Interspecific Breeding Germplasm for Rootstock Research & Development

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Location: Plant Sciences, Univ. of California/ Davis

Fig. 1. The wild almond *Prunus scoparia* in its native dessert environment in the mountains of Iran.

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Inter-species crosses, an important source for self-compatibility and disease resistance in the UCD Almond Variety Development program (see Variety Development Poster), can also contribute to rootstock improvement since many important high vigor and/or disease resistant rootstocks have interspecies origins. The potential range of current UCD germplasm diversity is demonstrated by the wild almond, *P. scoparia* which thrives in the severe deserts of central Iran (Fig. 1, see also Fig. 6). Interspecific UCD hybrids have previously demonstrated continued productivity under drought stress (Fig. 4) and modified scion tree architecture when used as rootstocks (Fig. 6). The goal of this project is to collect, preserve and distribute a core sample of the diverse germplasm developed by the UCD almond genetic improvement program for use by public and private researchers and breeders working to advance the development of improved rootstocks, as well as an improving our understanding important disease and drought resistant characteristics. Associated genomic studies promoting a greater understanding of the genetic basis of rootstock resistance are also being pursued with collaborators at UCD, UCR, USDA/ARS and private nurseries and breeders.

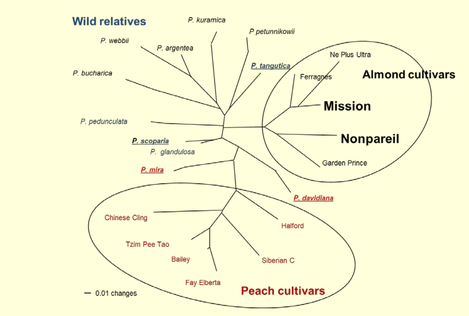

Fig. 2. Genetic relatedness among almond and closely related species (items more closely linked by lines are more closely related).

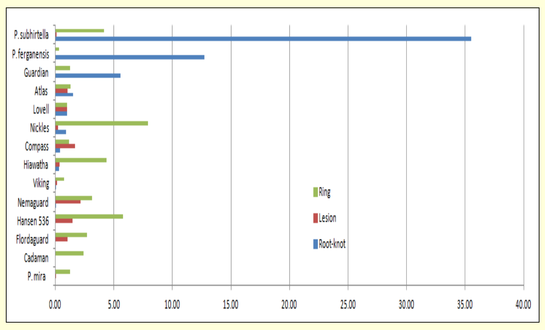

Fig. 3. Differences in interspecies germplasm resistance to various nematodes as documented by previous studies by Bliss et al.

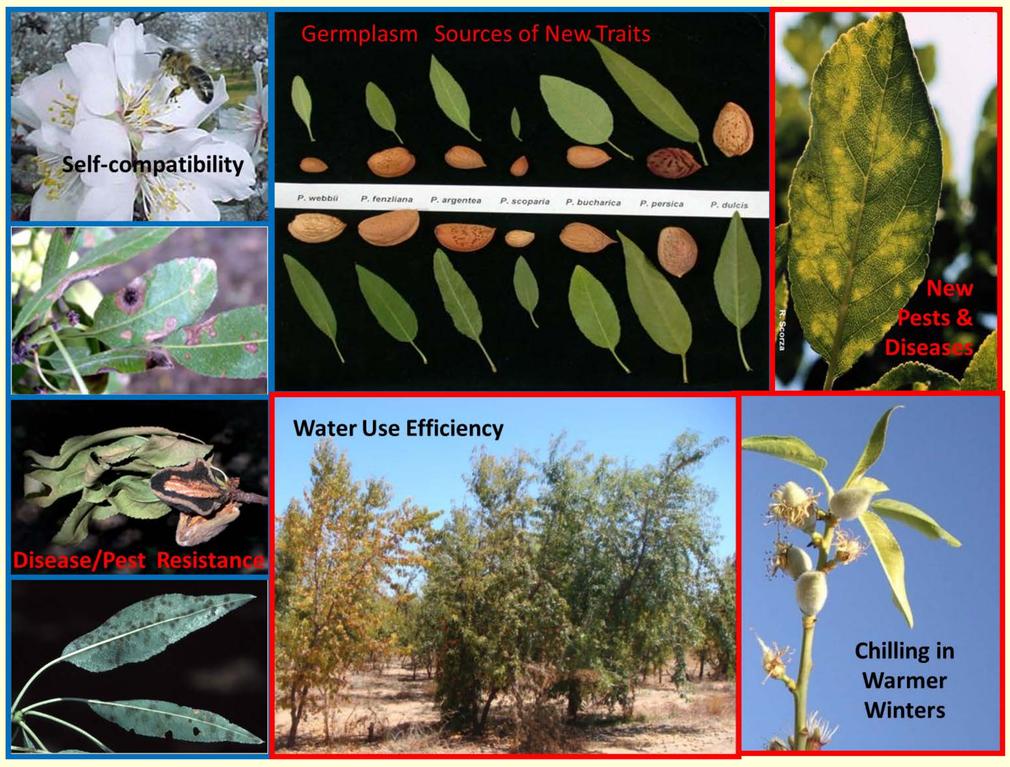

Fig. 4. Range in nut and leaf characteristics of almond and related species (center-top) as well as their hybrids with cultivated almond ((center, below ID label). Peripheral images show traits identified in hybrids and/or their UCD breeding progeny including self-compatibility, disease and pest resistance, improved water use efficiency and tolerance to climate change.

Table 1. Current range of UCD almond genetic germplasm and their derivation

Almond x (P. mira) BC1
Almond x P. argentea (BC1)
Almond x P. fenzliana (BC1)
Almond x P. mira (BC3)
Almond x P. mira (BC3)
Almond x P. mira (BC3)
Almond x P. mira (BC2)
Almond x P. webbii (BC1)
Almond x P. webbii (BC3)
Almond x P. webbii (BC4)
Almond x P. webbii (F2)
P. orthosepala
Almond x P.persica (BC3)
Almond x P.persica (BC4)
Almond x P. bucharica
Almond x P. webbii x Peach

Table 2. Progeny numbers (either stored seed or field-planted seedlings) for different lineages currently available in the UCD almond genetic improvement program.

Species	F1	F2	BC1	Other
Peach x P. argentea	2	175	100	200
Peach x P. scoparia	1	10	500	150
Peach x P. dulcis	100	500	100	1000
Peach x P. mira	3	150	100	500
Peach x P. davidiana	1	100	50	100
Peach x P. tangutica	1	50		
Peach x plum	2			
Almond x P.persica	100	200	5	2000

Table 3. UCD Almond genetic improvement interspecies selections for which molecular marker analysis is available (for approximately 500 molecular markers distributed relatively evenly over the 8 linkage groups (chromosomes)) via the RosBREED project.

Selection	Parent1	Parent2	Source	No. of hybrids
2008_3_196	Loadel	Yumyeong	P.persica	22
2005_17_1	Loadel	Vilmos	P. dulcis	42
2005_17_255	Carson	persXdavidiana	P.davidiana	23
2005_17_155	Loadel	persXdavidiana	P.davidiana	1
2006_1_107	18_8_11	P_Tang_Mix	P.tangutica	1
2003_1_329	DrDavis	P.mira19	P. dulcis	1
P.mira#19	P.mira	P.mira	P.mira	1
2001_7_180	Andross	P.argentea	P.argentea	1
2000_2_8	Loadel	P.argentea	P.argentea	2
2005_20_192	91_16_154	Ogawa	P. dulcis	1
Hansen1	Almondseed2	Nemaguard	P.davidiana	1
Nickels	CP_5_33	Nemaguard	P. dulcis	1
2000_3_205	Andross	MissionxScoparia	P.scoparia	1
Carmel	Nonpareil	Mission	P. dulcis	1
Jordanolo	Nonpareil	Harriott	P. dulcis	1
Panamint	BabcockxBoston	GoldminexRioOsoGem	P.persica	1
2000_2_16	Loadel	F8_5_166	P. dulcis	1
2005_22_204	91_17_195	F8_5_159	P. dulcis	2
98_2_132	Pallas	F8_1_96	P. dulcis	1
2005_16_172	OHenry	F8_1_42	P. dulcis	19
99_16_131	F8_1_121	F8_1_121	P. dulcis	1
2005_17_5	Loadel	F10C_12_28	P. dulcis	1
Woltemade	Kakamas	F_Wolvamade	P.persica	1
Stukey_6_9BF	Nonpareil	F_Stukey69BF	P. dulcis	1
Stukey_6_8	Nonpareil	F_Stukey68	P. dulcis	1
Stukey_6_27H	Nonpareil	F_Stukey627H	P. dulcis	1
Stukey_6_27	Nonpareil	F_Stukey627	P. dulcis	1
St_John	ChineseCling	F_StJohn	P. dulcis	1
Sonora	Nonpareil	F_Sonora	P. dulcis	1
F5C_6_9BF	Nonpareil	F_F5C_6_9BF	P. dulcis	1
F5C_6_8	Nonpareil	F_F5C_6_8	P. dulcis	1
F10C_20_51	F8_76_45	F_F10C_20_51	P. dulcis	1
F10C_12_28	F8_72_33	F_F10C_12_28	P. dulcis	1
2007_12_209	2000_16_133	dummy015	P. dulcis	1
2005_20_11	Carson	dummy014	P.persica	1
2005_18_151	2001_7_180	dummy013	P.argentea	1
2005_17_208	Carson	dummy012	P. dulcis	1
2005_17_148	Loadel	dummy011	P. dulcis	1
2008_58_18	2000_8_150	DrDavis	P.persica	1
54P455	GoldenGlory	Bonanza	P.persica	1
98_9_7	93_3_159	Bolinha	Bolinha	1
F8_7_179	Nonpareil	A80_10_22	P. dulcis	1
2009_19_18	Andross	96_9_292	P.persica	3
2005_29_95	92_14_73	92_14_73	P.persica	1
2001_18_215	91_18_6	91_18_6	P.persica	1
Ogawa	90_10_91	90_10_91	P. dulcis	6
F8_1_42	90_1_4	90_1_4	P. dulcis	1
2008_13_194	Loadel	2003_1_329	P.mira	11
2005_19_40	19_2_72	2001_7_180	P.scoparia	1
2005_18_244	Rizzi	2001_7_180	P.argentia	20
2009-28-152	18_8_11	2001_18_215	P.persica	1
2007_10_244	2000_8_150	2000_8_150	P. dulcis	3
2005_19_139	19_2_72	2000_3_205	P.scoparia	1
2005_20_117	Carson	2000_3_205	P.argentia	7
2005_18_191	2000_2_8	2000_2_8	P.argentia	3
2007_12_234	2000_16_133	2000_16_133	P. dulcis	35
2007_11_249	2000_15_122	2000_15_122	P. dulcis	1
Vilmos	F10C_12_28	*VP	P. dulcis	1
Mission_BF	Mission	*MUT	P. dulcis	1
NonpareilBF	Nonpareil	*MUT	P. dulcis	1
TardyNonpareil	Nonpareil	*MUT	P. dulcis	1
40A_17	Wild peach	-	P.persica	1
Hansen536	-almond	peach	P. dulcis	1
Mission	-	-	P. dulcis	1
Nemaguard	peach	P. davidiana	P. dulcis	1
Nonpareil	-	P. davidiana	P. dulcis	1
persicaXdavidiana	peach	-	P.davidiana	1
Winters	-	-	P. dulcis	1
Yumyeong	-	-	P.persica	1

Fig. 5. Range in tree growth characteristics of UCD germplasm transferred to USDA Germplasm Repository in order to make this potential breeding material more widely and publically accessible

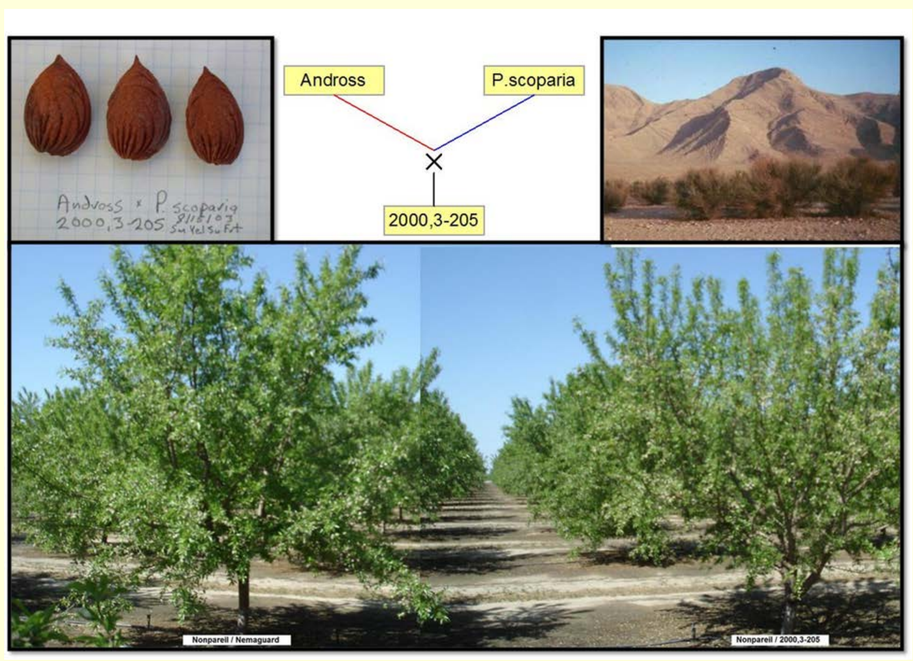

Fig. 6. Derivation of the peach by *P. scoparia* hybrid UCD2000,3-205 and its affect on Nonpareil tree architecture when used as a rootstock (Nonpareil on Nemaguard at left and on 200,3-205 at right , in a collaborative evaluation by UCD, Fowler Nurseries and Paramount Farms. (Image courtesy of C. Fleck).