

ANNUAL REPORT FOR CALENDAR YEAR 2006

USDA ARS

National Clonal Germplasm Repository

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Ribes uva-crispa L. cv. JEANNE named and released June 2006.

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Collaborators

Francis J. Lawrence
Maxine Thompson

Annual Report for Calendar Year 2006

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Major Accomplishments for 2006

Service

- Unit scientists participated in two USDA PEO sponsored plant collecting expeditions to collect tree fruit and nut germplasm in the trans-Caucasus region of Armenia and Georgia in September and October, 2006, and to collect wild blueberry species from endangered populations in Florida in May 2006. Nearly 300 seed and plant samples were collected and brought back for use by US researchers and for preservation at NPGS genebanks.
- We received 339 plant requests and 3744 items were shipped in 2006. More people are accessing us through our website so our order processing is way up. About one fourth of our distribution was international. Continued expansion of the ranges of new pathogens and newly found pathogens in our genera are being added to our pathogen testing routines to meet international requirements.
- NCGR hosted a team of international strawberry experts to prepare a written statement on global conservation of *Fragaria* Genetic Resources in preparation for the Global Crop Diversity Trust from 5 – 8 July in Corvallis, Oregon. This was in conjunction with the Trust of IPGRI-UN/FAO, Rome.
- Barbara Reed is continuing to work with scientists in Almaty, Kazakhstan on developing *in vitro* and cryostorage of fruit crop genetic resources. The project now has a large *in vitro* collection of apples, pears and cherries and is developing systems for other crops. Cryopreservation of *Ribes* and *Malus* germplasm was very successful and work with *Prunus* is now underway. Exchange of genetic resources is part of the project, and apricot seeds of selected wild plants were provided to the Davis Repository and are now growing in quarantine.
- NCGR scientists collaborated with NCGRP on the long-term storage of our *in vitro* and cryogenic accessions. We provided techniques and plant materials for cryopreservation of the shoot tips in liquid nitrogen. We collaborated with NCGRP (Fort Collins) on trials to test cryogenic storage of dormant pear buds.
- Monitored NCGR *Vaccinium* field collection for Blueberry Shock Ilarvirus, Blueberry Scorch Carlavirus and Peach Rosette Mosaic Nepovirus. No Blueberry Scorch or PRMV were detected in 2006. Spread of the pollen borne blueberry shock ilarvirus from nearby commercial fields has increased during the past few years to the point that we will no longer attempt to remove infected plants as they are discovered. All distributions of *Vaccinium* cuttings will now be made from our protected greenhouse collection.
- Repository staff hosted an open house in the NCGR *Pyrus* Collection on 29 August 2006. The open house attracted at least 100 visitors and positive media coverage in local newspapers and on TV.

Research

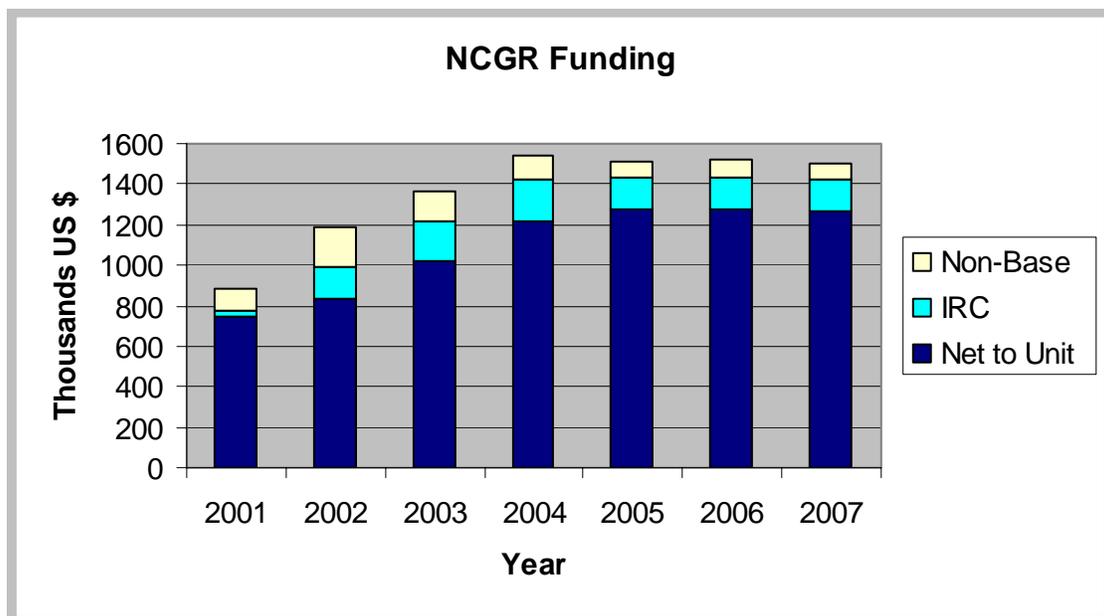
- Determined that *Humulus* cultures could be stored for a longer period of time if they had less iron in the storage medium.
- Found that a basic image-analysis screening technique for evaluation of *in vitro*-stored plantlets was equivalent to subjective human evaluation. The image analysis technique would require further development to be as efficient as the visual analysis.
- Studied the surface morphology of *Rubus* seed coats from 10 subgenera. Details of one seed accession indicate that it should be included in a different subgenus from its present classification.
- Continued and expanded our collaboration with the US Dept. of Interior, National Park Service (NPS) on identification of historic fruit trees in National Parks. DNA fingerprints were generated from pear samples collected by NPS colleagues at the John Muir National

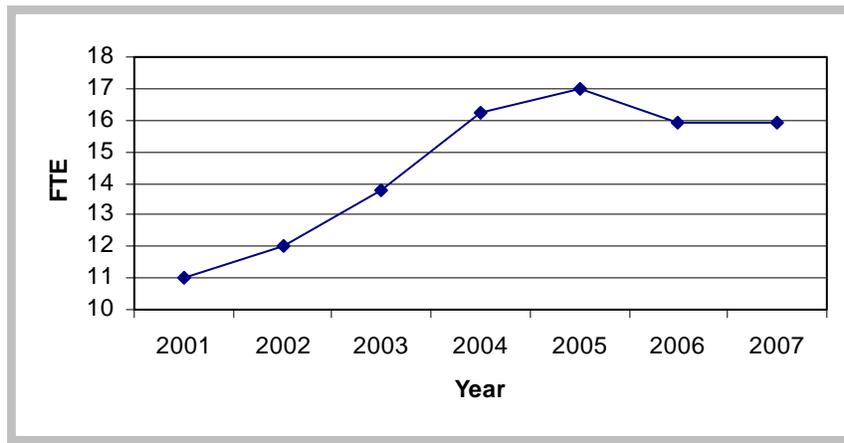
Historic Site in California and from the San Juan Island National Historic Park in Washington. SSR marker analysis recognized 27 of the 31 National Park pear trees as either identical to known cultivars, or identical to other trees sampled.

- Evaluated the NCGR quince (*Cydonia oblonga*) collection for incidence of *Fabraea* leaf spot and cedar-apple rust. Potential sources of disease resistance were observed. Evaluations will continue for at least 2 more years to confirm results.
- Identified 22 out of 72 SSRs to use in studying genetic diversity in *F. nipponica* and *F. iinumae* collected in Hokaido, Japan (collaboration with Kim Hummer and Tom Davis).
- Developed microsatellite markers for use in different species of *Fragaria*.
- Developed unique genetic profiles for 144 NCGR pear accessions using 9 SSR loci.
- Developed 12 new SSR loci in *Rubus* using SSR-enriched genomic libraries and used them to fingerprint 48 raspberry and 48 blackberry cultivars
- Used 10 SSR loci and 10 AFLP primer pairs to evaluate the genetic stability of four accessions of cryopreserved *Rubus* meristems
- Identified sixteen blueberry microsatellite markers that are useful for fingerprinting cranberry cultivars.

Administration

Budget and Staffing at the NCGR Corvallis





FY 2006

Amount	Purpose	Source
31,747	Cranberry genetic analysis	NW Center for Small Fruit
2,000	USDA ARS Summer Intern	USDA ARS PWA
6,700	Blackberry genetic analysis of juice	Oregon Blackberry Association
3,000	Cranberry genetic analysis of clones	BC Cranberry Growers Assn.
2,000	Cranberry genetic analysis	Oregon Cranberry Grow Assn
2,000	Cranberry genetic analysis	Washington Cranberry Alliance
9,500	Plant exploration to Georgia/Armenia	PEO, Beltsville, MD
10,000	Former Soviet Union Science Cooperative program for retraining scientists	ARS-OIRP
10,000	Azores travel and training grant	OIRP
6,000	Plant exploration to Florida to collect blueberries	PEO, Beltsville, MD
82,947	Total	

Administrative Overview

Staffing Changes

We have had a number of staffing changes this past year. In July 2006, Beth Timmons, Agricultural Science Research Technician working in our field collections, resigned to take on a job working with GPS systems in Linn County. Barbara Gilmore, Biological Science Research Technician for Dr. Nahla Bassil, resigned in October 2006 to finish her Ph. D. Barbara successfully defended her thesis on QTL's for white mold resistance in *Phaseolus coccinius*. We wish Dr. Gilmore the best in her new research career!

Nina Castillo, graduate student under Dr. Barbara Reed, also working with Dr. Nahla Bassil, successfully defended her M.S. thesis in the Fall 2006. In September 2006, Danny Dalton began a M.S. program on *Ribes* and white pine blister rust working under Dr. Kim Hummer.

The following staff members have been promoted during the past year: Joseph Postman, Plant Pathologist/Curator; Yvonne Pedersen, Program Assistant. We congratulate them.

Budget and Fiscal

Our base funding has remained at about \$1.4 million for the past three years. Our last significant increase was FY 2003, which came through executive request of congressional sources as a

result of lobbying efforts by the American Seed Trade Organization. With promotions, within grade increases and pay-act increases our salary costs are more than \$1 million. Our administrative overhead charges have been roughly the same for the past 3 years. The non-base funding that our scientists have been able to obtain has been fairly constant at about \$75,000 per annum.

View from the Front Office

Specialty crops, the lower acreage crops that we at the NCGR-Corvallis Genebank work with, are greatly important in world political circles and are becoming more important within the United States. As one looks around the world, considering efforts such as the Global Horticulture Initiative, one realizes that agriculture and horticulture on a small scale of farmer to farmer, not “magnum agriculture,” has the potential to allow humanity to meet the millennium goals to reduce poverty and feed the poor. Crop diversity is a foundation for the solution to poverty.

The very rich have become aware of agriculture, conservation and diversity issues. They are contributing millions of dollars towards the global trust of genetic diversity, seed and germplasm conservation, and rural development. The next Farm Bill of the U. S. Congress will emphasize “specialty crops” in a way that has not been seen in prior years. Genomics and germplasm will play a vital role in the next decades of scientific discovery.

While the above activities provide optimism about the future, the actuality of our present budget provides us with short and long term challenges. In 2003 we were provided with a base funding increase of \$187,000. With this increase we were able to hire needed limited scientific support and term positions to assist with our seed, in vitro, and plant conservation efforts. These positions are now in jeopardy. We are trying to revamp our approaches to be more efficient and yet not sacrifice security back-up of our genetic resources, but our tasks require a basic amount of skilled employees especially considering the long-term nature of our mission.

We are encouraged by efforts to include a National Clean Plant Network year’s Farm Bill. We hope that NPGS gene banks will be included as part of this network and that there will be support for an addition of a research plant pathologist could be added to our staff. Many diseases for our crops have expanded their range and are now significant issues that our staff has to manage. The additional oversight of a research plant pathologist with support of technical staff could scout for newly emerging disease situations and keep our collections clean of pathogens and certifiable to meet new quarantine requirements.

The ARS homeland security office has determined that national collections at germplasm repositories, such as ours, require additional protection. They have now installed CCTV monitoring and a more secure front gate for our facilities. We have new ID badges and all visitors sign in at the reception area prior to touring the Repository.

EEO/CR/Outreach

- We had an 1890s university graduate student visit our facility to give an EEO seminar at the Corvallis Location concerning improving communication between students at 1890s and ARS scientists.
- We are working with Dr. Bobby Phills, Florida A&M University, on an 1890’s Capacity Building Grant concerning development of low chilling *Rubus*. He and two of his staff members visited our unit in May 2006.

- We are working with Dr. Kirk Pomper, Kentucky State University on an 1890's Capacity Building Grant concerning evaluation of specialty fruit crops for Kentucky production.
- Through Research Support Agreement with Oregon State University four female graduate students were trained. Two of these students were women of color; two Asian; one disabled.
- During the winter, 15 disabled high school students (program was funded through local school district grant) were trained in greenhouse management activities.
- During the winter an additional 3 disabled individuals from a local private organization (Work Unlimited) were trained in strawberry greenhouse activities.
- Two disabled individuals have temporary federal technical appointments on our staff.

Facilities and Security

We are working within the federal mandate to have "greener" operations. We received funding from headquarters to upgrade our boiler this year. The new boiler being much more efficient than our old boiler will provide energy savings. We continue to replace old lighting with new efficient lighting systems. We have installed a new back-up generator that has provided us with stable electricity during recent winter power outages.

During 2006 we installed computerized greenhouse controllers so that ventilation, heating and cooling systems can be optimized and activated only when needed. We have installed a new positive air pressure system in the headhouse to prevent greenhouse air from infiltrating the headhouse during pest control actions.

Accession Summary – as of June 1, 2007

	Number of Taxa	Total Accessions	Seed Accessions	Field Plants	Screen- house Plants	in vitro Plants
Major Genera						
Actinidia (Hardy Kiwi)	34	160	22	125	52	0
Corylus (Hazelnut)	23	607	2	639	136	27
Cydonia (Quince)	3	87	14	98	32	0
Fragaria (Strawberry)	53	1491	377	0	1933	177
Humulus (Hops)	6	510	273	17	398	51
Mentha (Mint)	37	482	55	0	512	172
Pyrus (Pear)	46	1820	327	1930	628	146
Ribes (Currant/Gooseberry)	119	996	487	1132	437	40
Rubus (Blackberry/Raspberry)	174	1513	1131	190	1680	105
Vaccinium (Blueberry/Cranberry)	82	1237	771	640	756	72
Amelanchier (Serviceberry)	15	71	51	16	1	8
Total Major Genera:	592	8974	3510	4787	6565	798
Minor Genera						
Asimina (Pawpaw)	4	50	8	67	10	5
Chaenomeles (Asian Quince)	3	6	0	23	4	0
Crataegus (Hawthorn)	7	6	6	7	0	0
Duchesnea (False Strawberry)	1	4	1	0	9	0
Gaultheria	19	33	26	0	1	0
Gaylussacia	7	16	12	0	6	0
Intergeneric Hybrids	13	27	3	16	13	2
Juglans (Butternut)	2	60	0	21	2	0
Lonicera	13	52	28	31	22	0
Mespilus (Medlar)	3	46	18	24	43	0
Peraphyllum	1	6	5	0	0	0
Potentilla	1	2	1	0	1	0
Pycnanthemum (Mountain Mint)	27	94	69	0	67	30
Sambucus (Elderberry)	33	143	114	42	12	0
Sorbus (Mountain Ash)	68	227	161	59	8	0
Miscellaneous Other Genera	27	98	48	52	91	0
Total Minor Genera:	229	870	500	342	289	37
Total All Genera:	821	9844	4010	5129	6854	835

Awards 2006

Compiled by: Yvonne Pedersen

Kim Hummer – Performance Bonus Award for superior performance rating for January 2005 through December 2005; awarded February 2006.

Nahla Bassil – Performance Bonus Award for highly superior performance rating for January 2006 through December 2006; awarded January 2007.

Beth Timmons – Performance Bonus Award for superior performance rating for April 2005 through March 2006; awarded June 2006.

James Oliphant – Performance Bonus Award for implementation of many innovative ideas and highly superior performance during the April 2006 through March 2006 evaluation period; awarded June 2006.

Missy Fix – Performance Bonus Award for outstanding performance in all areas and all elements of the position; awarded June 2006.

Barbara Gilmore – Performance Bonus Award for outstanding performance in managing the genetics laboratory; awarded June 2006.

Janine de Paz – Performance Bonus Award for superior performance in the collection and distribution of in vitro plants at NCGR; awarded June 2006.

Jeanine DeNoma - Performance Bonus Award for superior performance in support of the cryopreservation program at NCGR; awarded June 2006.

Yvonne Pedersen - Quality Step Increase for outstanding rating in performance accomplishments for April 2005 through March 2006; awarded June 2006.

Barbara Gilmore – Spot Award for extra effort in maintaining the laboratory equipment for molecular analysis during absence of supervisor; awarded November 2006.

Training 2006

Compiled by: Yvonne Pedersen

Jim Oliphant, Missy Fix, and Joe Snead – Corvallis, Oregon to attend the Non-Crop Vegetation Management Course; January 2006.

Jim Oliphant, Missy Fix, and Joe Snead – Aurora, Oregon to attend the North Willamette Horticulture Society Meeting; January 2006.

Beth Timmons – Eugene, Oregon for pesticide applicator testing, March 2006.

Jim Oliphant, Missy Fix, and Joe Snead - Portland, Oregon to attend the Farwest Show and seminar; August 2006.

All employees completed the AgLearn training of Security Awareness and the Ethics Training; prior to September 2006.

Joseph Postman and Yvonne Pedersen continue to participate in the monthly ARS Site Publisher teleconference/training.

Travel 2006

Compiled by: Yvonne Pedersen

Nahla Bassil – British Columbia, for the North American Cranberry Research and Extension Workers Conference (NACREW), presented paper and preliminary results on the potential usefulness of microsatellite markers developed in blueberry for cranberry molecular analyses; October 2005.

Joseph Postman – Seattle, Washington, for the Western Washington Tree Fruit Association meeting; October 2005.

Kim Hummer – Geneva, New York, to attend and give report of the repository activities to SFCGC (National Berry Crop Initiative Strategic Planning Workshop) and NCCC-22 (Small Fruit and Viticulture Workshop) meetings; October 2005.

Kim Hummer – Baltimore, Maryland, to attend the NP-301 Planning Meeting; October 2005.

Nahla Bassil – Portland, Oregon, to attend the Northwest Center for Small Fruits Research meeting; November 2005.

Joseph Postman – Chicago, Illinois, to attend the NPGS Curator Workshop; December 2005.

Kim Hummer – Emeryville, California, to attend the PWA Leadership Conference; December 2005.

Joseph Postman – Mt. Vernon, Washington, to attend the Western Small Fruit Pest Conference; January 2006.

Nahla Bassil – San Diego, California, to attend Plant and Animal Genome XIV Conference; January 2006.

Doug Cook – College Station, Texas, invited for database management consultation, USDA Pecans & Hickory Station; March 2006.

Barbara Reed and Jeanine DeNoma – Ft. Collins, Colorado, to attend the NCGRP Program Meeting; April 2006.

Kim Hummer and Paul Lyrene – Florida, to collect at the request of the Plant Exploration Office; May 2006.

Barbara Reed – Minneapolis, Minnesota, to attend the SIVB (Society for *In Vitro* Biology) meeting to give presentation and serve as co-chairperson; June 2006.

Kim Hummer and Joseph Postman – Ames, Iowa, invited to attend the PGO (Plant Germplasm Operations Committee) the RTACs (Regional Technical Advisory Committees) and CGC Chairs meeting; June 2006.

Barbara Reed – Hamburg, Germany and Montpellier, France, to attend and present paper at the Joint meeting of the Society for Cryobiology and the Society for Low Temperature Biology and visit Dr. Patrick Doumas a biologist with the INRA in France; July 2006.

Kim Hummer and Nahla Bassil – New Orleans, Louisiana, to give presentations at the ASHS meeting; July 2006.

Kim Hummer – Seoul, Korea, to attend, convene/moderate, and give presentations at the International Horticultural Congress meeting; August 2006.

Joseph Postman – Lexington, Kentucky, to attend the North American Fruit Explorers Meeting; August 2006.

Doug Cook – Geneva, New York, to attend the GRIN Site Meeting; September 2006

Barbara Reed – Almaty, Kazakhstan for required site visit for grant project and Kew Gardens in London, England visit in vitro lab; September 2006

Kim Hummer – St. Louis, Missouri, to attend and participate in the NP301 Meeting; September 2006.

Barbara Reed and Sugae Wada attended the ISHS Seed Meeting in San Antonio, TX to present a poster, December 2006..

Visitors 2006

by: Yvonne Pedersen

During Calendar Year 2006, 574 people came through the Repository's doors. Guests arrived in large or small groups, or as individuals. The Repository served as a meeting site for a group of approximately 25 international strawberry researchers meeting to develop a global strategy, an Open House for the release of 'Jeanne' gooseberry with approximately 30 attending, and an

Open House celebrating the 25th anniversary of the National Clonal Germplasm Repository in Corvallis with approximately 25 attending.

Some groups used the Repository for their annual meetings such as the Oregon Hop Council, the Oregon Sweet Cherry Commission, and the Oregon Processed Vegetable Committee. Educational tours ranging from groups of 8 to 18 came from Western Forestry and Conservation Nursery Association, Home Orchard Society, Master Gardener Group, Oregon State University, Philomath School District, Corvallis School District, as well as the Greater Albany Public Schools to tour the facility for their horticultural experience. There were also numerous visitors from around the world: 1 each from the United Kingdom, Russia, Thailand, Poland, Italy, Portugal, Algeria, Tunisia, Germany, Uzbekistan, and 2 from China. Also, there were graduate students working at the National Clonal Germplasm Repository from Kenya, Nigeria, Japan, and the Philippines.

Plant Pathology

by Joseph Postman

Virus Indexing 2006

- Blueberry Scorch Carlavirus was not detected during annual ELISA monitoring of the NCGR field collection. We hope to have eliminated this virus from the Corvallis location. The NCGR *Vaccinium* field collection was also tested for Blueberry Shock Ilarvirus and Peach Rosette Mosaic Nepovirus. Although no Blueberry Scorch or PRMV was detected, Blueberry Shock is now well established in the Corvallis area. Spread of this pollen borne virus from nearby commercial fields has increased during the past few years to the point that we will no longer attempt to removed infected plants as they are discovered. All distributions of *Vaccinium* cuttings will now be made from our protected greenhouse collection.
- All new and untested *Corylus* accessions were assayed by ELISA for apple mosaic ilarvirus. One infected plant was detected, a seedling grown from seed collected in the Republic of Georgia in 2004. The plant was removed from the collection.

Summary of 2006 Virus Assays

Genus	Bioassays	ELISA or PCR
<i>Corylus</i>	3	139
<i>Cydonia</i>	54	-
<i>Fragaria</i>	32	23
<i>Humulus</i>	-	-
<i>Mentha</i>	-	-
<i>Mespilus</i>	17	-
<i>Pyrus</i>	-	2
<i>Ribes</i>	20	-
<i>Rubus</i>	0	30
<i>Sambucus</i>	1	-
<i>Vaccinium</i>	-	1164

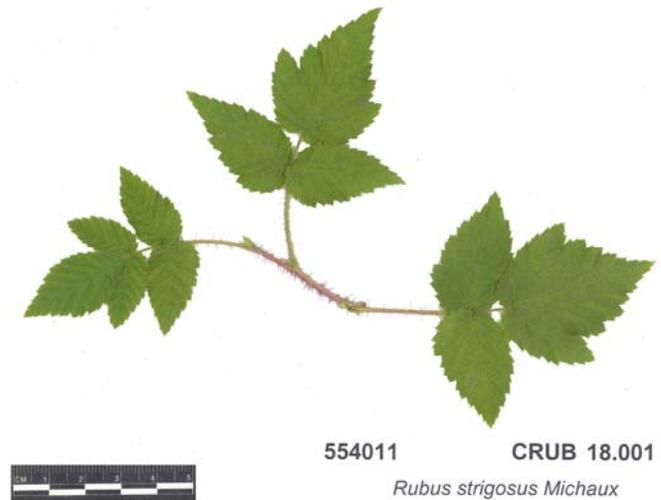
Other Plant Pathology Activities

Cydonia Evaluation – The NCGR quince (*Cydonia oblonga*) collection was evaluated for incidence of *Fabraea* leaf spot and cedar-apple rust. Potential sources of disease resistance were observed. Evaluations will continue for at least 2 more years to confirm and build upon these results.

Corylus – EFB is Still Near. We are still able to report that Eastern Filbert Blight of hazelnut (*Anisogramma anomala*) has not been observed in our collection. Last year we wrote that this fungal disease has been present in Corvallis since 2004 within 2 miles of the Repository. We continue to protect our field collection with prophylactic fungicide sprays and monitor several times a year for symptoms. Only *Corylus* in vitro cultures can be distributed to requestors outside the United States.

Plant Collections:

- **Rubus leaf scans** – With the assistance of Tyler Young, we scanned leaf samples from more than 100 *Rubus* accessions to be loaded to GRIN.
- **Pear fruit photos** – About 500 pear fruit photos were taken to document cultivar accessions.
- **New *Corylus* accessions** – 17 seedlings representing native North American hazelnuts, 16 seedlings from Korea, 2 EFB resistant cultivars released by Oregon State University, and several accessions from the Republic of Georgia were added in 2006.
- **New *Cydonia* accessions** – Four new quince cultivars and one seedlot from central Asia were received in 2006. A dozen cultivars were collected in Armenia and Georgia and sent to the National Plant Germplasm Quarantine Program for processing.
- **New *Mespilus* accessions** – 14 medlar clones and 4 seedlots were collected in Armenia and Georgia, significantly expanding the germplasm available in the U.S. from the center of origin of this “minor” crop.
- **New *Pyrus* accessions** – 13 new seedlots collected in Armenia and Georgia were added to the genebank in 2006. 20 clonal accessions were received from the National Plant Germplasm Quarantine Program, representing cultivated and wild *Pyrus* germplasm from many different countries. About 150 seedling accessions were added to the collection in 2006, either from new accessions collected during recent expeditions, or from old seedlots with low seed counts or poor germination assays. These seedlings will be planted in our new pear species orchard, allowing the preservation of at-risk seedlots and providing an opportunity for future seed replenishment through controlled crossing.



Molecular Genetics

By Nahla V. Bassil

Continuing Graduate Student

Wambui Njuguna, PhD, student in Horticulture at OSU is actively working on three projects that use molecular markers to answer different questions in *Fragaria*. The objective of the first project is to evaluate genetic diversity in *F. nipponica* and *F. iinumae* collected in Hokaido, Japan (collaboration with Kim Hummer and Tom Davis). Twenty-two out of 72 strawberry SSRs evaluated amplified in these two wild species and are in use for genetic diversity assessment in those two Asian diploid species. The second project evaluates four chloroplast sequences and the ITS nuclear DNA sequence for usefulness in barcoding and species identification in *Fragaria*. Wambui continues her work on identifying a strawberry microsatellite fingerprinting set.

Projects in Progress 2006

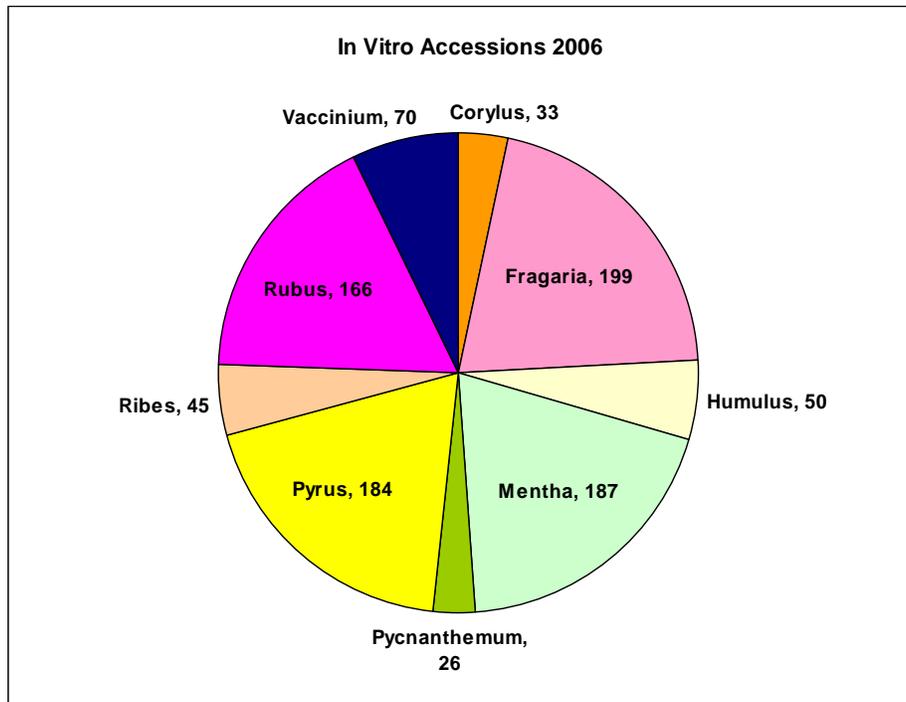
Genetic diversity of Corylus species using trinucleotide microsatellites. We are using 15 trinucleotide SSR markers to fingerprint 169 *Corylus* accessions including five shrub species (*C. avellana*, *C. americana*, *C. cornuta*, *C. heterophylla*, and *C. sieboldiana*), and five hazelnut tree species (*C. colurna*, *C. jacquemontii*, *C. chinensis*, *C. ferox* and *C. papyraceae*). We continue to collaborate with Dr. Shawn Mehlenbacher on developing additional microsatellite loci to saturate the hazelnut linkage map and on developing a hazelnut fingerprinting set.

Genetic fingerprinting and identification of pear. We are still evaluating 9 EST-SSRs for developing genetic profiles for 144 pear accessions. Six apple and five pear microsatellite markers were used to determine genetic relationships among 18 apple and 9 heritage European pear cultivars grown in the Azores and 8 additional standard accessions of each. Eleven SSR markers were used to identify 31 European pear trees growing in the San Juan Island National Historical Park (NHP) north of Seattle, Washington, and at the John Muir National Historic Site (NHS) in Martinez, California. Four pear trees growing at the English Camp at San Juan NHP had SSR fingerprints identical to 'Pound Pear'. Four other San Juan NHP pears were found to be identical to 'Bartlett' and one was identical to 'White Doyenne'. Other pear trees at San Juan NHS were identical to each other, but did not match any of the standards. Seven pear trees at John Muir NHS were indistinguishable from 'Bartlett', and two trees were identical to each other but we were unable to match them to the standards. About 20 pear trees remain in an orchard where John Muir was buried in 1915 and are now a part of the National Historic Site. A large tree growing by his gravesite was confirmed as 'Bartlett'.

Genetic fingerprinting of cranberry. Sixteen out of 46 blueberry SSRs were found to amplify and generate polymorphic markers in 16 important cranberry genotypes. Nine of these blueberry SSR markers were used to fingerprint 43 cranberry accessions making up the core collection at the NCGR, and to evaluate genetic variation of important cultivars growing in Oregon and Vancouver (British Columbia). These markers differentiated between all cranberry varieties except for 'Howes' and 'Pride'. Multiple genotypes or variants were found in five cranberry cultivars ('Stevens', 'Crowley', 'McFarlin', 'Olson's Honkers' and 'Pilgrim') collected from 11 Oregon bogs and in two cultivars ('Bergman' and 'Stevens') collected from Vancouver.

Genetic stability of cryopreserved Rubus plants. MS student Nina Castillo (studying at OSU on a Fulbright Fellowship) completed her study of the genetic fidelity of cryostored *Rubus* meristems in cooperation with Dr. Reed. This study used AFLP and SSR markers to look at the genetic stability of *Rubus* shoot tips following long-term storage (14 years) in liquid nitrogen. Nina compared

iron retained their healthy growth in storage longer than plants with added sequestrene iron. In a new test to determine the best storage conditions, plants were grown on two types of iron and then stored on eight iron concentrations. The stored cultures will be evaluated to determine the best pregrowth medium and the best storage concentration. Jeanine DeNoma carried out this study.



The In Vitro collection

The spring and summer explanting season included 447 accessions successfully initiated into culture. Janine de Paz and student helper Sonja McMackin collected materials as plants were available.

Antioxidant effects on cryopreserved shoot tips. Ph.D. student Esther Uchendu (studying at OSU on a Ford Foundation Fellowship) is studying the effect of antioxidants on cryopreserved shoot tips. This study will determine the effectiveness of including antioxidants at various stages of the cryopreservation protocol. Esther will also develop improved cryopreservation protocols for *Mentha* and *Vaccinium* accessions.

Germplasm preservation of fruit, berry cultures and grape in Kazakhstan.

Barbara Reed is continuing to work with scientists in Almaty, Kazakhstan, developing *in vitro* and cryostorage of fruit crop genetic resources. The project now has a large *in vitro* collection of apples pears and cherries and is developing systems for other crops. Cryopreservation of *Ribes* and *Malus* germplasm was very successful and work with *Prunus* is now underway. Exchange of genetic resources is part of the project, and apricot seeds of selected wild plants were provided to the Davis Repository. They were germinated in quarantine and will be released when certified by the quarantine lab.

Field Collections and North Farm Management 2006

By Joe Snead



The field collections continue to grow slowly. The field collections are becoming more diversified with new small collections of *Chaenoameles*, *Docynia*, and *Schisandra*. Each of these collections has been placed in the newly finished Minor Genera Block. Several new minor genera collections will go in the field in 2007.



A small planting of 20 *Vaccinium myrtillus* was planted for display purposes. There were 192 new accessions planted in all the different field collections in 2006 and about 50 replacement

plants. Altogether there are 5,078 plants in the ground, representing 4,188 accessions (some accessions are represented by 2 plants).

2006 Field Accessions

Genera	Accessions in field	Total plants	Accessions Planted 2006
Vaccinium	348	728	18
Corylus	613	613	41
Pyrus Field1	1699	1699	34
Pyrus Backup	101	101	0
Pyrus North Farm	124	124	5
Ribes	698	1121	24
Rubus	100	187	12
Lonicera	31	31	6
Actinidia	125	125	25
Sorbus	63	63	1
Juglan	34	34	11
Mespilus	27	27	1
IGC	13	13	0
Cydonia	98	98	4
Asimina	52	52	0
Aronia	7	13	1
Chaenoameles	6	6	2
Docynia	2	2	0
Schisandra	6	6	6
Amelanchier	8	8	8
Sambucus	33	33	0
Total	4188	5078	192

The North Farm is also used for several ARS projects and one OSU Horticulture project. In the last year the ARS Small fruits breeding program has given up two plots, a *Sambucus* planting and a lingonberry planting. The *Sambucus* planting will be maintained until the Repository collection is established. The lingonberry planting has disease and weed problems and most likely will be removed. The ARS Small fruits breeding program also has a *Vaccinium* breeding plot which has decreased significantly. It is now only four partial rows. Denny Bruck of the ARS Horticultural Crops Research Center has a small strawberry plot and a small pot-in-pot planting that he took over from a previous researcher. These small plots will probably be maintained for the near future. The ARS Hops breeding program continues to maintain two acres of hop germplasm on the farm. Maxine Thompson emeritus from OSU continues her *Lonicera* breeding program on three acres.

Changes in the field personnel continued in 2006. Presently there is one permanent technician aided by work-study students, short term appointments, and student help. There is the means to bring in contract labor for bigger jobs.

Looking to the future, several of the fields are filling up. The *Corylus* field has less than thirty plant spaces left. All the tree hazels are being propagated and will be planted by the pear field. They can grow to their full potential there without being hedged or topped. That will open up some spaces in the main field. The small fruits breeding program will be done with the field adjacent to the main *Corylus* collection in a year and that will allow for expansion space in

several years. The main *Pyrus* field is almost full, especially the cultivar section. The *Pyrus* species field on the north farm will allow the removal of the seedling rows at the end of the cultivar collection. Reorganization of the *Pyrus* rootstock selections and the rest of the species block will take some time. The *Actinidia* field was full this year, but the small fruits breeding program removed many of the seedlings that they had been evaluating. This opened up enough space for a few years. The many seedling plants that remain from the evaluations will probably be propagated and incorporated into the main collection.

Disease continues to be a real threat to two of the field collections. The *Corylus* field is under the threat of Eastern Filbert Blight. The field is carefully monitored and no blight has been detected. The field receives a heavy spray regime to combat the problem. The Blueberry field is infected with Blueberry Shock Virus. Material is no longer distributed from the field. The field will be used for display and evaluations.

Several of the field collections are world class and continue to attract visitors from around the world. In August of last year the Repository had an open house and showcased the pear collection. This attracted about one hundred people from the local area. People were very interested in what our mission is and amazed by the diversity of the fruit.

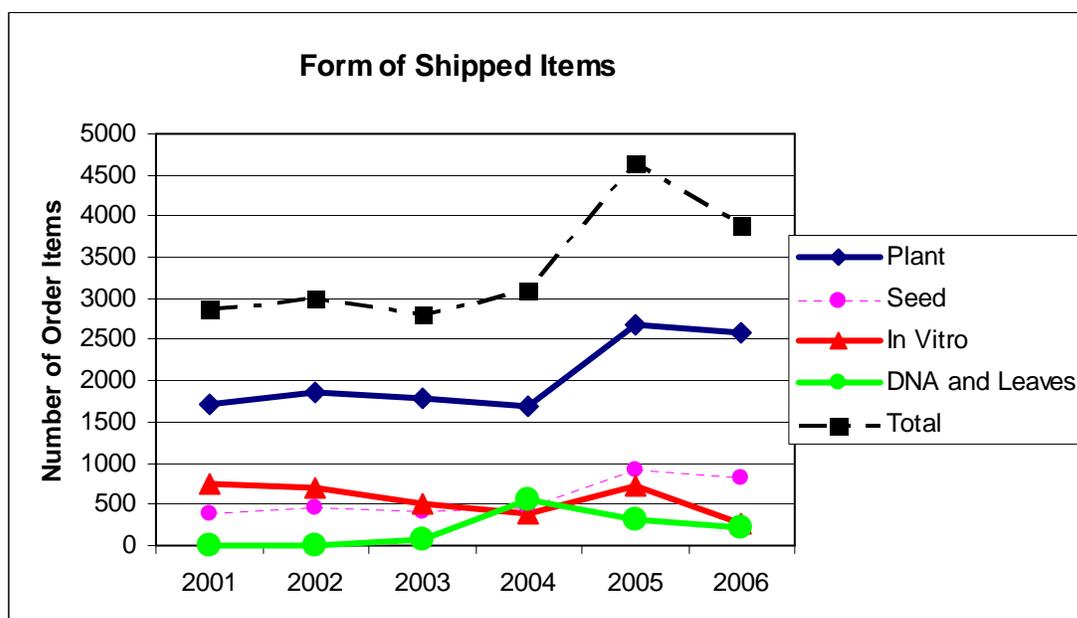
Plant Distribution

By Bruce R. Bartlett

2006 Highlights

- 3,895 items were shipped as seeds, cuttings, runners, scionwood, rooted plants, tissue culture and DNA.
- 245 tissue cultured accessions were sent to the National Center for Genetic Resources and Preservation (NCGRP) in Ft. Collins, Colorado as backup. This is 90% of all tissue culture accessions shipped to domestic requestors.
- 89 seed accessions were sent to NCGRP as backup. This is 11% of all seed accessions shipped to domestic requestors.
- 89% of accessions requested in 2006 have been shipped.
- 23% of all items shipped were sent to foreign requestors.
- Requests for DNA samples of our accessions, in the form of DNA and lyophilized leaves, were 222 or 6% of the total number of accessions shipped.
- Scionwood (33%), Seed (15%) and Dormant Cuttings (10%) were the top three forms sent to domestic requestors.
- Seed (42%), Dormant Cuttings (16%) and Plants (16%) were the top three forms sent to foreign requestors.

The NCGR-Corvallis continues to distribute plant germplasm within the United States and at the international level. The information supplied in this report reflect all items shipped in CY 2006 which represent some accessions requested from 2003 up to and including 2006. Information is also presented that represents all accessions requested only during CY 2006.

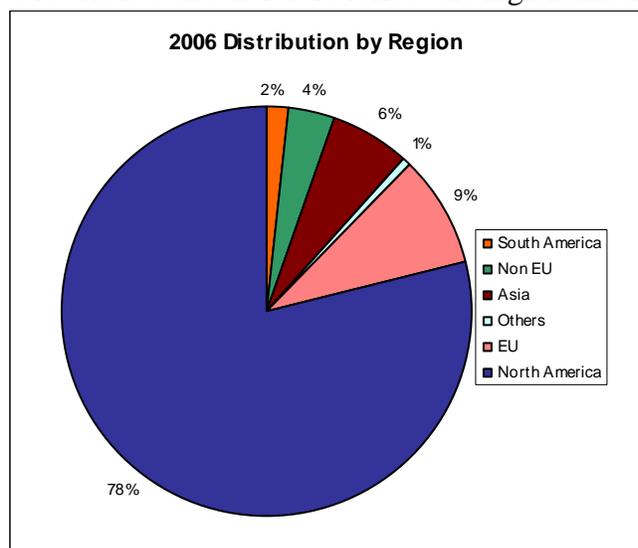


Plants and seed still remain the most predominant form sent.

Material requested in a given year may require more than one year before the item is eventually shipped. This is due to the fact that we have very diverse holdings and are a clonal facility. At times plant material needs to be propagated from our mother plants in order to have items in a form that is sufficient for shipping. This is especially true for international requests. However, 85 to 90% of items requested will be shipped within two years of the original request. During 2006, one item from request year 2003 was shipped, 52 from 2004, and 1,338 from 2005.

Domestically, *Pyrus*, *Rubus* and *Fragaria* were most requested. Internationally, the order was *Fragaria*, *Vaccinium* and *Pyrus*. When considering all items shipped, regardless of destination, the top three genera were *Pyrus*, *Fragaria* and *Vaccinium*.

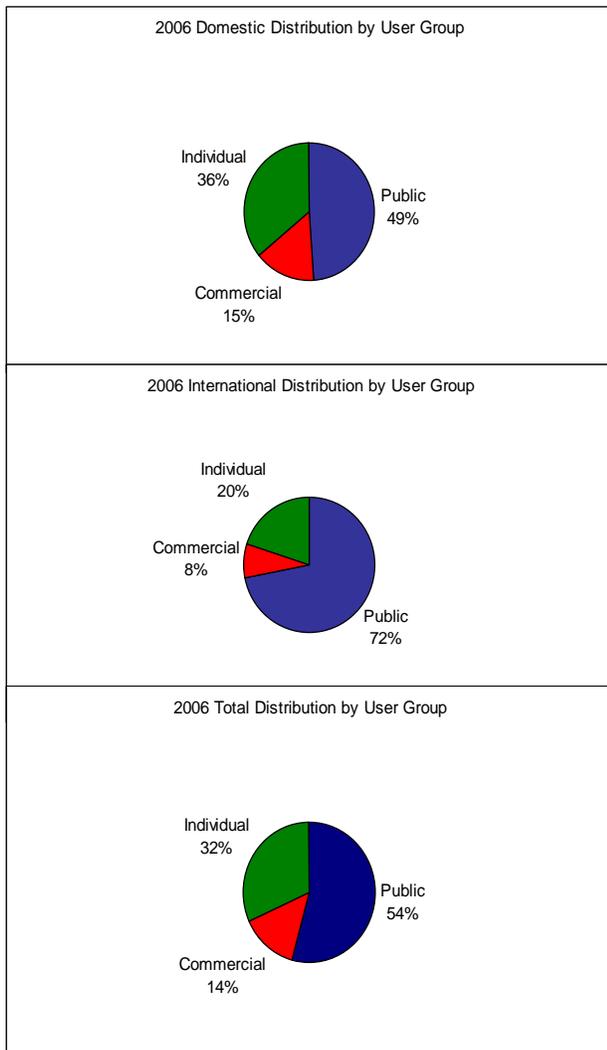
The EU has increased the list of plant viruses that *Rubus* and *Fragaria* accessions arriving from the United States must be tested free from. Since we primarily test for viruses important for American agriculture, this has resulted in a significant reduction in the number of accessions of *Rubus* and *Fragaria* being sent to the EU. *Fragaria* seed and DNA from all genera are allowed entry to the EU. However, Japan, South Korea, India and the Russian Federation have not been as restrictive and therefore reflect the high numbers of *Rubus* and *Fragaria* still being sent internationally.



During CY 2006 we shipped plant accessions to twenty seven countries including the United States.

By region most of the material was sent to North American destinations. The 'Others' category of 1% collectively represents material sent to India, Honduras, Russia, Australia, Morocco, and New Zealand.

Public user groups have received almost half (49%) of domestic shipments, 72% of items sent internationally and 54% of total distributions regardless of destination.



The total postage paid for domestic and international shipping was \$247.20. The total cost for Federal Express/DHL was \$4,196.24 and the total paid to the Oregon Department of Agriculture for 45 Phytosanitary Certificates was \$450.00. The total cost of shipping plant material in CY 2006 was \$4,893.44. This total is comparable to the amounts spent in CY's 2003 and 2004. The cost per item sent in CY2006 was less than the previous three years.

We continue to use Federal Express (Priority Overnight) for most domestically shipped items and all plants sent to Canada (International Priority). Since September of 2003, we have been using DHL for all international plant shipments (excluding Canada). DHL has been the only carrier that consistently allows plant shipments to foreign destinations and is used by many facilities within the National Plant Germplasm System. The concern of having plant items arrive at their destination in a timely manner amid increased security precautions precipitated the change to using private carriers for most domestic and all international shipments.

Screenhouse/Greenhouse Collections

By Jim Oliphant and Missy Fix

- Installation and programming of new greenhouse environmental control system.
- Reestablishment of the *Vaccinium* collection in screenhouse.
- Development of greenhouse climate zones for low latitude, high latitude, and high elevation accessions.
- Continued sanitation throughout facilities with an emphasis on weed control, in plant containers, floors inside the houses, and a wide buffer zone outside the houses.

ACTINIDIA

Actinidia is maintained in the screenhouse, as a back-up collection, at least until the field plants are established. Currently, we have 35 backup accessions which include 2 new accessions in the houses. Seven accessions have been identified as Non-hardy, within this group four are identified as 'Tropical' and are being housed in greenhouse 1 which provides the climate needed

for these plants. The remaining three accessions have been placed in greenhouse 3 which houses the non-hardy genera.

CORYLUS

Temporary back-up trees of all new young field trees and virused clones of *Corylus* are maintained under screen. Before a new accession can be planted in the field it must be grafted and layered until the scion is on its own roots. Scionwood of core clones is also grafted and maintained in a greenhouse as needed for tissue culture source material. Currently, 120 accessions are being maintained.

FRAGARIA

All clonal accessions of *Fragaria* are maintained under screen. An additional backup set of Supercore is maintained in the greenhouse. We are continuing our 3-year re-propagation cycle using runners.

HUMULUS

All clonal accessions of *Humulus* are maintained in the screenhouse.

MENTHA

All clonal accessions of *Mentha* are maintained under screen. We are continuing our 3-year re-propagation cycle via cuttings.

PYRUS

In an effort to free up screenhouse space, non-hardy *Pyrus* clones were repropagated for field back-up as tubes and the screenhouse plants discarded.

RIBES

All core or non-hardy clonal accessions of *Ribes* are maintained under screen. To date, 233 of the 244 core accessions are established in the screenhouse. We received 34 new accessions or replacements which are being established for the collection. Currently we have 336 accessions in the screenhouse. 167 re-propagated accessions will be ready for screenhouse replacement in fall of 2007.

RUBUS

All clonal accessions of *Rubus* are maintained under screen. Accessions from tropical, subtropical, and high latitude habitats are maintained in the greenhouse. This year we received 33 new or replacement accessions bringing the total number of accessions to 814 of which 268 are core accessions. 275 re-propagated accessions were placed in screenhouse. Successful re-propagation of the *Rubus* of Concern allowed 31 of these to be removed from the list and placed back into the permanent collection; 21 remain under this listing.

VACCINIUM

Our goal is to maintain all core, named cultivars, and non-hardy clonal blueberry under screen. Additionally, all prostrate accessions, including lingonberry and cranberry are also maintained under screen. Due to blueberry shock virus and *Phytophthora ramorum* concerns, we have established the primary collection in the screenhouse. We are growing vigorous stock plants to provide hard cutting material for distribution. Only 2 of the 235 core accessions remain in the field without a plant under screen.

Clonal Accessions maintained in the Greenhouses and Screenhouses as of May 2007

	Total # Accessions	Core		Available		Single Plants With No Back-Up	
		# Ac.	%	# Ac.	%	# Ac.	%
Actinidia	35	9	26	32	91	7	20
Corylus	120	63	53	91	76	20	17
Fragaria	1365	526	39	1299	95	717	53
Humulus	260	87	34	246	95	131	50
Mentha	458	52	11	450	98	265	58
Pycnanthemum	36	19	53	36	100	1	3
Pyrus	518	25	5	191	37	305	59
Ribes	372	216	58	239	64	56	15
Rubus	814	268	33	733	90	71	9
Vaccinium	532	225	42	442	83	77	14
Other²	156	58	37	76	49	41	26
Total	4666	1548	33	3835	82	1691	36

JMO 05-23-07

1) includes: ASI, CYD, GAY, MES, SAM, SOR, and OTHINV

Quarantined Plants

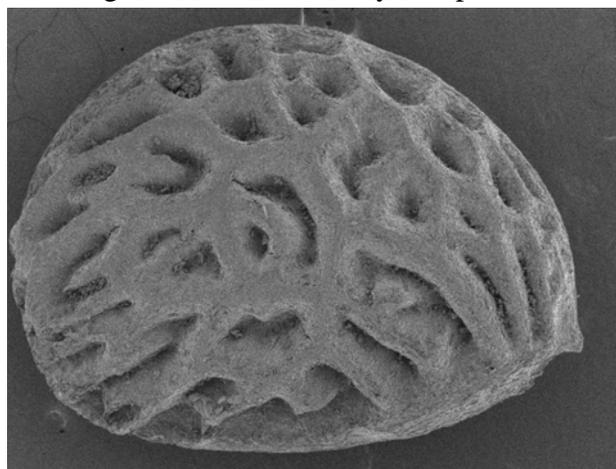
At this time we have 144 accessions in quarantine, including 7 *Fragaria* under a federal departmental permit, 7 *Humulus* under an Oregon Director Exemption, and 100 *Pyrus* provisionally released from Beltsville Quarentine.

Seed Program

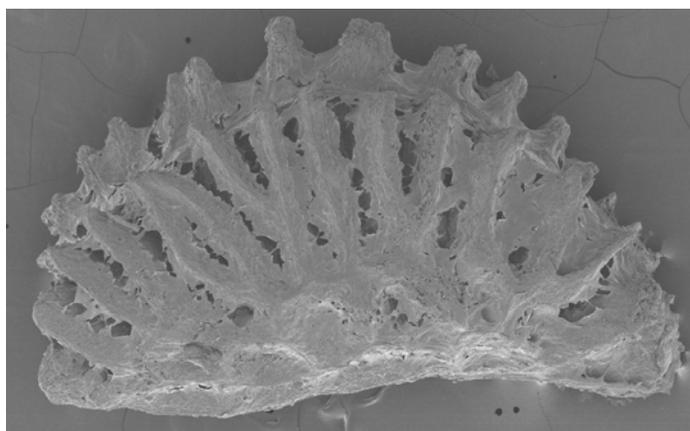
By Jack Peters, 2006

New graduate student

Ms. Sugae Wada from Tokyo, Japan started a Ph.D. program with Barbara Reed in January 2006. She will study the species of *Rubus* in the seed collection and compare their seed structure, taxonomy and physiology. Sugae will also test dormancy breaking treatments



Rubus canascens (rounded seed)



Rubus multibracteatus (elongated seed)

and relate their success to the seed anatomy.

Sugae completed a scanning electron microscope study of *Rubus* seeds showing characteristic seed coat anatomy for each subgenus and presented the work at the ISHS Seed Meeting, Dec. 2006.

Projects in Progress

Viability Testing

Viability tests were completed on all major genera accessions and some of the minor genera. A four-to-five year spot checking cycle on viability began in 2006. Any seed accession which shows a dramatic decrease in viability or where the viability drops below 20% is flagged as a potential seed regeneration accession. Initial viability is evaluated using the biochemical Tetrazolium Test. Data from the Tetrazolium Test is given below for the major genera at the NCGR:

Genus	No. Accessions		Viability percentage (tested 2004-06)			
	Total	Tested	0%	1-30%	31- 60%	>60%
<i>Fragaria</i>	402	380	9	51	154	166
<i>Humulus</i>	305	276	40	116	100	29
<i>Mentha</i>	59	55	2	1	10	42
<i>Rubus</i>	1220	1119	199	297	369	254
<i>Ribes</i>	517	475	22	26	158	269
<i>Pyrus</i>	378	276	9	23	57	187
<i>Actinidia</i>	59	35	24	2	2	7
<i>Vaccinium</i>	802	<u>767</u>	7	112	444	204
		3383 total				

In addition, 117 minor genera accessions have been tested for viability to date.

Seed Regeneration Program

The first genus used for seed increase is *Fragaria*, because of its manageable plant size, relatively short life-cycle, and importance to the NCGR seed collection.

To establish this program, outside raised beds and pollen or insect inclusion or exclusion cages had to be built and seedling/plant populations had to be maintained over a minimum two year period. The greater the number of plants from a population biology standpoint statistically captures more genetic diversity in a particular accession and decreases the genetic drift. Results of the seed increase program were small, but positive in 2006 and should be more conclusive and successful in 2007 as plants mature.

In 2006, the project design was incorporated, plant accessions identified, propagation of strawberry runners and transplanting occurred, the infrastructure of raised beds, pollen cages, and fences were built. Plants were also transferred to the tubehouse for growth and hardening off until the next growing season.

Seed Backup Program

The criteria for remote location seed backup at the NCGRP is:

- the in-house accessions amount is greater than 2000 seeds

- the seed accession has been tested for viability and viability $\geq 20\%$
- the seed is not 'proprietary'
- the seed accession is not in high distribution demand
- the seed has no known pathogens and no quarantine requirements
- the seed taxonomic identity is verified
- the seed is not a recalcitrant type

A sub-set of seed is taken (usually a minimum of 1000 seeds) for back-up distribution. The seed is repackaged and labeled for the shipping to the NCGRP. The total seed accessions backed up at the NCGRP through 2006 = **804**.

Seed Conservation Strategy Plan for Fragaria

During the year, a Seed Conservation Strategy was developed at the request of the Curator. This action was tied to an earlier meeting of Repository staff from around the country in which a strategic plan for germplasm was suggested to be developed and used world-wide. Major issues such as collecting, identification, cleaning and processing, testing, packaging and labeling, storage criteria, back-up plans, distribution and regeneration were all addressed in the document.

Seed Inventory and Maintenance of the Collection

There are now in 2006 over 4000 seed accessions at the NCRG. That accounts for over one third of all the identified germplasm accessions at the Repository. The total number of new seed accessions that came in to the Repository in 2006 was 112. Seeds are also exchanged through the germplasm system. Seed collecting trips occur throughout the year, which also bring in new material to the Repository. In 2006 collecting trips to Florida, the Republic of Georgia and Armenia brought in approximately 75 new seed accessions to the Repository. Seeds are processed within a few days after entering the NCGR. Some seed accessions arrive in the form of fruit. The seed extracted from the fruit, processed and then added to the collection. Seed distribution continues to be expedited at the Repository. Turn around for seed orders being filled and ready for shipment is only a couple of days. The number of seed distribution requests and shipments in 2006 was 833.

Computer/Information Management

By Douglas Cook and Kim Hummer

GRIN Records

Table GRIN Records Activity during CY 2006

<u>GRIN Area</u>	<u>Created</u>	<u>Modified</u>
Accession	1898	939
Inventory	1460	1158
Observation/Voucher	440	34
Pathogen	0	0
Distribution	4292	1903
Cooperator	146	35
<u>Total</u>	8236	4069

This year there were 1898 new accession and other sub-tending data categories added to GRIN (237 accessions, 372 Accession Names, 6 Habitat, 25 Narratives, 224 Pedigree, 460 Source, 443

Source Member, 109 Citations, 22 Annotated labels, 390 Observations and 50 Vouchers). There were 581 new Inventory items and 879 Inventory Actions added to GRIN. For Distribution there were 314 Orders, 3496 Order Items, 482 Order Actions and 146 Cooperator records add. Among 939 existing accession records, and other sub-categories, modifications were made during the year (86 Accessions, 41 Accession Name, 40 Habitat, 9 Narratives, 137 Pedigree, 12 IPR, 1 Citation and 613 Source). There were 623 Inventory, 535 Inventory Action and 35 Cooperator records modified.

Hardware and Infrastructure

All 24 workstations operate with Pentium (P3) or higher CPU's (with memory at 256 megabytes or higher) operating with Windows® XP-Pro Service Pack 2. All workstations are equipped with uninterruptible power and anti-virus protection. Two new workstations were purchased.

Fileserver backup data is stored on an external hard-drive. In addition, a second back-up hard-drive alternates weekly with the first. The hard-drive not in use is secured in an off-site ARS building. Numerous minor (and critical) computer software configurations and repairs took place.

Publications Submitted in 2006

Journal Articles and Websites

1. Aynalem, H., Righetti, T. and **Reed, B.** 2006. Nondestructive Evaluation of In Vitro-Stored Plants: A Comparison of Visual and Image Analysis. *In Vitro Cellular and Developmental Biology – Plants*. 00:1-7.
2. Aynalem, H., Righetti, T. and **Reed, B.** 2006. Iron Formulation Affects In Vitro Storage of Hops: An Image Analysis. *In Vitro Cellular and Developmental Biology – Plants*.
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4. **Hummer, K.** 2006. Blue Honeysuckle. *HortScience*, 41(5).
5. **Hummer, K.** 2006. Past, Present, and Future of Fruit Germplasm Exploration. *HortScience*.
6. **Hummer, K. E.** 2006. Introduction to the Workshop. *HortScience*.
7. Mehlenbacher, S., Brown, R., Nouhra, E., Gokirmak, T., **Bassil, N.**, and Kubisiak, T. 2006. A Genetic Linkage Map for Hazelnut (*Corylus avellana L.*) Based on RAPD and SSR Markers. *Genome*. 49:122-133.
8. **Postman, J., Hummer, K.,** Stover, E., Krueger, R., Forsline, P., Grauke, L., Zee, F., Ayala, S., and Irish, B. 2006. Fruit and Nut Genebanks in the US National Plant Germplasm System. *HortScience*. 41(5):1188-1194.
9. **Reed, B.,** Hummer, K., Chang, Y., and Gupta, S. 2006. Medium and Low-Term Storage of *Rubus* Germplasm. *Acta Horticulturae*.
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12. Stoner, A. and **Hummer, K.** 2006. 19th and 20th Century Plant Explorers.
13. Strik B. and **Hummer K.** .2006. 'Ananasnaya' Hardy Kiwifruit. *Journal of American Pomological Society*. 60(3):106-112.

14. Tzanetakis, I.E., **Postman, J.**, Gergerich, R.C., and Martin, R. 2006. A Virus Between Families: Nucleotide Sequence and Evolutions of Strawberry Latent Ringspot Virus. *Virus Research*. 121:199-204.
15. Tzanetakis, I. E., **Postman, J.** and Martin, R. 2006. First Report of Blackberry Chlorotic Ringspot Virus in *Rubus* in the United States. *Plant Disease*.
16. Volk, G., Richards, C., Henk, A., Reilley, **Bassil, N.**, A., and **Postman, J.** 2006. Diversity of Wild *Pyrus communis* Based on Microsatellite Analyses. *Journal of the American Society for Horticultural Science*. 131:408-417
17. Wada, S. and **Reed, B.** 2006. Morphological Analysis of *Rubus* Seed. *Acta Horticulturae*..

Presentations, Abstracts, and Miscellaneous publications

1. **Bassil, N., Hummer, K.** and **Postman, J.** 2006. Microsatellites are Used to Examine Apple and Pear Identities and Genetic Relationships [abstract]. *HortScience*. 41(4):993.
2. **Bassil, N. V.** and **K. Hummer.** 2006. Developing Genetic Fingerprints for Cranberry [abstract]. Northwest Center for Small Fruit Research Proceedings.
3. **Bassil, N., Postman, J., Hummer, K.,** Dolan, S., and Lawliss, L. 2006. Molecular Fingerprints Identify Historic Pear Trees in US National Parks [abstract]. Pear International Symposium.
4. Castillo, N., **Bassil, N.** and **Reed, B.** 2006. Microsatellite Markers Identify Raspberries and Blackberries [abstract]. *Plant and Animal Genome*.
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6. **Hummer, K.** 2006. The APS Gavel Meets a New Block. *Journal of American Pomological Society*.
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11. **Postman, J.** 2006. European Pears (In: Brooks & Olmo Register of New Fruit and Nut Varieties List 43). *HortScience*.
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14. Sabitov, A., Chebukin, P., and **Hummer K.** 2006. Plant Exploration for Fruit Genetic Resources in Sakhalin Territory. *Acta Horticulture Proceedings*.
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