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Isozyme Phenotypes Support the Interspecific Hybrid Origin of *Prunus xdasycarpa* Ehrh.

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Abstract

The black or purple apricot, *Prunus xdasycarpa* Ehrh., has been reported to be a naturally occurring interspecific hybrid between apricot (*Prunus armeniaca* L.) and myrobalan plum (*P. cerasifera* Ehrh.). The isozyme phenotypes of five black apricot clones support its hybrid origin since each one has at least two plum specific and two apricot specific alleles.

Prunus xdasycarpa Ehrh., commonly known as the purple or black apricot, was first recorded in 1755 (8) and described in 1791. It belongs to the section *Armeniaca* (Miller) Koch (9). In the beginning of the twentieth century Schneider speculated that it was a natural hybrid between *P. cerasifera* Ehrh. and *P. armeniaca* L. (5). Evidence from several studies supports the proposed hybrid origin of *P. xdasycarpa* (3, 6, 7). This species is intermediate between *P. cerasifera* (myrobalan plum) and *P. armeniaca* both morphologically (leaves, fruit, flowers) and physiologically (time of bloom, cold tolerance and tolerance to fungal diseases). Most clones of *P. xdasycarpa* are not highly fertile and produce abortive seeds with poor germination and have flowers with defective pollen as is observed in artificially produced plum x apricot hybrids. In addition, plants of the black apricot are only sporadically found where the distributions of apricot and the myrobalan plum overlap. The purpose of this study is to provide additional evidence of hybrid origin of *P. xdasycarpa* via isozymic analysis.

Materials and Methods

Five clones of *P. xdasycarpa*, 7 artificially produced plumcots, 11 clones of *P. cerasifera*, 50 clones of cultivated apricots, and 32 Japanese plum (*P. salicina* Lindl.) genotypes were examined for six enzymes. The starch gel electrophoretic procedures followed those previously described (1, 2). The enzymes assayed were peroxidase (PX, EC 1.11.1.7), malate dehydrogenase (MDH, EC 1.1.3.7), phosphoglucomutase (PGM, EC 2.7.5.1), phosphoglucose isomerase (PGI, EC 5.3.1.9), 6-phosphogluconate dehydrogenase (6PGD, EC 1.1.1.44), and leucine aminopeptidase (LAP, EC 3.4.11.1). The isozymes, enzyme variants coded by one locus, were designated numerically as to percent of migration compared to a common electromorph found in the peach (*Prunus persica* (L.) Batsch) control, which was designated as the '100' allele. For enzymes with multiple loci, the presumptive locus with the greatest anodal migration was designated as 1; loci with slower migration rates received progressively higher numerical designations. Cathodal bands for peroxidase were designated with "C."

Results and Discussion

Electrophoretically the *P. xdasycarpa* clones are very similar to the artificially produced plum x apricot clones (Table 1). All five clones are heterozygous for Px-C (100/60) as is expected of plum x apricot hybrids (2). In this case, Px-C^{100} is derived from the plum parent and Px-C^{60} is from the apricot parent. Other loci also have alleles specific to either plum (Pgi-2^{100}, Pgi-2^{80}, Lap-1^{105}, Lap-1^{112}, Mdh-1^{160}, Pgm-1^{89}, Pgm-2^{62}) or to apricot (Mdh-1^{110}, Mdh-1^{50}, Pgm-1^{70}, Pgm-2^{100} and 6Pgd-2^{78}) (Table 2). Each of the clones of *P. xdasycarpa* examined here have at least one other plum (Mdh-1^{160}, Pgi-2^{100}) and apricot (Pgm-1^{70}, Pgm-2^{100}) specific allele which further supports their hybrid origin.

When Burbank first announced that he had produced hybrids between plums and apricots there were many

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Table 1. Isozyme phenotypes of *Prunus xdasycarpa* and plum x apricot hybrids.

Clone	Px-C	Mdh-1	Mdh-2	Pgm-1	Pgm-2	Pgi-2	6Pgd-2
Prunus xdasycarpa[z]							
Mesch Amrah	60/100	130/130	100/100	70/78	83/83	90/100	66/66
Mirocais	60/100	130/130	100/100	70/78	83/83	90/100	66/66
Tlor Ciran	60/100	130/130	100/100	78/78	83/100	90/100	66/66
Purpuroui Early	60/100	130/160	100/100	78/78	83/100	90/90	66/66
Irani Olju	60/100	130/160	100/100	78/78	83/100	90/100	66/66
Plum x apricot hybrids							
BY69-1637P	60/100	130/130	100/100	70/78	83/83	90/100	66/66
NJPC1	60/100	130/130	100/100	78/78	83/100	90/100	66/78
NJPC2	60/100	130/160	100/100	78/78	83/100	90/90	66/66
NJPC3	60/100	130/130	100/100	78/78	83/100	90/90	66/66
NJPC4	60/100	130/130	50/100	78/78	83/100	90/100	66/66
NJPC5	60/100	130/160	100/100	78/78	83/100	90/100	66/66
K 537-67	60/100	130/130	100/100	78/78	83/100	90/100	——

[z]Irani Olju = Irany Oiiu = P1292699 = P1307520 (Poland).
Tlor Ciran = Flor Tsiran = Shlor Tsiran = Tlor Tsiran = PI113534 (Russia).

Table 2. Isozyme allelic frequency for cultivated apricots, myrobalan plum, and Japanese plums.

Isozyme locus	Allele	Frequency (%)		
		Cultivated apricots	Myrobalan plum	Japanese plum[y]
Px-C	100	0	100	100
	60	100	0	0
Mdh-1	160	0	41	0
	130	91	59	100
	110	9	0	0
Mdh-2	100	88	100	100
	50	12	0	0
Pgm-1	89	0	14	30
	78	75	86	70
	70	25	0	0
Pgm-2	100	94	0	0
	83	6	95	100
	62	0	5	0
Pgi-2	100	0	73	52
	90	100	27	48
6Pgd-2	78	5	0	0
	66	95	100	100
Lap-1	112	0	10	0
	105	0	75	3
	100	100	15	97

[z]6Pgd-1 was monomorphic for apricot and plum.
[y]Cultivated plum clones without *P. angustifolia*, *P. cerasifera* or *P. hortulana* in background.

who doubted that interspecific hybrids could be made (6). Since then it has been discovered that natural interspecific hybrids occur, especially among woody perennial plant species (4). The black apricot is a natural apricot x plum hybrid. The supposition that the plum involved is *P. cerasifera*, although not proven by, is consistent with the isozyme data since the plum specific alleles seen in the black apricot clones are also common in *P. cerasifera* (Table 2). The best evidence for myrobalan plum as a parent is the morphological comparisons of the three taxonomic species as well as their overlapping distributions (3, 7).

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