continue seed collections and site protection activities for FL-listed *H. carnosus* in 2007.

2. ***H. longifolius:*** Obtaining permit from NPS to allow collection within "Little River Canyon Nat. Preserve" by retired NDSU professor Robert Stack. *H. longifolius* limited to GA and AL, and only two populations collected on 2006 trip.

3. ***H. debilis* ssp. *vestitus***: Discussions with botanist Keith Bradley, Institute of Regional Conservation, regarding their survey and report which documented that only 7 of 60 presumed sites of this species still contained viable populations. State and county agencies in FL are using nursery-raised plants of *H. debilis* ssp. *debilis* to stabilize dunes, and the proximity of the two species may lead to loss of genetic identity of *H. debilis* ssp. *vestitus*. Six of seven sites are in state or county parks, and I am starting process of obtaining a state permit plus permission from the park officials.

4. ***H. niveus* ssp. *tephrodes***: Discussions with Erin Dreyfuss, BLM-El Centro CA, and with Michell Stevens, botany professor at Imperial Valley College, to contract for repeated seed collection efforts.

5. ***Contact with VIR in Russia:*** During a visit to Russia in November, 2006, I spent one day visiting the VIR Institute in St. Petersburg, and spent a day touring the facility and talking with Dr. Vera Gavrilova (accompanied by Dr. Nikolay Balbyshev, NDSU). In subsequent emails with Dr. Gavrilova she said she could supply us with an Excel spreadsheet listing the cultivated and wild sunflower accessions in the VIR germplasm collection, and include descriptors, which are not available on the web-accessible database. I hope to visit Dr. Gavrilova in July, 2007 when she will be spending a month at the VIR site in Botaniak, near Krasnodar. Once we exchange information on seed collections, it would be appropriate for the CGC committee or a subset to request germplasm from VIR which is not currently in the USDA collection.

APPENDIX 11

EXPEDITION TO AUSTRALIA TO COLLECT WILD *HELIANTHUS* SPECIES FOR SUNFLOWER CROP IMPROVEMENT

The genus *Helianthus*, with its 60+ taxa, is native to North America, with the majority of species within the confines of the United States. However, wild sunflowers (*H. annuus*) have been inadvertently introduced into several countries and have become naturalized, most notably in Argentina, Australia, and South Africa. Within these three countries other *Helianthus* species, notably *H. argophyllus* and *H. debilis* ssp. *cucumerifolius,* have also become naturalized, presumably after escaping from household gardens. Within the continent of Australia, there are records of six *Helianthus* species: *H. annuus (*common annual sunflower)*, H. argophyllus* (silver leaf sunflower), *H. ciliaris (*Texas blueweed), *H. debilis ssp. cucumerifolius* (cucumber-leaf sunflower*),* and *H. tuberosus* (Jerusalem artichoke)*.* The Sunflower Crop Germplasm Committee recognizes the value of these species which have become naturalized in other countries, and the possibility that they have traits distinct from their North American progenitors due to different environments, diseases and insect pests. Thus, even though there is a large collection of *H. annuus* within the present germplasm collection, the addition of Australian populations should expand the genetic diversity of this species. Australian herbaria have records of *H. annuus* and the other species occurring primarily within five states: Queensland, New South Wales, Victoria, South Australia and Western Australia. Our USDA Sunflower Unit has a decade-long interaction with Dr. Gary Kong, of the Queensland Dept. of Primary Industries and he has participated in three *Helianthus* collecting trips in the U.S. His involvement would greatly enhance the success of such a trip. Our objective would be to primarily collect seeds of *H. annuus*, *H. argophyllus*, and *H. debilis* ssp. *cucumerifolius* in VIC, SA and WA, and any other *Helianthus s*pecies that we find incidentally. Dr. Kong is already collecting seeds of *Helianthus annuus* in QLD and NSW in 2006 to supplement our proposed trip. This expedition will be made in compliance with Australia's laws, and those of each state, governing foreign access to germplasm. The germplasm will be incorporated into the National Plant Germplasm System where it will be curated on behalf of the U.S. Government and will be available to all qualified scientists/organizations, domestic and foreign, who are eligible to receive it. Additionally, a portion of the seeds will be deposited in the appropriate Australian national or state seedbanks. Complete location records will be kept, to be shared with DPI and USDA, as well as multiple herbarium voucher specimens to be deposited in both countries. All seeds will be cleaned and processed within Australia, and will be fumigated to eliminate any insects prior to shipment to the U.S.

The seeds will be shipped to the USDA Plant Germplasm Quarantine Center, Beltsville, Maryland, from which it will be distributed to the USDA-ARS-NCR Plant Introduction Station in Ames, Iowa.

Submitted by: Drs. Thomas Gulya & Gerald Seiler
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PLANT EXPLORATION IN THE SOUTHWESTERN UNITED STATES TO COLLECT SUNFLOWER GERMPLASM FOR CROP IMPROVEMENT

The sunflower CGC has determined there is a need for additional sunflower germplasm from the southwestern United States. The three species targeted in this collection proposal, *Helianthus arizonensis*, *H. ciliaris* and *H. laciniatus* are poorly represented in the U.S. National Plant Germplasm System (NPGS): one accession of *H*. *ciliaris* is available for distribution; no germplasm is available for either *H. arizonensis* or *H. laciniatus*. This germplasm is desired for breeding programs for crop improvement, does not exist in other germplasm collections and can only be obtained by collection. The *Helianthus* germplasm will be collected as seed. All collections will be documented with voucher herbarium specimens and digital images of the collection site. Complete passport data (description, locality of collection, including latitude and longitude) for each collection will be recorded and the data entered into the NPGS web-accessible Germplasm Resources Information Network database. The exploration will be made in compliance with state and federal regulations governing seed collection on public controlled land. Collected germplasm will be deposited in the NPGS at the North Central Regional Plant Introduction Station in Ames, IA. Germplasm in the NPGS is curated on behalf of the U.S. Government and will be available to all qualified scientists/organizations, domestic and foreign, who are eligible to receive it.

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