Root and Bulb Vegetable Crop Germplasm Committee Meeting
Thursday, 19 July 2007, 8:00-10:00 AM
Merriam A, Westin Kierland Resort and Spa
Scottsdale, Arizona

AGENDA

1. Current membership list

2. Sub committee reports (Cramer, Simon)

3. Update of RBV germplasm at Geneva, NY (Larry Robertson)

4. Update of RBV germplasm at Ames, IA (Kathy Reitsma)

5. Update of RBV germplasm at Pullman, WA (Barbara Hellier)

6. 2007 National Germplasm Resources Laboratory Report (Ray Mock)

7. 2007 National Program Staff Report (Peter Bretting)

8. Status of garlic descriptor list (Hellier)

9. Tunisia collection trip (Simon)

10. Status of 2007 germplasm evaluation proposal (Cramer)

11. Status of phenotypic and molecular marker evaluation of new garlic accessions (Simon/Hellier)

12. Status of garlic virus evaluation (Hellier)

13. Status of onion smut resistance germplasm evaluation (McDonald)

14. Upcoming RBV conferences and activities.

Minutes of Root and Bulb Vegetable Crop Germplasm Committee Meeting
Thursday, 19 July 2007, 8:00-10:00 AM
Merriam A, Westin Kierland Resort and Spa
Scottsdale, Arizona

Chair: Dr. Christopher Cramer
Attendees: Chris Cramer, Mark Bohning, Barbara Hellier, Maria Jenderek, Mary Ruth McDonald, Kathy Reitsma, Larry Robertson, Phil Simon, Gayle Volk.

These minutes are respectfully submitted by K. Reitsma

1. Membership List (Appendix 1)
Add David Spooner and Gayle Volk; possibly add Dave Wolyn (Guelph)
Re-add Maria Jenderek
Removed Irwin Goldman and Leonard Pike
Bill Randle and Ellen Peffley would like to remain members

2. Subcommittee Reports (Appendices 2, 3)

A. Allium (Cramer, Simon) [please see attached report of the Onion and Garlic Subcommittee Meeting, Root and Bulb Vegetable Crop Germplasm Committee meeting minutes from 8 December 2006 for the 2006 National Allium Research Conference, College Station Hilton Hotel, College Station, TX.]

Gained some new members who will probably not make it to ASHS meetings but will participate in Allium meetings. The group reviewed a list of the Allium holdings at Geneva, NY. They polled breeders to determine which accessions should be maintained and which should be inactivated. Table 1 of the handout lists accessions of hybrid origin which the subcommittee recommended for inactivation, most of which are G-numbered (Geneva-numbered) accessions. Larry Robertson mention that the Crucifer CGC decided to maintain the hybrids as a bulk if it is no longer maintained commercially (suggest that at least the genes are still there). Mary Ruth McDonald feels this is a good idea and suggested that 'Taurus' (G 32051) and 'Aries' (G 32052) are two Allium accessions that fit this category – that they should still be maintained as they are no longer available in the trade but often used in screening programs. 'Fortress' (G 32117) is another accession she would recommend keeping. It was decided the Allium Subcommittee will revisit this issue and let Larry know how to proceed – whether to maintain the hybrids or inactivate them.

Chris also provided a handout with the following six tables listing issues/status of Allium germplasm he had collected. The subcommittee reviewed these accessions for possible inclusion or inactivation after viability testing.
Table 1: Collected material removed because of no seed germination.
Table 2: Collected material in which no germination test was conducted.
Table 3: Collected material removed because of hybrid origin.
Table 4: Collected material removed because of PVP concerns.
Table 5: Collected material that already exists in collection.
Table 6: Remaining material for possible inclusion into collection.

Phil Simon said that the Carrot Subcommittee has not yet met. There is a carrot conference in France, but not a good representation for the subcommittee. The California Carrot Advisory Board is not an appropriate venue for the subcommittee.

3. Update of RBV germplasm at Geneva, NY (Larry Robertson) [Appendix 4]
Much of Larry's report was covered in the Allium subcommittee report, but he added that he will possibly start regeneration this fall of the items listed in Table 6 mentioned above. Discussion ensued about trying to develop a program providing for a more long-term means of managing the short-day onion germplasm. Suggestions included finding an alternative regeneration site (Hilo, Hawaii?), and/or a sufficient funding increase to support the continued maintenance program. Larry and Chris will work on developing a strategy. It was suggested that a letter of recommendation from the CGC supporting sufficient funding over the next 10 years for continued maintenance by C. Cramer at New Mexico for short-day onion be submitted to Peter Bretting. Should this be brought up to PGOC or at the CGC Chairs meeting in Fort Collins, CO in 2008?

4. Update of RBV germplasm at Ames, IA (Kathy Reitsma) [Appendix 5]]
In addition to the information provided in the Ames report and the work to be done by Spooner, Simon, Widrlechner, and Reitsma, Phil Simon added these comments about work in his lab: We have ~175 carrot microsatellite primers, and we have evaluated all of them in several F2 families and found about 50 to 55 to be polymorphic so far. We have only evaluated one in all of our Daucus diversity set thus far, but it even forms a PCR product with Orlaya, much to my surprise. We have sequenced most of the PCR products, but not all. We intend to evaluate as many SSRs as we can afford in that set. We have already evaluated ITS, to verify its use to discern species. Data collected but not yet analyzed. We have done COSII marker evaluation for 8 markers, but only on a fraction of the diversity set so far. Not all of them worked on carrot using primers developed thus far.

5. Update of RBV germplasm at Pullman, WA (Barbara Hellier) [Appendix 6]
Maria Jenderek initiated discussion concerning the prioritization of garlic accessions to be preserved by cryopreservation at NCRGP. NCGRP is currently able to prepare and store 19 to 20 garlic accessions per year but there are over 200 accessions to back up. Should garlic accessions which produce seed be a lower priority for cryopreservation or higher? Does garlic breed true from seed – will you get back to the bulb you started with from the seeds? How much allelic diversity are you losing from seeds. It was suggested that an evaluation may be necessary to answer these questions. Currently, Barbara is using Gayle Volk's genetic information, Pullman's phenotypic data, and bulb availability status to determine which accessions go into cryo.

There was also discussion concerning interest in the production of virus-free garlic seed and a suggestion that maybe Barbara could pursue a proposal to work with other garlic growers to achieve this. (Pullman does not currently have a program for producing seed on garlic.) Gayle Volk said she could provide some contacts for Barbara of growers who were helpful and successful in some of her previous work with garlic. Phil Simon stated that bulb size decreases due to a photoperiod response in germplasm unadapted to the area is it being grown – that the decrease in bulb size is not necessarily due to virus infection.

6. 2007 National Plant Germplasm Resources Laboratory Report (Mark Bohning)
There is still no replacement for Alan Stoner who retired as research leader of NGRL two years ago. Dr. Gary Kinard is the acting RL until the position can be advertised and a replacement hired. There is also no replacement for Jim Mowder who retired as database manager from DBMU. Quinn Sinnot is filling in as the database manager, and it is not known yet if this position will be refilled. Highlights from Bohnings report include the ability for GRIN to now handle molecular data; the progress on the rewrite of Public GRIN to meet user needs (a prototype will hopefully be available in about one year), and the work with the Global Biodiversity Information Facility to develop a germplasm specific portal allowing users to search multiple databases for characteristic and evaluation descriptors.

7. 2007 National Program Staff Report (Peter Bretting). No report received; Dr. Bretting was not able to attend ASHS.

8. Status of garlic descriptor list (Hellier)
Barbara has had input from Maria Jenderek and Phil Simon, and she will be updating GRIN, soon. Gayle Volk asked if Barbara would send her the garlic descriptor list.

9. Tunisia collection trip (Simon) [Appendix 7]
Trip Summary: P.W. Simon traveled ~ 3100 km through Tunisia with M. Neffati or other scientific staff of Insitut des Regions Arides (IRA) from Djerba/Medenine to Remada to Tabarka and back to Djerba/Medenine over 13 days collecting 51 seed or bulb samples including native, wild *Allium* (2 species) and *Daucus* (6 species), as well as local cultivated varieties of carrot, onion, and garlic. Germplasm collections of particular interest were: 1) first collection of *Daucus sahariensis* for the USDA collection, 2) first collection of *Daucus syrticus* for the USDA collection, and 3) collection of the rare *Daucus durieua*. Critical observations were made of diversity in wild *Daucus carota*, noting a range of plant types beyond those that are observed in Central Asia, Anatolia, Middle East, Europe, or the Americas. Plans were discussed for future collections of germplasm and for collaborative research characterizing phenotypic and molecular diversity in *Allium* and *Daucus*, and evaluating nutritional/medicinal variation in *Allium*, hopefully involving exchange of students and staff.

A proposal to re-collect in Tunisia in 2008 has been submitted.

10. Status of 2007 germplasm evaluation proposal (Cramer)
Funding for the 2007 evaluation proposals has been awarded, and Chris Cramer and Ted Kisha will begin working on the evaluation to “Determine redundancy of short-day, onion accessions in the current collection” this fall.

11. Status of phenotypic and molecular marker evaluation of new garlic accessions (Simon/Hellier)
Evaluation of 14 wild garlic collected in Uzbekistan in 2004. Barbara will have 2 years of evaluation data soon and Phil has some AFLP data back.

12. Status of garlic virus evaluation (Hellier)
Dr. Hanu Papu has finished evaluating the garlic collection for virus infection. He is in the process of writing up his findings.

13. Status of onion smut resistance germplasm evaluation (McDonald) [Appendix 8]

Promising material identified from the evaluation of the Geneva Allium collection will be sent on to Mike Havey for his breeding program.

14. Upcoming RBV conferences and activities

- Carrot Conference, France, September 5-7, 2007
- 2007 International Symposium on Edible Alliaceae and World Onion Congress that is being held Oct. 29 - Nov. 1. in Dronsten, The Netherlands

NEXT MEETING – ASHS Orlando, Florida July 21-24 2008

Appendices:

1. Current Membership list
2. Subcommittee Report: 2007 Onion Seed Collection Status
3. Subcommittee Report: 2006 National Allium Research Conference – Onion & Garlic Subcommittee RBV-CGC minutes.
4. Geneva, NY report
5. Ames, IA report
6. Pullman, WA report
7. Tunisia collection trip (Simon)
8. Status of onion smut resistance germplasm evaluation (McDonald)

Appendix 1

Root and Bulb Vegetable Crop Germplasm Committee Membership List, 2007

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Appendix 2

Onion and Garlic Subcommittee Meeting, Root and Bulb Vegetable Crop Germplasm Committee
Friday, December 8, 2006, 4:10-5:10 PM
2006 National Allium Research Conference, College Station Hilton Hotel
College Station, TX

Meeting Minutes

People Present: Martha Mutschler, Hilary Barton, Rick Watson, Rene Emch, Barbara Hellier, Dave Whitwood, Rick Jones, Mike Havey, Mary Ruth McDonald, Al Burkett, Dan Brotslaw, Ryan Walker, Chris Cramer

1. Current membership list – Added Al Burkett, Rick Jones, and Rick Watson to membership list. All were willing to attend the Onion and Garlic Subcommittee meetings held biennially to the National Allium Research Conference.

2. Minutes from 2006 annual meeting in New Orleans, LA – These were present to the group.

2. Update of RBV germplasm at Geneva, NY (Larry Robertson) – The report from the annual meeting were presented to the group. Larry was not present.

3. Update of RBV germplasm at Pullman, WA (Barbara Hellier) – Copies of this report were placed out to the group. Mike Havey mentioned that he had some garlic seedlings that had originated from a self-pollinated of a true-seeded garlic plant – accession. Mike requested that the material needed to be maintained and he was unable to do it. The group discussed the future of this material. Barbara agreed to maintain the material. Mike will send the material to Barbara. Mike agreed to enter the molecular data collected on this material into the GRIN system. Also at this time, there was some discussion on how to clean up garlic accessions that are infected with various viruses. It was suggested that Barbara contact Maria Jenderek about doing this task. The committee felt that in her new position, Maria might be able to do this.

4. Revisions to garlic descriptors (Hellier) – Barbara passed a copy of the current garlic descriptors. Please see attached sheet. After some discussion, Barbara will email the current descriptors and proposed additions to the descriptor list. The group was generally in favor of adding these additional descriptors.

5. Domestic plant exploration trip (Cramer) – There was some discussion on the short-day onion accessions collected during the trip and whether to include this material in the collection. There was some discussion about the redundancy of non hybrid material in the short-day class. There was also some discussion about the propencity of hybrids in the collection. The committee asked about the policy of adding and regenerating hybrid accessions. Several members felt that hybrids should not be added to the collection and also should not be regenerated in the collection. Also several members felt that the current accessions that were hybrids should not remain in the collection. The hybrid

status of some accessions is not known. Several members agreed to review the current list of onion accessions and identified those accessions that are hybrids. The committee chair will sent out the current list of onion accessions to all committee members to review. Several committee members will also review the list of collected germplasm and identified those hybrids and their pedigree. Several members felt that maintaining hybrids in the collection was a waste of time and resources. Also members felt that the maintenance of material in sterile cytoplasm was not beneficial and did not contribute to the onion community. All of the information collected by the committee chair will be sent to onion curator and he will decide the future of hybrid accessions in the collection.

6. Short-day onion accession regeneration report (Cramer) – This report was presented to the group.

7. Other business

Appendix 3

Table 1. Collected material removed because of no seed germination.

Adalante	White Creole
Early Premium	White Creoso
Red Creole	White Dehydrator #3
Baia Periforme	White Dehydrator #5
Creole A x Southport White Globe	White Dehydrator #8
Creoso	White Dehydrator #14
Early Creole PRR	White Delight
Early Round Creole	White Express
Early Supreme PRR	White Granex PRR
F_1 Hybrid Dehydrator #6	White IPA
Hybrid Dehydrator #2	White Keeper
Hybrid Dehydrator #4	Arka Bindr
Hybrid Dehydrator #5	Arka Kalyan
Primero	Armada
Rio Blanco Grande	Caribou
Robust White PRR	Siohu ADR
Southport White Globe	Siohu P.B. Naroya
Temprana	Siohu PBR-3
White Australian	Spano

Table 2. Collected material in which no germination test was conducted.

PI 142790	PI 293756
PI 164349	PI 433342 – White Portugal
PI 212587	PI 433629 – Hakyshyu Giant
PI 229680	PI 433630 – Ishikura Long White
PI 236025	PI 433631 – Kincho Long White
PI 288074	PI 433632 – Tsukuba Long White
PI 289690	

Table 3. Collected material removed because of hybrid origin.

Hybrid Yellow Granex	La Nina
Hybrid White Granex	Navigator
Excel 986 A	Nikita
Alabaster	Rio Gigante
Aspen	Riviera
Excaliber	Utopia

Table 4. Collected material removed because of PVP concerns.

Cardinal
Daybreak
Ibex

Table 5. Collected material that already exists in collection.

Blanco Duro	Ringer Grano
Contessa	Texas Early Grano 502
Eclipse	White Creole
Excel 986 B	White Creole PRR
Red Creole	White Grano
Red Grano	Yellow Creole

Table 6. Remaining material for possible inclusion into collection.

Red Flat Italian	Rio Jefe
Red Torpedo	Rio Plata
White Mexican	Rio Verde
Red X	White Tampico
Samson	AC 595
Extra Early White Grano	Ben Shemen
White Grano Improved	Dawn
Early Red Burger	Jarit JTO-91
Italian Red Torpedo	Jarit JTO-308
Rio Blanco Grande	Jarit JTO-520
Stockton Early Red	Jarit Sunshine
Stockton Early Yellow	Siohu N-53
Stockton Red	Siohu PBR-1
Asgrow W45	Siohu PBR-2

Table 1. Current accessions in collection recommended for removal because of hybrid origin.

G 26468 Saturn	G 32053 Buccaneer
G 26714 Vega	G 32060 Spartan Banner 80
G 26715 Yula	G 32068 Rocket
G 27219 Fiesta	G 32069 Sweet Sandwich
G 27227 Saturn	G 32070 Sweet Sandwich Yellow Jumbo
G 27688 Sweet Sandwich	G 32080 PSR 3586
G 28006 1607 Super Sleeper F1	G 32106 Meteor F1
G 28011 Brown Beauty	G 32107 Siberia F1
G 28202 Golden Beauty	G 32108 Hysam F1
G 28204 PSR 385	G 32109 Corona F1
G 28206 Top Keeper	G 32110 Spirit F1
G 28970 Pioneer	G 32111 Daytona F1
G 29016 Pioneer	G 32114 Hyfast F1
G 29183 Avalanche	G 32115 Centurion F1
G 29186 Brahma	G 32117 Fortress
G 29187 Bullring	G 32118 Garrison
G 29190 Cuprum	G 32626 Autumn Pride
G 29191 Dehydrator No. 5	G 32627 Autumn Pride F1
G 29193 Eye No. 155	PI 433314 Dragon Eye Hybrid O-Y
G 29194 Golden Cascade	PI 433322 Hybrid Elite
G 29208 Valiant	PI 522166 Okhotzk F1
G 29215 Winner	
G 30385 Norstar	
G 32051 Taurus	
G 32052 Aries	

Appendix 4

Allium Collection of the PGRU at Geneva, New York

July 2007
Scottsdale, Arizona

Status of Collections

Currently there are 1276 accessions of *Allium* maintained at the Northeast Regional Plant Introduction Station at Geneva, New York (Table 1). The taxa of *Allium* in the U.S. National Plant Germplasm System (NPGS) maintained at Geneva are *Allium cepa*, *A. fistulosum,* and amphidiploids of hybrids of *A. cepa* and *A. fistulosum* with each other and several other species. The current backup status of the Geneva *Allium* collection at the National Center for Genetic Resources Preservation is also given in Table 1. In 2005/2006 Dr. Christopher Cramer of New Mexico State University acquired 85 accessions of short-day onion that were recently received at PGRU and are in the process of being processed and added to the onion collection.

Table 1. Taxa of *Allium* maintained at Geneva, New York

Taxa	G*	PI	Total	Number accessions backed up NCGRP
Allium cepa var. *cepa*	362	768	1130	519
Allium fistulosum	53	76	129	38
Allium total	421	855	1276	567

*Geneva local number, not yet PIed.

Regeneration Activities

Regenerations conducted the past three years are detailed in Table 2. The current SCA with Dr. Christopher Cramer at New Mexico State University (NSMU) was conducted for regeneration of short day onions with NMSU during 2005/2006 and has been extended for another season (2006/2007). The objective of this cooperative research project this past year was to regenerate 35 accessions of the short-day *Allium cepa* collection maintained at the Plant Genetic Resources Unit (PGRU) of Geneva. A total of 30 onion accessions were grown in order to produce bulbs for seed regeneration in 2007. Bulbs harvested from all accessions were stored under ambient conditions until September 2006. Efforts were made in 2005/2006 to identify sources of seed for short day onions for a) accessions that were in the collection which have been lost because of poor germination, and b) to identify varieties and lines of short day onions that should be added to the germplasm collection, which resulted in acquisition of 85 lines.

Germplasm Distribution

Between May 1, 2006 and July 1, 2007 a total of 280 samples of 233 accessions were distributed in 20 domestic and 9 foreign orders (Table 3).

Table 2. Regenerations of *Allium*

Place/Year/Type	*Allium cepa* var. *cepa*	*Allium fistulosum*	*Allium* total
Geneva			
Seed 2005	96	9	105
Seed 2006	55	7	62
Seed 2007	64	5	69
Bulbs/Plants 2005	78	12	90
Bulbs/Plants 2006	70	5	75
Bulbs/Plants 2007	85	11	96
Cooperators/NPGS Sites			
Seed 2005	38	0	38
Seed 2006	45	0	45
Seed 2007	42	0	42
Bulbs 2005	19	0	19
Bulbs 2006	30	0	30
Bulbs 2007	0	0	0
Total Seed Production			
Seed 2005	134	9	143
Seed 2006	100	7	107
Seed 2007	106	5	111

Table 3. Distribution of the Geneva *Allium* collection 2006/2007

Type/Statistic	*Allium cepa* var. *cepa*	*Allium fistulosum*	*Allium* total
Domestic			
Orders	17	10	20
Accessions	90	28	120
Samples	106	39	148
Foreign			
Orders	9	1	9
Accessions	112	13	125
Samples	119	13	132
Total			
Orders	26	11	29
Accessions	193	38	233
Samples	225	52	280

Appendix 5

North Central Regional Plant Introduction Station
Root and Bulb Vegetable CGC Report
Scottsdale, AZ
July 19, 2007
Submitted by K. R. Reitsma

DAUCUS

Statistics for the NCRPIS collection are found in the table below. Collection availability is at 78% with 84% of the collection backed up at the National Center for Genetic Resources Preservation (NCGRP) in Ft. Collins, CO. Only 1 new accession of *Daucus pusillus* was received thus far in 2007.

Taxon	New Accessions	PI Numbers	Ames Numbers	Total Accessions	Available	Backed up at NCGRP
D. aureus		7	3	10	2	4
D. broteri		1	12	13	9	10
D. capillifolius		1		1	1	1
D. carota		514	258	772 (801*)	690	729
D. carota ssp. *carota*		2	14	16	4	4
D. carota ssp. commutatus			2	2	1	1
D. carota ssp. *drepanensis*		3		3	1	2
D. carota ssp. *gadecaei*		1		1	1	1
D. carota ssp. *gummifer*		3	1	4	3	3
D. carota ssp. *hispanicus*			1	1		
D. carota ssp. *hispidus*			4	4		
D. carota ssp. maritimus			17	17		
D. carota ssp. *maximus*		2	14	16	1	2
D. carota var. *boissieri*		2		2	1	2
D. carota var. *sativus*		55	42	97	80	71
D. crinitus		2	10	12	3	3
D. durieua		1	1	2		
D. glochidiatus		1		1		
D. guttatus		1	17	18	16	13
D. halophilus			1	1		1
D. involucratus			4	4	3	2
D. littoralis		2		2	2	2
D. muricatus		2	6	8	2	3
D. pusillus	1	5	2	7	2	5
D. unidentified species			70	70	51	62
Total	**1**	**605**	**479**	**1113**	**873**	**942**

*The total number of *Daucus carota* accessions is 801 when including 29 NSSL-numbered accessions sent to us by NCGRP in 2006 for regeneration due to low viability.

Regeneration:
Accessions regenerated at Ames in 2006 have been processed, but we are awaiting viability test results before the seeds will be inventoried and stored for distribution. Fifty-five *Daucus* accessions were planted in the Ames greenhouse in October 2006 for the 2007 regeneration cycle. Five accessions failed to germinate, 5 were annuals, 45 were biennials, and 5 had mixed annual/biennial life cycles. Annual plants were pollinated by blue bottle flies and alfalfa leaf cutter bees in greenhouse isolation tents. Biennial plants of 45 accessions were vernalized and transplanted to field cages in May 2007, and 3

annual accessions were started in the greenhouse and also transplanted to field cages in May. All field cages will be controlled pollinated using blue bottle flies, house flies, alfalfa leaf cutter bees, and/or honey bees. Approximately 30 accessions will be started in the GH this fall for regeneration in 2008.

We also received seed increases of 6 “at risk” NCGRP accessions from Rob Maxwell (Seminis), and 8 “at risk” and 2 PI-numbered accessions from Roger Freeman (Nunhems). The 14 NCGRP (“at risk”) accessions will be assigned PI numbers and incorporated into the working collection at Ames. Sub-samples were sent to the NCGRP to replace their low-viability seed lots.

Distribution:
Thus far in 2007, 316 packets (284 accessions) of *Daucus* have been distributed for domestic orders, and 16 packets (16 accessions) were distributed for foreign requests.

Special projects:
I. In the spring of 2007, 73 *Daucus* accessions were transplanted into a biennial observation field so that we may collect characterization data, herbarium specimens, and images on each accession. Thus far, we have collected data for eight descriptors on basal leaf samples for each accession. Digital flat-bed scans have also been made of these leaf samples. We will collect root characterization data throughout the summer, and data will be collected on the inflorescences as plants bolt and flower this year and in 2008. These data and images will be loaded to GRIN. Our goal is to plant observation fields each year in order to collect data on all accessions in the collection.

II. Dr. David M. Spooner, Botanist, USDA-ARS, Vegetable Crops Research Unit, University of Wisconsin, Madison, WI visited our station July 5 and 6. Dr. Spooner has recently been redirected to begin working on the genus *Daucus*, and he gave a presentation to station and university staff about how he will apply his work in potato and tomato germplasm systematics to his work on *Daucus*. His visit to Ames was to begin to get acquainted with the NPGS *Daucus* collection and to discuss collaborative activities with NCRPIS personnel on future research activities. Dr. Spooner, Dr. P. Simon, Dr. M. Widrlechner, and I will be coordinating our efforts to develop molecular tools, to acquire herbarium specimens and images, and to collect characterization and molecular data on the *Daucus* collection. As part of this work, we will identify gaps that still remain in the NPGS collection and attempt to collect germplasm for underrepresented species. Dr. Spooner’s end goal is to use these data to publish a monograph for the genus *Daucus*.

III. Regarding development of molecular tools, Dr. Spooner was awarded a USDA NRI competitive grant (Jan 1-2008-Dec 31, 2009), entitled “COSII-based mapping and diversity in the Solanaceae” (Meredith Bonierbale, International Potato Center; Lucas Mueller, Cornell University; Cecile Ané, University of Wisconsin, collaborators). Although this proposal focused on the Solanaceae, Spooner added *Daucus* to the proposal just before submission when he learned that 20% of his time would be devoted to *Daucus* taxonomy and germplasm collection for his next CRIS’s 5-year cycle to begin in early 2008.

The focus of this call for proposals was molecular marker tool development. Relative to *Daucus*, the goals are to:

1. Facilitate comparative mapping by mapping 300 single-copy putative orthologues (COS-II markers or COSII) in 1) potato [*Solanum tuberosum*, mapping to a diploid

mapping population], and sequencing their orthologues in mapping parents of three other Euasterid crops where genomic resources are as yet undeveloped: 2) lulo or naranjilla, a sweet tropical fruit, using a *Solanum quitoense/S. hirsutum* cross, 3) diploid relatives of sweet potato, *Ipomoea batatas*, a member of the Convovulaceae, the sister family to the Solanaceae, using an intraspecific cross of diploid *I. trifida*, 4) carrot, *Daucus carota*, a member of the Euasterid clade that contains *Solanum*, using an intraspecific *D. carota* cross. Philipp Simon will provide DNA of two parents of one of his mapping populations for this purpose.

2. Make these data publicly available on GRIN and the SGN bioinformatics platform (http://sgn.cornell.edu/).

These COSII markers will be useful not only as mapping tools, but will be used to investigate the phylogeny of all available wild *Daucus* species available in the US Germplasm System. Spooner is collaborating with Philipp Simon to expand the collection of new wild species in the NPGS system that will be used in this project and in diversity assessment with DNA sequencing and with microsatellite markers.

IV. Last winter, Mark Widrlechner, David Brenner, and I summarized the status of Philipp Simon's 1999 umbel germplasm collections from Greece, Turkey, and Syria in the form of a paper entitled, "Results of an exploration to expand the diversity of *Daucus* and Apiaceae germplasm collections," which will be published in the next volume of the Umbelliferae Improvement Newsletter. It presents an overview of the 1999 exploration trip and information about the availability of these collections, their current taxonomic identities, and how they may be used in research.

PASTINACA

No new accessions of *Pastinaca* have been received, and no accessions are being regenerated in 2007. Of the 70 accessions in the collection, 51 are currently available for distribution and 47 accessions are backed up at the NCGRP. Five packets (5 accessions) were distributed for domestic orders in 2007.

Appendix 6

Status Report on the *Allium* Collection at the Western Regional Plant Introduction Station Submitted to the Root and Bulb Crop Germplasm Committee by Barbara Hellier (Curator) July 2007

There are currently 1012 accessions (467 PIs and 545 W6 numbers) in 104 species in the *Allium* collection at the Western Regional Plant Introduction Station in Pullman, WA. This collection contains both true seeded species and those maintained vegetatively. Of the 793 accessions of true seeded species, 399 are available for distribution. There are 232 vegetatively maintained accessions. These accessions are regenerated each year with availability determined after harvest and cleaning in September.

From June 2006 to June 2007, we received 19 new accessions: 6 wild *Allium* sp. from Kyrgystan ; 8 *Allium* sp from Tajikistan; 3 *Allium longicuspis* from Tajikistan; and one elephant garlic from California.

From June 2006 to June 2007 we distributed 314 seed or bulb packets of 208 accessions in 42 orders to 39 requestors. 2 of the requestors were from outside the US. The majority of the packets sent out were of *Allium sativum* and *A. longicuspis* (152 packets, one to two bulbs each). We also distributed 50 packets of *A. ampeloprasum*, 20 packets of *A. schoenoprasum*, and 15 packets of *A. tuberosum*. The remaining 77 distributions were for requests of 38 wild *Allium* species.

We are continuing to provide *A. sativum* material to the NCGRP for cryopreservation for a long term security back-up. We will be working with Dr. Maria Jenderek on this project. The back-up grow out for 2006-2007 was at the National Arid Land Plant Genetic Resource Unit in Parlier, CA.

We are continuing our work on assessing the genetic diversity patterns of *A. acuminatum* in the Great Basin. In 2005 we collected over 3,000 bulbs of *A. acuminatum* in southern Oregon, Idaho and north eastern Nevada. This material has been planted in two common garden plots and the DNA evaluated using SRAP markers. The second year common garden data has been collected.

We are taking a second year of phenotypic data on the new Central Asian garlic and *A. longicuspis* accessions. This includes flower and pollen data which will be entered into GRIN.

In June 2006, Dr. Richard Hannan resigned as WRPIS research leader. The position has been advertised and we hope to begin interviewing in late August. Our acting research leader is Dr. Daniel Skinner, Wheat Genetics Unit, Pullman, WA.

Appendix 7

Trip Report and Future Germplasm Collection Prospects

Allium and *Daucus* Germplasm Exploration in Tunisia

May 14-27, 2007 P.W. Simon, M. Neffati, et al.

Trip Summary: P.W. Simon traveled ~ 3100 km through Tunisia with M. Neffati or other scientific staff of Insitut des Regions Arides (IRA) from Djerba/Medenine to Remada to Tabarka and back to Djerba/Medenine over 13 days collecting 51 seed or bulb samples including native, wild *Allium* (2 species) and *Daucus* (6 species), as well as local cultivated varieties of carrot, onion, and garlic. Germplasm collections of particular interest were: 1) first collection of *Daucus sahariensis* for the USDA collection, 2) first collection of *Daucus syrticus* for the USDA collection, and 3) collection of the rare *Daucus durieua*. Critical observations were made of diversity in wild *Daucus carota*, noting a range of plant types beyond those that are observed in Central Asia, Anatolia, Middle East, Europe, or the Americas. Plans were discussed for future collections of germplasm and for collaborative research characterizing phenotypic and molecular diversity in *Allium* and *Daucus*, and evaluating nutritional/medicinal variation in *Allium*, hopefully involving exchange of students and staff.

Daily Log

May 13-14: Flight to Djerba. Trip plans reviewed on May 14 with Dr. Mohamed Neffati, Head of Pastoral Ecology Dept. and Range Ecology Lab at IRA, and Mr. Ameur Ben Dhafer, Didon Events. Dr. Neffati arranged scientific and overall logistical aspects of the trip. Mr. Ben Dhafer arranged vehicle, driver (Kareem), and rooms. Since the expedition plans called for travel throughout Tunisia during the trip and no long distance trekking with overnight camping was required to access germplasm, placing the travel arrangements with Didon Events was a very convenient, logistically sound (since they know hotel options and road conditions), and cost effective approach.

May 15: Djerba to Medenine. Observed *Allium ampeloprasum, Daucus carota, D. muricatus*, and *D. syrticus* on this short trip between Djeba and Medenine and collected all 3 *Daucus* species. As was the case for most of this expedition, most *D. carota*, much *D. muricatus*, and all *A. ampeloprasum* were too immature to collect ripe seed, but *D. syrticus* was prime for collecting. This was the first time Simon saw *D. syrticus*. Delivered lecture "Carrot and Garlic: New Directions for Old Crops" to about 40 IRA staff in Medenine. Met with Dr. Khettali and left for Tataouine (South of Medenine) with Bechir Bouzbida and Jamila Zamouri. Collected *D. syrticus, D. muricatus*, and first *D. sahariensis* near Bir Lahmer. This was the first time Simon saw *D. sahariensis*.

May 16: Collected between Tataouine and Remada (southernmost point of the trip) – *D. saharienis, D. syrticus* and end of season *A. roseum*. Remada to Chenini – more collection and observed *Citrullus*(?) roadside. At the Tataouine market we purchased carrot and onion landrace seed grown in Ferech (between Ghoumrassen and Tataouine). Return to Tataouine.

May 17: Many *A. ampeloprasum* and *Anethum* near Beni Kdache (no seed mature). South of Beni Kdache collected *D. durieua* (very rare), rather immature seed; also *D.*

syrticus. Hundreds of *D. carota* ("yellow"-flowered) near Zammour (no seed mature). Jamila Zamouri left the group in Medenine and Arbi Guetat joined us. Much *D. syrticus* from Medenine to Matmatas, and more *D. carota* near Matmatas (450 m altitude). In Gabes market, purchased onion, carrot, and (other) Apiaceous vegetable seed all produced in Gabes area. Also softneck local garlic. Numerous *D. syrticus* growing in immobilized sand on unattended land. Traveled to Matmatas.

May 18: Matmatas to El Hamma (near Gabes airport) much *D. syrticus*, and also on way to Gafsa. Near Gafsa in orchards (250 m altitude) abundant white-flowered, about 30-60 cm tall umbel, perhaps *Petroselinum*, that was evident throughout the trip north to about Sousse. Spineless, dark brown fruit but no mature seed. *D. carota* also in orchards, white-flowered in this area (no mature seed). Long trek in very rocky valley near Zannouch to view abundant diverse *A. ampeloprasum*. Returned to Gafsa.

May 19: Hwy 3 north collected *Allium sp.* bulbs (2-4 cm diam.). Not flowering. Abundant *D. carota* (yellow-flowered). *Thapsia garganica* evident near El Mzarra and throughout central-north Tunisia. Purchased local pink softneck garlic (similar to one seen in Gafsa). Saw local carrot and parsley seed fields. West of Sidi Bouzid on Hwy 125 observed harvest of a red hardneck garlic (with small bulbils and many flowers) that originated in Kelibia (on Cap Bon) grown by farmer Shrri Hamdi. On Hwy 13 in Lassouda Regional Forestry Park observed abundant *A. ampeloprasum* and harvested bulbs and seed of *Allium sp.* with fistulate leaves; very weak odor. Traveled to Sfax. We expected to see *D. syrticus* along eastern Hwy 13, based upon the Flora of Tunisia, but we did not find any.

May 20: Sfax north on Hwy 1 to Hwy 87 west to Souassi then east to Mahdia collecting *D. muricatus* and *A. sp.* We were given a tour of local *Allium* sites by two local extension agriculture specialists near Sidi El Hani where we saw the same *Allium* sp. as collected near Lassouda. Travelled to Sousse.

May 21: In downtown Hammam Sousse (a suburb of Sousse) we were led by two local extension agriculture specialists (Fatma Guen and Fathi Knaz) to a field, surrounded by city buildings, of 80 year old farmer Bechir Jedidi (located on 18 January Street, House 68, Bir El Akabaa, Hammam Sousse, Tunisia 4011) and his son, who produce their own seed and grow a crop for local sale of leek, carrot, beet, and a crucifer. Seed originated from crops Jedidi purchased in local markets about 50 years ago. We saw numerous *D. carota* along Hwy 1 north of Sousse. Collected the only *D. aureus* of the trip along the road next to a wheat field in a mixed stand with *Petroselinum*. Wild fennel is very common in this area and often infests cereal fields. In Nabeul farm market, we purchased local white hardneck garlic grown in Beja (NW Tunisia, about 50 km south of Tabarka; see May 24). *A. roseum*, just beginning to flower, was observed in a Nabeul city park. Traveled to Tunis. Met Dr. Neffati and Hanen Naajja there, who joined us.

May 22: Left Tunis on Hwy 3 (south) and found a "field" of *D. muricatus* in an olive grove between two wheat fields. Numerous *D. carota*, with white flowers and large umbel of 20-25 cm diameter were found here, but we observed a shift to "yellow"-flowered types as we traveled eastward beginning approx. 50 km from eastern seaboard. Also abundant *A. ampeloprasum*. Leaving Hwy 3 to Hwy 36 to Zaghouan and then on

Hwy 133 to Entida, *D. muricatus* was collected and more *A. ampeloprasum* was observed. *D. aureus* and *D. sahariensis* expected in this area, based upon the Flora of Tunisia, but they were not found. Returned to Tunis.

May 23: Met with Drs. Mougou and El Mourid in Dr. Mougou's office. Discussed this trip and prospects for small capacity building SCA, establishment of collaborative research and related exchange of personnel, and prospects for business opportunities that could develop for vegetable crop and seed production in Tunisia, both small-scale and large. Inquired about obtaining a phytosanitary permit and traveled toward Tabarka on Hwy 7. Observed white-flowered *D. carota* and odd umbelliferous plant (about 30 cm tall, short fennel-like leaves, no secondary branches) near wet area on way to Mateur. The region near Sejnene (about 10-20 km west) is an excellent *Daucus* area. Large *D. muricatus, D. carota*, and a species new on this trip, *D. setifolius* (need to confirm; no ripe seed), was observed amidst *A. ampeloprasum* and *Iris sp*. In a Division of Forestry reforestation project about 2-3 km east of Nefza, an unusual *D. carota* with large bracts and undulating outer whorl of umbellets was observed (immature seed). Travel to Tabarka.

May 24: From Tabarka to Beja (south on Hwy 17 to Ain Drahm, then east to Beja) much *D. carota* (white large umbels). On Hwy 17, 53 km from Beja, we visited a Forestry Reserve practicing cork harvesting. Young plants, perhaps a *Daucus*, was growing in rock wall (alt. 530 m). Large *D. muricatus* stands were easily evident along the roadside. Our group was joined by Lamiar Bellali, a local agriculture/natural resources specialist, and brought us to a goat-grazed hill with a new (on this trip) species of *Allium* with thin white petals, about 25 cm tall in early-mid flowering. *D. muricatus* and a new *D. carota* type (white flowers with small petals, no PCU, pale green-grey pubescent leaves, about 2 m tall), was prevalent in this region. Both *D. carota* and *D. muricatus* were abundant, covering hillsides. Returned to Tunis to get a phytosanitary certificate (Drs. Souad Mahmoad and Saled Jelassi) and then traveled to Kairouan.

May 25: Traveled to Medenine to split seed/bulb samples, pack shipping box containing samples, and reconnoiter for final discussions with Dr. Neffati, IRA staff, and with Dr. Khettali. Traveled to Djerba.

May 26: Traveled to Tunis. Met with Dr. El Mourid and discussed ICARDA efforts regarding field research and potential cooperative efforts.

May 27: Returned to Wisconsin.

General Observations, Future Prospects and Considerations

i) At least 2 collection times are necessary (mid- to late- May and late June to early July) to get mature seed of all species of interest in Tunisia. This collecting expedition was very successful in making the first collections of *Daucus sahariensis* and *Daucus syrticus*, heretofore not represented in the USDA Plant Germplasm Collections or any other genebank in the world. Collection of these species would not likely have been successful later in the season, as they were rapidly approaching the end of their short seed production period. A second collection expedition is necessary to collect a broader range

of ripe seed of *D. carota, D. muricatus, (Daucus* species predominantly found in northern Tunisia), as well as *Allium ampeloprasum*, northern *A. roseum*, and other *Allium* species. Dr. Neffati has indicated a willingness to collect more southern species in the Medenine region, which will help broaden the collection, but a full-scale expedition comparable to our 2007 effort is necessary to collect the abundant and diverse germplasm in a systematic and complete manner.

ii) *D. muricatus* occurred along edges and into grain fields, throughout orchards, and along roadsides throughout the trip. *D. syrticus* occurred in weedy areas near orchards and fields and most reliably in patches of vegetation that hold sandy soil from moving. *D. sahariensis* occurred in sites similar to *D. syrticus* but was much more prevalent in southern sandier soil. *D. muricatus* often occurred in small groups of 5-20 plants in the south but large populations in the north. *D. syrticus* and *D. sahariensis* occurred in very large populations of thousands, but were never obvious from a distance because of their small size. The latter two species have small umbels of 5-50 flowers that mature progressively as does the plant, but mature umbels break off and are blown away as they mature, making collection of more than 2-3 mature umbels on a plant unlikely.

iii) We may have observed *D. aureus* near Zaghouan that was immature and passed up it, if it was mixed amongst the plentiful smaller white-flowered umbels numerous along the roadside (*Petroselinum).* To collect the later-maturing species, the next collecting expedition needs to be later and may require numerous stops to find *D. aureus* among *Petroselenium*. *D. sahariensis* was expected near Zaghouan, based upon the Flora of Tunisia, but they were not found. Soil along the roadside seems too heavy to support *D. sahariensis*, based on what we saw in the south. Perhaps small hills offs the road are sandier and warrant closer explorations in the future.

Seed Samples Collected by P.W. Simon, M. Neffati, et al.
Tunisia May 14-27, 2007

Sample #	GPS #	GPS (altitude)	Genus species
1	2	N33.47.966 E10.52.790	*Daucus carota*
2	3	N33.47.227 E10.50.930	*D. syrticus*
3	4	N33.31.947 E10.40.359	*D. muricatus*
4	5	N33.12.049 E10.26.932	*D. sp. syrticus? sahariensis?*
5	5	N33.12.049 E10.26.932	*D. syrticus*
6	6	N32.39.905 E10.18.980	*D. syrticus*
7	6	N32.39.905 E10.18.980	*D. sahariensis*
8	7	N32.21.064 E10.20.039	*D. sahariensis*
9 (IRA only)	7	N32.21.064 E10.20.039	*Allium roseum (small bulbs)*
10	7	N32.21.064 E10.20.039	*D. sp.*
11	9	N32.395.88 E10.18.899	*D. sahariensis*
12	-	No GPS-Tataouine Market	*D. carota* (local cultivated carrot)
13	-	No GPS-Tataouine Market	*A. cepa* (local cultivated onion)
14	12	N33.12.714 E10.14.267	*D. syrticus*
15	12	N33.12.714 E10.14.267	*D. durieua? D. syrticus?*
16	13	N33.18.997 E10.22.965	*D. syrticus*
17	14	N33.23.085 E10.21.946	*D. syrticus*
18	-	No GPS-Gabes Seed Market	*A. sativum (*bulbs*)*
19	-	No GPS-Gabes Seed Market	*D. carota* (local cultivated carrot)
20	-	No GPS-Gabes Seed Market	*A. cepa* (local cultivated onion)
21	-	No GPS-Gabes Seed Market	*Pimpinella anisum* (local cultivated anise)
22	-	No GPS-Gabes Seed Market	*Cavum carvi (*local cultivated caraway)
23	-	No GPS-Gabes Seed Market	*Coriandrum sativum* (local cultivated coriander)
24	-	No GPS-Gabes Seed Market	*Cuminum cyminum* (local cultivated cumin)
25	-	No GPS-Gabes Seed Market	*Foeniculum vulgare (*local cultivated fennel*)*
26	16	N33.44.564 E10.00.952	*D. syrticus*
27	17	N33.44.026 E09.56.807	*D. syrticus*
28	18	N34.11.845 E09.39.433	*D. syrticus*
29	19	N34.23.000 E08.49.245	Unknown umbel *(Daucus?)*
30	20	N34.45.565 E09.05.104	*Allium sp. (*bulbs*)*
31	-	No GPS-Sidi Bouzid Farm Market	*Allium sativum* (bulbs)
32	21	N35.03.017 E09.23.808	*Allium sativum* (bulbs)

33	22	N35.06.600 E09.32.08	*Allium sp. (*bulbs)
34	23	N35.25.844 E10.35.366	*D. muricatus*
35	23	N35.25.844 E10.35.366	*Allium sp.*
35A	24	N35.51.312 E10.35.280	*D. carota*
36	25	N36.08.142 E10.23.657 (30m)	*D. aureus*
37	-	No GPS-Nabeul Farm Market	*A. sativum (*bulbs)
38	26	N36.41.071 E10.10.623 (30m)	*D. muricatus*
39	27	N36.36.861 E10.09.826 (70m)	*D. carota*
40	28	N36.33.441 E10.09.227 (200m)	*Daucus sp.*
41	29	N36.29.892 E10.08.223 (220m)	*D. muricatus*
42	29	N36.29.892 E10.08.223 (220m)	*D. sp.*
43	30	N30.23.904 E10.12.681 (120m)	*D. muricatus*
44 (IRA only)	31	N36.09.779 E10.18.740 (80m)	*Coriandrum*
45	33	N37.05.222 E09.33.212 (15m)	*D. muricatus*
46	34	N37.03.076 E09.27.681	*D. carota*
47	36	N37.02.024 E9.20.706 (250m)	*D. muricatus*
48	40	N36.46.675 E9.07.455	*D. muricatus*
49	7	N32.21.064 E10.20.039	*A. roseum*
50	22	N35.06.600 E09.32.08	*Allium sp.*

SCREENING OF A SAMPLE OF THE USDA BULB-ONION (*ALLIUM CEPA*) COLLECTION FOR RESISTANCE TO ONION SMUT (UROCYSTIS CEPULAE)

M.J. HAVEY AND M.R. MCDONALD

Introduction

The disease, onion smut, is specific to bulb onion and a few other *Allium* species. In some onion production areas, high rates of fungicide must be applied to protect onion seedlings from infection. However, fungicides are not always effective. Without fungicides, crop losses can be 50 to 75 percent. Identification of resistance, or even partial resistance to this disease would reduce crop losses and increase onion quality, while reducing the pesticide load in the environment.

Onion smut was first reported in 1869 in Connecticut, and has become an important disease throughout the onion production areas of the northern states, and around the world. The causal agent, Urocystis cepulae persists for years in the soil as teliospores, which germinate when stimulated by exudates from the host. Anderson (1925) tested 54 onion lines and found no indications of resistance to smut. Subsequently Utkhede and Rahe (1980) tested 225 plant introduction lines from the USDA world germplasm collection in addition to 60 onion cultivars. They identified three plant introduction lines that were completely resistant to smut. One cultivar, Hardy White Bunching, was also completely resistant to smut, but it is most likely that this is *Allium fustulosum*, which is know to be resistant. A cultivar of *A. cepa*, Wolska and six PIs showed some levels of resistance.

Utkhede and Rahe (1980) used a field screen in highly infested soil. This method allowed many lines to be tested but also resulted in a high degree of variability in the number of plants that emerged and in percent infection. The internal control used was Autumn Spice. Emergence of this cultivar ranged from 15 to 41 plants, while smut infection ranged from 65 to 100 percent, with a mean of 88.

Materials and Methods

Onions were seeded, one per cell, into plastic plug trays (200 plugs per tray) used for transplant production. The trays were filled with screened, naturally infested field soil, collected from the Muck Crops Research Station farm and stored at room temperature. There were 50 seeds per replicate and four replicates per line. Bioassays suggest that this soil contains approximately 250,000 teliospores per gram. Previous work (McDonald et al. 2003) has demonstrated that the incidence of onion smut infection on commercial onions grown in this soil ranges from 70-100%, depending on temperature.

Seeded trays were watered and placed in a germination room (12- 15 ^{o}C) until emergence, then placed in a greenhouse maintained at 15 -22 ^{o}C . Onion smut was assessed visually at the first true leaf stage and by destructive sampling at the three leaf stage. Emergence counts were recorded, because apparent susceptibility may be affected by the rate of emergence. Plants that emerge quickly will not be in the susceptible stage as long as those which emerge more slowly. Any relationship between rate of emergence

and incidence of onion smut will be investigated.

Approximately ninety lines will be evaluated at one time. This included PIs and a commercial standard Millennium. A total of 281 PIs were assessed in the greenhouse during the winter of 2003/2004.

Surviving plants of some of the most resistant lines were grown to bulbs. These putatively resistant bulbs were sent to Dr. Michael Havey for S1 and test cross seed production. In the future, these families will be re-evaluated for smut resistance and incorporated into onion breeding programs in the public and private sectors.

The USDA Plant Genetic Resources Unit, Geneva, NY, supplied the seed (100. All data on smut incidence and relative susceptibility to onion smut for each line will be provided to Geneva and entered into the GRIN network.

Results

Significant differences in onion smut incidence were found in each assessment, although most lines were not significantly different from Millennium, which was relatively susceptible to smut infection. Some of the most resistant lines were *Allium fistulosum.* Cultivars such as Nasik, Hamlet, Gala, Ringmaster and Sunset Red appeared to be highly susceptible to smut infection. Several lines appeared to have some resistance to smut, including Downing yellow globe, F-C 8432, Tareh, W6 4254, F-C 8407, and Morvanka.

Lines that were highly susceptible or resistant will be reassessed to confirm reaction to smut.