National Clonal Germplasm Repository, Davis

Technical Report for the Calendar Year 2004

W6 Regional Technical Committee

Ed Stover, Bernard Prins, and Malli Aradhya

During the period under report, the Davis repository continued to focus on its missions of acquisition, maintenance, evaluation, and distribution of its mandated fruit and nut germplasm.

Distribution and Acquisition

The following table shows the trend in the germplasm distribution during the past ten years. In the last few years there has been a sharp increase in the number of domestic requests for fig and pomegranate cuttings. This has resulted in a decrease in the percentage of foreign requests although the absolute number has gone down less sharply.

The Davis NCGR distributed more accessions in 2004 than in any previous year, with almost 3000 requests distributed to 12 different countries. Numbers will be similar for 2005, but will be somewhat reduced by the decision not to send out summer cuttings for pomegranate and fig, since large amounts of budwood were collected in winter. We improved quality of material distributed by developing procedure that no material remains in storage for more than 3 weeks before shipment to clients (previously could remain in storage for as long as 3 months).

Number of accessions sent per crop for ten years.

Crop	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Fig	69	202	442	428	269	392	361	539	1187	740
Grape	559	329	611	706	779	868	1236	928	618	847
Kiwi	23	21	9	20	9	4	3	1	16	7
Mulberry	0	10	1	85	49	70	63	84	73	50
Olive	46	66	142	238	212	133	79	52	21	70
Persimmon	9	37	21	12	22	23	24	32	35	50
Pistacio	24	47	32	79	42	50	39	10	45	25
Pomegranate	9	43	48	25	68	81	50	116	787	235
Stonefruit	128	291	486	157	213	281	331	259	135	124
Walnut	32	43	113	82	18	291	122	24	6	41
Wingnut	2	0	1	0	0	3	0	2	4	1
TOTAL	901	1089	1906	1833	1681	2196	2308	2047	2929	2193

** 2005 numbers are through 6-17-2005

Table 1: Country-wise germplasm distribution during the past ten years

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Afghanistan	0	0	0	0	0	0	0	0	0	26
Argentina	0	0	0	0	0	0	0	10	0	0
Australia	0	19	0	4	0	3	1	24	0	0
Belgium	0	0	0	4	0	0	10	11	0	0
Belize	0	0	0	2	0	0	0	0	0	0
Bolivia	0	0	0	23	3	0	0	0	0	0
Brazil	7	0	0	0	0	9	0	0	0	0
Canada	0	0	0	0	0	3	13	17	60	35
China	17	16	75	74	69	134	42	18	14	2
Cyprus	0	0	1	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	3	0	0
Denmark	0	0	0	0	10	17	0	0	4	0
Germany	0	0	9	0	24	62	0	8	4	23
Holland	0	0	0	8	0	6	2	1	0	0
India	11	13	19	66	2	0	0	0	11	0
Iran	0	0	113	0	16	0	0	0	0	0
Israel	0	0	0	16	0	1	0	0	0	0
Italy	0	0	8	0	0	12	9	0	3	0
Japan	4	0	0	0	7	1	0	0	0	1
Korea	0	0	0	0	0	0	13	0	0	0
Kyrgyzstan	5	0	0	13	15	6	0	0	0	0
Lativia	0	28	0	16	0	0	0	0	0	0
Mexico	0	25	0	0	18	0	0	0	0	29
Morocco	0	0	0	0	0	0	0	0	0	3
New Zealand	3	0	0	6	0	3	5	0	0	0
Pakistan	0	0	0	16	0	0	0	0	0	0
Philipine	0	0	0	0	0	0	0	5	0	0
Poland	14	3	0	0	0	0	0	0	0	0
Puerto Rico	0	0	0	0	0	1	0	0	5	1
RSA	7	7	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	101	34	0	0
Russia	190	0	0	73	0	83	0	74	0	0
Singapore	0	0	0	0	1	0	0	0	0	0
Slovak Republic	0	0	0	0	4	1	0	0	0	0
South Africa	0	0	0	0	0	0	0	0	18	0
Spain	0	0	0	0	0	2	159	0	0	4
Sudan	0	0	0	0	0	0	0	0	0	22
Turkey	0	31	0	0	0	0	22	0	0	0
Ukraine	0	0	16	0	0	3	0	0	0	0
United Kingdom	0	0	0	32	0	2	0	5	0	25
USA	643	944	1665	1482	1455	1817	1935	1837	2794	2165
Total	**901**	**1089**	**1906**	**1835**	**1624**	**2166**	**2312**	**2047**	**2912**	**2340**
Overseas	258	145	241	353	169	349	377	210	118	175
% to USA	71%	87%	87%	81%	90%	84%	84%	90%	96%	93%

** 2005 numbers are through 6-17-2005

One hundred and eleven accessions were added to our collections during the year 2004. We developed draft 5 year plans for acquisition of new accessions in *Juglans* and *Prunus* and have begun implementation. Plant exploration for grape accessions in Taiwan is scheduled for Sept 2005. Exploration proposals are in preparation for tropical *Juglans* in Guatemala, domestic *Vitis*, and various cultivated material from Georgia and Armenia. The list of quantities, donors, and sources of germplasm acquired in 2004 are listed in the following table.

Table 2. Germplasm received during the year 2004, sorted by genus.

Genus	Qty	Name	Institution	Information
Actinidia	5	Scott Johnson	Kearney Research and Extension Center	
Diospyros	40	Keizo Yonemori	Kyoto Univ. Ag Grad School, Japan	
Ficus	3	Adolfo Rosati	Instituto sperimentale, Spoleto, Italy	
Morus	2	Kim Hummer	USDA ARS NCGR Corvalis	
Punica	1	Marine Mosulishvl	Inst. Botany, Tbilisi, Republic of Georgia	
Vitis	7	David Ramming	USDA ARS	Chinese species
Vitis	13	David Ramming	USDA ARS	Includes tetraploids
Vitis	39	Susan Nelson-Kluk	FPS	Leftovers from Dr. Olmo's and Goheens programs.
Vitis	1	Rich Hannan	USDA-ARS Western Regional Plant introduction Station, Pullman WA	V. arizonica found on a collecting trip to Arizona

Germplasm Maintenance

The current staffing at NCGR, Davis is 2 FTE scientists and 11 FTE support staff, which is reduced from FY04. Three 2 Year TERM position were hired at GS 5-7 level to assist repository horticulturists and the farm manager. A 2 Year TERM Office Automation Assistant began work in June 2005 to accelerate GRIN data entry. A new curator / research leader joined the Davis NCGR in August 2004.

In FY2005, we improved individual attention to minor collections. "Crop managers" were designated for each collection. Developed cultural practice / management calendars for each collection to improve average plant health, reduce cost of maintenance, and produce crops better suited to characterization. 82% of *Vitis* germplasm is now protected from PD in screenhouses.

Several changes have been implemented to increase efficiency of collection management. Initial mechanical hedging in part of the grape collection saved $3000 in pruning costs. Full implementation of this strategy should save $6000 per year. In previous years we have used only hand-labor to water nursery collections, costing $40,000 per year. In FY05 we began construction of automatic irrigation systems and they are now in place in 3 of our screenhouses. National program funds have been assigned to complete installation of automatic irrigation. Our goal is to have these systems throughout the screenhouse/greenhouse/nursery collections by the beginning of FY06.

We initiated a plan to enhance phytosanitary status of collections. Fifty-four grape accessions from Afghanistan have been placed in TC thus far, which will be repatriated after clean-up. Fifty accessions of grape from Turkmenistan, in quarantine since 1995, will be TC-propagated and will be field indexed for removal from post-entry quarantine.

Client awareness and potential for utilization of the Davis NCGR have been greatly increased in FY05. Presentations outlining NCGR resources, and opportunities for contributing to clients, have been made at: 3 international meetings, 4 national meetings, and 7 state meetings. Numerous discussions have also been held with commodity groups relevant to the Davis NCGR, to strengthen industry collaboration.

Germplasm Characterization

I. Plant/Fruit Evaluation

Plant/fruit evaluation data and photo-documentation continue to be collected with data being organized and added to GRIN and our local database. Accumulated data for 5 years evaluation of *Prunus* and *Vitis* are being organized and analyzed for uploading to GRIN. Detailed data are being collected in 2005 on our Iberian grape collection, the entire olive collection, and the cherry and plum collections. A new project, funded by the California Fig Advisory Board, involves detailed data collection on 24 fig cultivars.

We have initiated several other new characterization projects which should lead to published papers. In a joint project with ARS nutritionists we have begun looking at antioxidants across a range of pomegranate accessions. Interestingly, some yellow cultivars have high levels of antioxidants that were similar to the deep red industry standard, 'Wonderful'. In collaboration with ARS plant pathologist Dan Kluepfel, seedlings of a broad cross-section of the *Juglans* collection are being germinated to assess crown-gall resistance.

II Molecular evaluation

To finalize identification of our accessions, we will need to compare fingerprints with "type" material from other collections through international cooperation. Arrangements have been made this year with the national grape collections of France, Portugal, and Spain. Discussions are underway with Portuguese and Spanish collections of fig and olive, and considerable interest was generated at the recent International Fig Symposium to adopt a standard set of markers.

***1. Genetic characterization of* Prunus**

In FY2005, molecular characterization of variability and relationships within and among cultivated species of *Prunus* was completed and results were published. Several projects on genetic evaluation of diversity and structure within and among taxa representing the traditional primary, secondary, and tertiary gene pools of the genus *Prunus* have been initiated during the reporting period. So far, DNA from about 550 accessions representing about 50 taxa and hybrids have been isolated and PCR protocol has been standardized for fourteen microsatellite loci that are available in the public domain. All of these loci are compatible across wide range of *Prunus* species maintained in collections at the NCGR, Davis, thus allowing for examining the genetic structure and differentiation within and among species of *Prunus*. We are currently testing more loci to bring up the final number to about two dozen polymorphic loci for the final evaluation of collections.

2. Microsatellite fingerprinting of the NCGR Juglans collection.

Also completed study on development and use of microsatellite markers in walnut identification and genetic relationships. This study has led to redrawing of the existing pedigree tree depicting the relationships among the walnut cultivars developed and grown in California. The protocols and fingerprint database have been handed to the Foundation Plant Services of UC Davis for use in servicing industry ID needs.

3. Molecular characterization of genetic variability and differentiation in the NCGR Fig collection.

Seventy-four fig genotypes have been fingerprinted using 12 microsatellite markers and the diversity and relationships within and among different types of figs were assessed. Sixty-eight out of 74 genotypes examined possessed unique fingerprints. The fig collection showed considerable polymorphism with the observed number of alleles per locus ranging from three for MFC4 and 5 to six for MFC1 with an average of 4.3 alleles per locus. The cluster analysis (CA) using the neighbor-joining method revealed seven groups with somewhat distinct affinities. In this preliminary study, all of the San Pedro type figs fell into a single group. It will be interesting to see if this relationship is sustained when the entire collection is assessed using more markers. We anticipate complete testing of our collection over the next year.

4. Molecular characterization of genetic variability and differentiation in olives.

In collaboration with the Department of Pomology, UC Davis and the Biology Department, UC Santa Barbara, we are conducting a survey of genetic polymorphism within and among the original populations of olives introduced by different Christian missionaries into California during the late 19th century. The goals of this project are (1) relate these introductions to the collection at the repository and (2) understand the history of introduction and domestication process leading to the development of the crop, genetic diversity and structure.

Publications 2004-05

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