

Table 1. Pollen testers for incompatibility alleles in hazelnut.

<u>Allele No.</u>	<u>Tester^z</u>	<u>Alleles in tester (no.)^y</u>	
1	'Barcelona'	<u>1</u>	2
2	OSU 20.058 ^x	<u>2</u>	<u>2</u>
3	'Nonpareil'	1	<u>3</u>
4	OSU 194.001	<u>4</u>	<u>4</u>
5	'Badem'	2	<u>5</u>
6	'Henneman #3'	<u>6</u>	10
7	OSU 278.095	4	<u>7</u>
8	'San Giovanni'	2	<u>8</u>
9	'Segorbe'	<u>9</u>	23
10	'Kargalak'	2	<u>10</u>
	'Gamma'	2	<u>10</u>
11	OSU 278.121	4	<u>11</u>
12	OSU 55.077	2	<u>12</u>
13	'Ashrafi' 1226.004	<u>13</u>	31
14	'Gem'	2	<u>14</u>
15	GN66(3)AF5	11	<u>15</u>
16	OSU 485.015	11	<u>16</u>
17	'Mortarella'	2	<u>17</u>
18	'Neue Riesen'	<u>18</u>	25
19	OSU 452.026	4	<u>19</u>
20	OSU 1038.084	2	<u>20</u>
21	OSU 168.026	2	<u>21</u>
22	OSU 937.069	4	<u>22</u>
23	OSU 385.006	4	<u>23</u>
24	OSU 54.041	2	<u>24</u>
	OSU 1092.108	4	<u>24</u>
25	'Ordu'	4	<u>25</u>
26	OSU 447.015	<u>26</u>	<u>26</u>
27	'Buttner's Zeller'	11	<u>27</u>
	OSU 962.014	4	<u>27</u>
28	OSU 562.031	26	<u>28</u>
29	OSU 930.081	4	<u>29</u>
30	OSU 1116.049	4	<u>30</u>
31	'Ata Baba'	4	<u>31</u>
32	'Reka #2'	2	<u>32</u>
33	'Ganja'	<u>4</u>	<u>33</u>

^zTwo testers are used for some S-alleles.

^y Alleles expressed by the pollen are underlined.

^x Oregon State University

Table 2. Origin of hazelnut seed lots by country, year and collection location, and the number of selections from each lot whose S-alleles were identified.

<u>Country</u>	<u>Lot No.</u>	<u>Year</u>	<u>No. Selections</u>	<u>Location</u>	<u>Description</u>	<u>Other comments</u>
Turkey	1	1975	11	Giresun	Orchard	
	2	1990	12	Istanbul	Market	
	3	1991	24	Unknown	Market	
	4	1993	30	Akcakoca	Orchard	
	5	1993	17	Giresun and Ordu	Orchards	
	6	1993	31	Trabzon	Orchard	
	7	1997	18	Samsun	Orchard and market	
	8	2004	114	Giresun	Hazelnut Research Institute	
Georgia	1	2001	8	Kakheti	Orchards	
	2	2001	10	Zugdidi	Orchards	Large, round nuts
	3	2001	11	Zugdidi	Orchards	Small, round nuts
	4	2001	3	Zugdidi	Orchards	Oblate nuts
	5	2001	6	Zugdidi	Orchards	Dark-shelled nuts
	6	2003	5	Vani and Abasha	Orchards	
Azerbaijan	1	2001	26	Zaqatala	Orchards	
	2	2001	8	Qabala	Orchards	
	3	2001	15	Xacmaz	Orchards	
Armenia	--	2002	26	Various	Markets Six vendors	
Russia	1	2002	8	Sochi	Institute cultivar collection	
	2	2002	18	Sochi	Market	Seven vendors
	3	2002	18	Holmskij	Market	Five vendors
	4	2002	10	Krasnodar	Market	Three vendors
	5	2002	13	Central Asia	Cultivar collection	'Panahei' seeds
	6	2002	3	Maikop	VIR ^z cultivar collection	
	7	1989	6	Leningrad	VIR collection, southern Russia	
	8	1992	18	Moscow	Wild	
Ukraine	--	2002	24	Alushka-Simferopol	Vendors (4), Nikita Gardens	
Iran	--	2003	9	near Caspian Sea	Orchard and roadside vendor	
Other	1	1992	13	Piemonte	Wild	
	2	2005	3	Latvia	Cultivar collection	
	3	2005	1	Lithuania	Cultivar collection	
	4	2000	1	Estonia	Wild	
	5	1987	1	Univ. of Minnesota	Seedlings	

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Table 3. Dominance relationships among pairs of S-alleles in hazelnut^z.

Allele no.	1	2	3	4	5	6	7	8	9	10	11	12	13
2	1 > 2												
3	1 < 3	2 < 3											
4	1 > 4	2 > 4	3 > 4										
5	1 = 5	2 < 5	3 > 5	4 < 5									
6	1 < 6	2 < 6	3 > 6	4 < 6	5 < 6								
7	1 = 7	2 < 7	3 > 7	4 < 7	5 = 7	6 > 7							
8	1 < 8	2 < 8	3 = 8	4 < 8	5 < 8	6 < 8	7 < 8						
9	1 > 9	2 > 9	3 > 9	4 < 9	5 > 9	6 > 9	7 > 9	8 > 9					
10	1 = 10	2 < 10	3 > 10	4 < 10	5 = 10	6 > 10	7 = 10	8 > 10	9 < 10				
11	1 > 11	2 > 11	3 > 11	4 < 11	5 > 11	6 > 11	7 > 11	8 > 11	9 = 11	10 > 11			
12	1 = 12	2 < 12	3 > 12	4 < 12	5 = 12	6 > 12	7 = 12	8 > 12	9 < 12	10 = 12	11 < 12		
13	1 > 13	2 > 13	3 > 13	4 < 13							11 > 13	12 > 13	
14	1 = 14	2 < 14	3 > 14	4 < 14	5 = 14	6 > 14	7 = 14	8 > 14	9 < 14	10 = 14	11 < 14	12 = 14	
15	1 = 15	2 < 15	3 > 15	4 < 15	5 = 15	6 > 15	7 = 15	8 > 15	9 < 15	10 = 15	11 < 15	12 = 15	15 > 13
16	1 = 16	2 < 16	3 > 16	4 < 16	5 = 16	6 > 16	7 = 16	8 > 16	9 < 16	10 = 16	11 < 16	12 = 16	
17	1 = 17	2 < 17	3 > 17	4 < 17	5 = 17	6 > 17	7 = 17	8 > 17	9 < 17	10 = 17	11 < 17	12 = 17	
18	1 = 18	2 < 18	3 > 18	4 < 18	5 = 18	6 > 18	7 = 18	8 > 18	9 < 18	10 = 18	11 < 18	12 = 18	
19	1 > 19	2 > 19	3 > 19	4 < 19	5 > 19	6 > 19	7 > 19	8 > 19	9 < 19	10 > 19	11 < 19	12 > 19	
20	1 = 20	2 < 20	3 > 20	4 < 20	5 = 20	6 > 20	7 = 20	8 > 20	9 < 20	10 = 20	11 < 20	12 = 20	
21	1 = 21	2 < 21	3 > 21	4 < 21	5 = 21	6 > 21	7 = 21	8 > 21	9 < 21	10 = 21	11 < 21	12 = 21	
22	1 > 22	2 > 22	3 > 22	4 < 22	5 > 22	6 > 22	7 > 22	8 > 22	9 = 22	10 > 22	11 = 22	12 > 22	13 < 22
23	1 > 23	2 > 23	3 > 23	4 < 23	5 > 23	6 > 23	7 > 23	8 > 23	9 > 23	10 > 23	11 > 23	12 > 23	
24	1 = 24	2 < 24	3 > 24	4 < 24	5 = 24	6 > 24	7 = 24		9 < 24	10 = 24		12 = 24	
25		2 = 25		4 < 25	5 > 25					10 > 25		12 > 25	
26	1 > 26	2 > 26	3 > 26	4 < 26	5 > 26	6 > 26	7 > 26	8 > 26	9 = 26	10 > 26	11 = 26	12 > 26	
27	1 > 27	2 = 27	3 > 27	4 < 27				8 > 27		10 > 27	11 < 27		
29	1 > 29	2 > 29		4 < 29						10 > 29			
30		2 < 30	3 > 30	4 < 30		6 > 30				10 = 30		12 = 30	
31	1 > 31	2 > 31	3 > 31	4 < 31					9 > 31	10 > 31	11 > 31		13 > 31
32	1 = 32	2 < 32				6 > 32		8 > 32				12 = 32	
33	1 > 33	2 > 33		4 = 33				8 > 33				12 > 33	

Table 3 (cont'd). Dominance relationships among pairs of S-alleles in hazelnut.

Allele no.	14	15	16	17	18	19	20	21	22	23	24	25	26	27
15	14 = 15													
16	14 = 16	15 = 16												
17	14 = 17	15 = 17	16 = 17											
18	14 = 18	15 = 18	16 = 18	17 = 18										
19	14 > 19	15 > 19	16 > 19	17 > 19	18 > 19									
20	14 = 20	15 = 20	16 = 20	17 = 20	18 = 20	19 < 20								
21	14 = 21	15 = 21	16 = 21	17 = 21	18 = 21	19 < 21	20 = 21							
22	14 > 22	15 > 22	16 > 22	17 > 22	18 > 22	19 > 22	20 > 22	21 > 22						
23	14 > 23	15 > 23	16 > 23	17 > 23	18 > 23	19 > 23	20 > 23	21 > 23	22 < 23					
24			16 = 24		18 = 24	19 < 24			22 < 24	23 < 24				
25		15 > 25			18 > 25	19 < 25	20 > 25		22 < 25	23 < 25				
26		15 > 26		17 > 26		19 > 26	20 > 26	21 > 26	22 = 26	23 < 26	24 > 26	25 > 26		
27		15 > 27					20 > 27			23 < 27	24 > 27			
29		15 > 29							22 > 29					
30	14 = 30				18 = 30		20 = 30		22 < 30		24 = 30		26 < 30	
31		15 > 31	16 > 31		18 > 31			21 > 31					26 > 31	27 > 31
32											24 = 32			
33														

^zPairs of S-alleles not previously reported are shown in bold. S_{28} from the cutleaf hazelnut gives self-compatibility in some pairs. S_{28} was not included in this study.

1 > 2 indicates that S_1 is dominant to S_2 ; 1 < 3 indicates that S_1 is recessive to S_3 ; and 1 = 5 indicates that S_1 and S_5 are codominant in the pollen.

Table 4. S-alleles and origins of hazelnut cultivars by group.

Group ^z	Cultivar	Origin	S-alleles (no.)		Parentage ^{y,x,w,v}
Spanish-Italian	Alcover	Spain	<u>15</u>	22	
"	Amarillo	Chile	2	<u>6</u>	
"	Amarillo Tardio	Chile	<u>2</u>	<u>2</u>	
"	B-3	Macedonia	<u>2</u>	<u>25</u>	
"	Badem	Turkey	2	<u>5</u>	
"	Barcelona	Spain	<u>1</u>	2	
"	Barrettona	Italy	2	<u>6</u>	
"	Belle di Giubilino	Italy	<u>1</u>	<u>10</u>	
"	Bianca	Italy	<u>2</u>	<u>2</u>	
"	Camponica	Italy	<u>1</u>	2	
"	Casina	Spain	<u>10</u>	<u>21</u>	
"	Closca Molla	Spain	2	<u>5</u>	
"	Comen	Italy - Piemonte	<u>2</u>	9	
"	Comun	Portugal	<u>10</u>	unknown	
"	Culpla	Spain	9	<u>10</u>	Negret x Unknown ^v
"	Da Viega	Portugal	<u>10</u>	<u>21</u>	
"	Daria (104E)	Italy	2	<u>3</u>	TGdL x Cosford ^y
"	Durazno	Chile	<u>1</u>	2	
"	Fitzgerald 20	USA, Oregon	<u>2</u>	11	
"	Francoli	Spain	<u>17</u>	22	Negret x Tomasina ^v
"	Garrofi	Spain	1	<u>6</u>	
"	Ghirara	Italy	2	<u>21</u>	
"	Gironell (Grossal)	Spain	<u>1</u>	2	
"	Gironenc Vermellet	Spain	2	<u>17</u>	
"	Grifoll	Spain	<u>2</u>	22	Negret x Morell ^v
"	Gubener Barcelloner	Germany	<u>1</u>	23	
"	Iannusa Racinante	Italy	1	<u>8</u>	
"	Lluenta	Spain	<u>17</u>	22	Negret x Gironenc Vermellet ^v
"	Lozovskoi Sharovidnyi	Ukraine	<u>2</u>	<u>25</u>	

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)		Parentage
Spanish-Italian	Macrocarpa	United Kingdom	<u>1</u>	2	San Giovanni x Tonda Bianca ^v
"	Martorella (COR 444)	Spain	<u>17</u>	22	
"	Molar	Portugal	2	<u>10</u>	
"	Morell	Spain	<u>1</u>	2	
"	Mortarella	Italy	2	<u>17</u>	
"	Napoletana	Italy	<u>1</u>	23	
"	Napoletanedda	Italy	2	<u>14</u>	
"	Negret	Spain	<u>10</u>	22	
"	Nocchiolino Sangrato	Italy	<u>7</u>	<u>17</u>	
"	Nociara	Italy	1	<u>3</u>	
"	Pauetet	Spain	<u>18</u>	22	Negret x Artellet ^v
"	Pere Mas	Spain	9	<u>10</u>	
"	Pinyolenc #1	Spain	<u>2</u>	<u>2</u>	
"	Pinyolenc #2	Spain	2	<u>17</u>	
"	Planeta	Spain	<u>1</u>	2	
"	Punxenc	Spain	<u>1</u>	<u>10</u>	Negret x Unknown ^w
"	Ratllada	Spain	<u>10</u>	22	
"	Ratoli	Spain	2	<u>10</u>	
"	Ribet	Spain	2	<u>16</u>	
"	Riccia di Talanico	Italy	<u>1</u>	2	
"	Römische Nuss	Italy (?)	<u>10</u>	<u>18</u>	
"	San Giovanni	Italy	2	<u>8</u>	
"	Sant Jaume	Spain	<u>1</u>	<u>17</u>	Barcelona x Pinyolenc #2 ^v
"	Sant Joan	Spain	<u>2</u>	<u>25</u>	
"	Sant Pere	Spain	<u>22</u>	<u>26</u>	Negret x Unknown ^v
"	Segorbe	Spain	<u>9</u>	23	
"	Siciliana Montebello	Italy	<u>1</u>	2	
"	Simon	Spain	<u>6</u>	22	Negret x Garrofi ^v
"	Tapparona di Mezzanego	Italy	<u>5</u>	25	
"	Tapparona di S.C.C. ^t	Italy	2	<u>24</u>	

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)		Parentage
Spanish-Italian	Tokolyi Cosford	Australia	<u>5</u>	23	
"	Tomasina	Spain	<u>17</u>	22	
"	Tonda Bianca	Italy	<u>1</u>	23	
"	Tonda di Giffoni	Italy	<u>2</u>	23	
"	Tonda Gentile delle Langhe	Italy	2	<u>7</u>	
"	Tonda Romana	Italy	<u>10</u>	<u>20</u>	
"	Tonda Rossa	Italy	<u>8</u>	23	
"	Tonnolella	Italy	2	<u>24</u>	
"	Tonollo	Australia	<u>1</u>	2	
"	Trenet	Spain	2	<u>15</u>	
"	Turk	USA, Oregon	<u>1</u>	2	
"	Verde	Chile	2	<u>6</u>	
Central European	Acorn Hazelnut	Poland	<u>5</u>	11	Cosford x Unknown ^v
"	Alli	Estonia	9	<u>20</u>	
"	Anglais	France	<u>5</u>	19	
"	Aveline d'Angleterre	France	<u>5</u>	<u>16</u>	
"	Barr's Zellernuss	United Kingdom	<u>5</u>	11	
"	Bergeri	France	<u>3</u>	25	
"	Blumberger Zellernuss	Germany/Poland	4	<u>20</u>	
"	Borovskoi	Ukraine	<u>10</u>	<u>24</u>	
"	Catalan	Poland	<u>10</u>	25	
"	Early Long Zeller	United Kingdom - Wertheim	<u>20</u>	25	
"	Frango #2	Poland	<u>5</u>	unknown	Cosford x Pallagrossa ^v
"	Frango #4	Poland	<u>15</u>	25	
"	Frango #5	Poland	11	<u>25</u>	Cosford x Pallagrossa ^v
"	Goc	Poland	<u>6</u>	15	
"	Gunslebert	Germany	<u>5</u>	23	
"	Gustav's Zeller	Germany	<u>15</u>	<u>20</u>	
"	Hall's Giant	Germany	<u>5</u>	<u>15</u>	
"	Hemplov Zellsky	Germany	<u>12</u>	<u>20</u>	

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)		Parentage
Central European	Karol	Poland	11	<u>15</u>	
"	Lange Landsberger	Germany	<u>15</u>	<u>20</u>	Hall's Giant x Early Long Zeller ^v
"	Lech	Poland	<u>5</u>	<u>15</u>	
"	Lenka #3	Poland	<u>3</u>	5	Cosford x Unknown ^v
"	Liegel's Zellernuss	Germany	<u>12</u>	<u>20</u>	
"	Louisen's Zellernuss	Germany	<u>10</u>	25	
"	Ludolph's Zeller	Germany	<u>5</u>	<u>20</u>	Hall's Giant x Early Long Zeller ^v
"	Maria	Poland	11	<u>15</u>	Cosford x Unknown ^v
"	Neue Riesennuss	Germany	<u>18</u>	25	
"	Pallagrossa	Italy - Piemonte	<u>5</u>	25	
"	Pirosok	Ukraine	<u>10</u>	<u>24</u>	
"	Red Fortrin	USA-Washington	2	<u>6</u>	Barcelona x Rode Zeller ^v
"	Rode Zeller (Rote Zellernuss)	Netherlands/Germany	<u>6</u>	11	
"	Riekchen's Zeller	Germany	<u>5</u>	25	Hall's Giant x Early Long Zeller ^v
"	Sickler's Zellernuss	Germany	<u>5</u>	<u>20</u>	Hall's Giant x Early Long Zeller ^v
"	Syrena	Poland	<u>6</u>	15	
"	Truchsess Zellernuss	Germany	<u>5</u>	25	
"	Veleten	Ukraine	<u>15</u>	<u>15</u>	
"	Vistula	Poland	2	<u>5</u>	
"	Volski Round	Poland	<u>5</u>	11	Hall's Giant x Cosford ^v
English	Artellet	Spain	<u>14</u>	<u>18</u>	
"	Bandnuss	United Kingdom	<u>10</u>	11	
"	Brixley's New	USA, Oregon	<u>1</u>	<u>15</u>	
"	Brixnut	USA, Oregon	<u>1</u>	<u>14</u>	Barcelona x DuChilly ^v
"	Butler	USA, Oregon	2	<u>3</u>	Barcelona x Daviana ^{x,v}
"	Buttner's Zellernuss	Germany	11	<u>27</u>	
"	Compton	USA, Oregon	2	<u>3</u>	Barcelona x Daviana (?)
"	Contorta	United Kingdom	<u>5</u>	<u>10</u>	
"	Corabel	France	1	<u>3</u>	Barcelona x Cosford ^{x,v}

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)		Parentage
English	Frizzled Filbert	United Kingdom	9	<u>10</u>	
"	Cosford	United Kingdom	<u>3</u>	11	
"	Creswell	USA, Oregon	2	<u>10</u>	
"	Daviana	United Kingdom	<u>3</u>	11	
"	Dowton Long #1	United Kingdom	<u>3</u>	14	
"	Dowton Long #2	United Kingdom	9	<u>10</u>	
"	DuChilly	United Kingdom	<u>10</u>	<u>14</u>	
"	Empress Eugenie	United Kingdom	<u>3</u>	14	DuChilly x Cosford ^{x,v}
"	Ennis	USA, Washington	<u>1</u>	11	Barcelona x Daviana ^{x,v}
"	Fitzgerald	USA, Washington	2	<u>3</u>	Barcelona x Daviana ^v
"	Fitzgerald #20	USA, Washington	<u>2</u>	11	Barcelona x Daviana (?)
"	Freehusker	USA, Oregon	<u>1</u>	11	Barcelona x Cosford ^v
"	Garibaldi	United Kingdom	<u>5</u>	11	
"	Gauna	Aregntina	<u>1</u>	<u>1</u>	
"	Gem	USA, Oregon	2	<u>14</u>	Barcelona x DuChilly ^v
"	Henneman #3	Unknown	<u>6</u>	10	
"	Jemtgaard 76	USA, Oregon	2	<u>3</u>	
"	Jemtgaard 80	USA, Oregon	2	<u>3</u>	
"	Lansing #1	USA, Oregon	1	<u>3</u>	Barcelona x Daviana (?)
"	Lansing #2	USA, Oregon	<u>3</u>	10	
"	Little Poland	Poland	<u>3</u>	5	Cosford x Unknown ^v
"	Lyons	USA, Oregon	2	<u>14</u>	Barcelona x DuChilly ^v
"	Mar del Plata	Argentina	<u>16</u>	23	
"	Medium Long	USA, New York	11	<u>12</u>	
"	Moscow N35	Moscow Forestry Institute	5	<u>6</u>	
"	Nixon	USA, Oregon	2	<u>3</u>	Barcelona x Cosford ^v
"	Nonpareil	USA, Oregon	1	<u>3</u>	Barcelona x Daviana ^v
"	Nooksack	USA, Washington	<u>6</u>	14	DuChilly x Unknown ^v
"	Nottingham	United Kingdom	<u>8</u>	10	
"	Princess Royal	United Kingdom	11	<u>14</u>	

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)		Parentage
English	Prolific Closehead	United Kingdom	<u>5</u>	11	
"	Royal	USA, Oregon	1	<u>3</u>	Barcelona x Cosford ^{w,v}
"	The Shah	United Kingdom	<u>14</u>	<u>30</u>	
"	Wallace Seedling	USA, Oregon	<u>2</u>	11	Barcelona x Daviana (?)
"	Warsaw Red	Poland	1	<u>6</u>	Barcelona x Henneman #3 ^v
"	Woodford	USA, Oregon	1	<u>3</u>	Barcelona x Daviana ^v
"	Volle Zeller CC05.45	Germany	11	<u>14</u>	
"	Volle Zeller R639	Germany	<u>3</u>	14	
Black Sea	Anakliuri	Georgia	4	<u>14</u>	
"	Arzu	Azerbaijan	<u>31</u>	<u>31</u>	
"	Ashrafi 1090.011	Azerbaijan	<u>16</u>	31	
"	Ashrafi 1226.004	Azerbaijan	<u>13</u>	31	
"	Aslan Baba	Azerbaijan	4	<u>15</u>	
"	Ata Baba	Azerbaijan	4	<u>31</u>	
"	Ata Ula	Azerbaijan	4	<u>10</u>	
"	Azeri	Azerbaijan	<u>2</u>	<u>27</u>	
"	B-4	Macedonia	<u>10</u>	<u>17</u>	
"	Barli	Azerbaijan	<u>10</u>	31	
"	Bomba	Azerbaijan	<u>2</u>	33	
"	Bulgaria XI-8	Bulgaria	4	<u>12</u>	
"	Cherkesskii II	Russia	4	<u>24</u>	
"	Chikivistava	Georgia	4	<u>10</u>	
"	Cozia	Romania	<u>5</u>	<u>15</u>	
"	Dal Rossa	Italy	<u>5</u>	<u>18</u>	
"	Dedoplistiti	Georgia	<u>8</u>	14	
"	Elbari	Azerbaijan	<u>2</u>	33	
"	Firavan	Azerbaijan	4	<u>31</u>	
"	Galib	Azerbaijan	4	<u>16</u>	
"	Ganja	Azerbaijan	<u>4</u>	<u>33</u>	
"	Georgian OSU 759.010	Georgia	4	<u>20</u>	

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)	Parentage
Black Sea	Gizil Findiq	Azerbaijan	<u>10</u>	31
"	Gobekli	Azerbaijan	4	<u>5</u>
"	Imperiale de Trebizonde	Turkey	2	<u>10</u>
"	Istarski Duguljasti	Slovenia	<u>10</u>	<u>17</u>
"	Ordu	Turkey	4	<u>25</u>
"	Kalinkara	Turkey	4	<u>21</u> Incekara x Palaz or Kan ^u
"	Khachapura	Georgia	<u>3</u>	18
"	Kudryavchik 1226.003	Georgia	4	<u>10</u>
"	Kudryavchik 1226.041	Georgia	4	<u>24</u>
"	Mincane (Akcakoca)	Turkey	4	<u>10</u>
"	Nasimi	Azerbaijan	4	<u>31</u>
"	Nemsa	Georgia	<u>1</u>	4
"	Palaz	Turkey	<u>2</u>	4
"	Pellicule Rouge	France (?)	<u>5</u>	<u>10</u>
"	Pioneer	Ukraine	<u>2</u>	4
"	Qabala	Azerbaijan	4	<u>6</u>
"	Red Lambert	United Kingdom (in 1600s)	<u>5</u>	<u>10</u>
"	Romavel	Romania	<u>2</u>	unknown
"	Sachakhli	Azerbaijan	<u>5</u>	<u>10</u>
"	Ordu	Turkey	4	<u>25</u>
"	San Benedetto	Italy	4	<u>12</u>
"	Shokoladnyi	Ukraine	4	<u>11</u>
"	Shveliskura	Georgia	<u>5</u>	<u>10</u>
"	Shvelilskura Row 1190	Georgia	4	<u>14</u>
"	Skorospelka	Georgia	4	<u>23</u>
"	Sivri Ghiaghli	Greece	4	<u>12</u>
"	Sivri Ocak 5	Turkey	<u>8</u>	10
"	Tala	Azerbaijan	2	<u>5</u>
"	Tombul (syn. Extra Ghiaghli)	Turkey	4	<u>12</u>
"	Tombul Ghiaghli	Greece/Turkey	4	<u>8</u>
"	Topkhara	Azerbaijan	2	<u>10</u>

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)		Parentage
Black Sea	White Filbert	southern Europe (?)	<u>5</u>	<u>10</u>	
"	Whiteheart	New Zealand	2	<u>10</u>	White Filbert x Unknown ^v
"	Ugbrooke	New Zealand	<u>5</u>	9	
"	Uzum Sakar	Azerbaijan	4	<u>10</u>	
"	Webb's Prize Cob	United Kingdom	<u>17</u>	<u>17</u>	
"	Yagli Findiq	Azerbaijan	<u>4</u>	<u>4</u>	
Other	Albania 80	Albania	<u>8</u>	32	
"	Aurea	France	<u>6</u>	9	
"	Barbakan	unknown?	5	<u>6</u>	
"	Barcelloner Zellernuss	Spain	<u>10</u>	<u>17</u>	
"	Bosio	Italy	<u>1</u>	2	
"	Burchardt's Zellernuss	Germany	2	<u>7</u>	
"	Crvenje	Serbia	<u>6</u>	23	
"	Cutleaf	United Kingdom	<u>20</u>	<u>28</u>	
"	Danish Wild	Denmark	<u>8</u>	23	
"	Dnepr-1	Ukraine	<u>15</u>	<u>21</u>	
"	Ducalovici	Serbia	<u>1</u>	9	
"	Finland COR 187	Finland	9	<u>25</u>	
"	Fusco Rubra	Germany, Breslau	<u>6</u>	19	
"	Gasaway	USA - Washington	<u>3</u>	26	
"	Jean's	Italy (?)	2	<u>10</u>	
"	Menoia	Italy	<u>8</u>	10	
"	Moscow N01	Moscow Forestry Inst.	<u>21</u>	23	
"	Moscow N01.06	Moscow Forestry Inst.	<u>6</u>	20	
"	Moscow N01.07	Moscow Forestry Inst.	<u>6</u>	20	
"	Moscow N02	Moscow Forestry Inst.	<u>6</u>	20	
"	Moscow N06	Moscow Forestry Inst.	2	<u>20</u>	
"	Moscow N08	Moscow Forestry Inst.	<u>5</u>	26	
"	Moscow N11	Moscow Forestry Inst.	<u>6</u>	20	
"	Moscow N12	Moscow Forestry Inst.	<u>6</u>	20	

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)		Parentage
Other	Moscow N23	Moscow Forestry Inst.	<u>6</u>	30	
"	Moscow N26	Moscow Forestry Inst.	<u>1</u>	29	
"	Moscow N27	Moscow Forestry Inst.	<u>19</u>	23	
"	Moscow N28	Moscow Forestry Inst.	<u>2</u>	26	
"	Moscow N30	Moscow Forestry Inst.	26	<u>30</u>	
"	Moscow N31	Moscow Forestry Inst.	26	unknown	
"	Moscow N33	Moscow Forestry Inst.	<u>5</u>	19	
"	Moscow N34	Moscow Forestry Inst.	9	<u>20</u>	
"	Moscow N36	Moscow Forestry Inst.	<u>1</u>	<u>20</u>	
"	Moscow N37	Moscow Forestry Inst.	1	<u>6</u>	
"	Moscow N38	Moscow Forestry Inst.	<u>20</u>	<u>30</u>	
"	Moscow N43	Moscow Forestry Inst.	<u>6</u>	32	
"	Moscow N45	Moscow Forestry Inst.	<u>6</u>	32	
"	Pendula	France	<u>3</u>	9	
"	Polli 3-10	Estonia	<u>2</u>	<u>27</u>	
"	Reka #1	Serbia	<u>1</u>	<u>17</u>	
"	Reka #2	Serbia	2	<u>32</u>	
"	Sodlinger	Serbia (Slovenia)	<u>6</u>	11	
"	Stepovy	not in USDA database	2	<u>5</u>	
"	Suvodol	Ukraine	5	<u>6</u>	
"	Trbusani	Serbia	<u>15</u>	26	
"	Uebov	Serbia	<u>12</u>	<u>16</u>	
"	Zimmerman	USA, Oregon	1	<u>3</u>	Barcelona x Gasaway ^y
OSU ^s Breeding Program	Clark (OSU 276.142)	USA, Oregon	<u>3</u>	<u>8</u>	Tombul Ghiaghli x Willamette ^y
"	Delta (OSU 510.041)	USA, Oregon	<u>1</u>	<u>15</u>	OSU 249.159 x VR 17-15 ^y
"	Dorris (OSU 876.041)	USA, Oregon	<u>1</u>	<u>12</u>	OSU 309.074 x Delta ^y
"	Epsilon (OSU 699.073)	USA, Oregon	<u>1</u>	4	(T. Romana x T. Ghiaghli) x Zimmerman ^y
"	Eta (OSU 984.075)	USA, Oregon	<u>11</u>	<u>26</u>	OSU 581.039 x OSU 553.090 ^y
"	Felix (OSU 941.016)	USA, Oregon	<u>15</u>	<u>21</u>	OSU 384.095 x Delta ^y

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)		Parentage
OSU Breeding Program	Gamma (OSU 589.028)	USA, Oregon	2	<u>10</u>	Casina x (R. di Talanico x Gasaway) ^y
"	Jefferson (OSU 703.007)	USA, Oregon	1	<u>3</u>	OSU 252.146 x OSU 414.062 ^y
"	Lewis (OSU 243.002)	USA, Oregon	<u>3</u>	<u>8</u>	(Barc. x Tombul Ghiaghli) x Willamette ^y
"	Red Dragon	USA, Oregon	<u>6</u>	26	OSU 487.055 x OSU 367.039 ^y
"	Sacajawea (OSU 540.130)	USA, Oregon	<u>1</u>	22	OSU 43.091 x Sant Pere ^y
"	Santiam (OSU 509.064)	USA, Oregon	<u>3</u>	15	OSU 249.159 x VR 17-15 ^y
"	Theta (OSU 1001.008)	USA, Oregon	<u>5</u>	<u>15</u>	OSU 561.184 x Delta ^y
"	Tonda Pacifica (OSU 228.084)	USA, Oregon	<u>1</u>	2	TGdL x (Barc. x Extra Ghiaghli) ^y
"	VR 11-27	USA, Oregon	1	<u>3</u>	Montebello x Gasaway ^y
"	VR 20-11	USA, Oregon	2	<u>3</u>	(Barc. x Compton) x Gasaway ^y
"	VR 23-18	USA, Oregon	1	<u>3</u>	(Barc. x Lansing) x Gasaway ^y
"	VR 4-31	USA, Oregon	1	<u>3</u>	Montebello x Gasaway ^y
"	Wepster (OSU 894.030)	USA, Oregon	<u>1</u>	2	T. Pacifica x OSU 440.005 ^y
"	Willamette (OSU 43.058)	USA, Oregon	1	<u>3</u>	Montebello x Unknown ^y
"	Yamhill (OSU 542.102)	USA, Oregon	<u>8</u>	26	OSU 296.082 x (Montebello x Gasaway) ^y
"	York (OSU 878.048)	USA, Oregon	2	<u>21</u>	OSU 479.027 x OSU 504.065 ^y
"	Zeta (OSU 670.095)	USA, Oregon	<u>1</u>	<u>1</u>	OSU 342.019 x Zimmerman ^y
Interspecific Hybrids	Bixby	USA, interspecific hybrid	<u>20</u>	23	Rush x Italian Red ^y
"	Buchanan	USA, interspecific hybrid	<u>12</u>	<u>15</u>	
"	Chinese Trazel Gellatly #4	BC, Canada, interspecific hybrid	<u>15</u>	25	
"	Chinese Trazel Gellatly #11	BC, Canada, interspecific hybrid	13	<u>15</u>	
"	Chinese Trazel Gellatly #6	BC, Canada, interspecific hybrid	13	<u>15</u>	
"	Dalian 83-81	China, interspecific hybrid	<u>3</u>	19	
"	Dawei (Dalian 84-329)	China, interspecific hybrid	5	<u>6</u>	
"	Dalian 84-75	China, interspecific hybrid	<u>3</u>	7	

Table 4 (cont'd). S-alleles and origins of hazelnut cultivars.

Group	Cultivar	Origin	S-alleles (no.)		Parentage
Interspecific Hybrids	Faroka	USA, Michigan, interspecific hyb.	<u>11</u>	13	
"	Farris 88BS	USA, Michigan, interspecific hyb.	<u>3</u>	11	
"	Grand Traverse	USA, Michigan, interspecific hyb.	11	<u>25</u>	Faroka x Unknown ^y
"	Potomac	USA, interspecific hybrid	<u>5</u>	<u>12</u>	Rush x DuChilly ^y
"	Reed	USA, interspecific hybrid	<u>12</u>	<u>15</u>	Rush x Hall's Giant ^y

^z Cultivars assigned to groups based primarily on SSR analysis (Bocacci et al., 2006; Gökirmak et al., 2009; Mehlenbacher, unpub.) with consideration of morphology and geographic origin

^y parentage based on publications and/or breeder records

^x parentage based on SSR markers (Bocacci et al., 2006)

^w parentage based on SSR markers (Bocacci et al., 2008)

^v parentage based on SSR markers (Gökirmak et al., 2009)

^u parentage based on SSR markers (Gürcan et al., 2010)

^t Tapparona di San Colombano Cortemoli

^s Oregon State University

Table 5. Frequency of S-alleles in hazelnut cultivars by group.

Allele	Group							
	Spanish-Italian		Central European		English		Black Sea	
	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1	20	14.08	0	0.00	12	12.77	1	0.86
2	43	30.28	2	2.63	11	11.70	10	8.62
3	2	1.41	2	2.63	18	19.15	1	0.86
4	0	0.00	1	1.32	0	0.00	32	27.59
5	4	2.82	16	21.05	5	5.32	10	8.62
6	5	3.52	4	5.26	4	4.26	1	0.86
7	2	1.41	0	0.00	0	0.00	0	0.00
8	3	2.11	0	0.00	1	1.06	3	2.59
9	4	2.82	1	1.32	2	2.13	1	0.86
10	13	9.15	4	5.26	9	9.57	18	15.52
11	1	0.70	7	9.21	13	13.83	1	0.86
12	0	0.00	2	2.63	1	1.06	4	3.45
13	0	0.00	0	0.00	0	0.00	1	0.86
14	1	0.70	0	0.00	12	12.77	3	2.59
15	2	1.41	11	14.47	1	1.06	2	1.72
16	1	0.70	1	1.32	1	1.06	2	1.72
17	9	6.34	0	0.00	0	0.00	4	3.45
18	2	1.41	1	1.32	1	1.06	2	1.72
19	0	0.00	1	1.32	0	0.00	0	0.00
20	1	0.70	9	11.84	0	0.00	1	0.86
21	3	2.11	0	0.00	0	0.00	1	0.86
22	11	7.75	0	0.00	0	0.00	0	0.00
23	7	4.93	1	1.32	1	1.06	1	0.86
24	2	1.41	2	2.63	0	0.00	2	1.72
25	4	2.82	10	13.16	0	0.00	1	0.86
26	1	0.70	0	0.00	0	0.00	0	0.00
27	0	0.00	0	0.00	1	1.06	1	0.86
28	0	0.00	0	0.00	0	0.00	0	0.00
29	0	0.00	0	0.00	0	0.00	0	0.00
30	0	0.00	0	0.00	1	1.06	0	0.00
31	0	0.00	0	0.00	0	0.00	9	7.76
32	0	0.00	0	0.00	0	0.00	0	0.00
33	0	0.00	0	0.00	0	0.00	3	2.59
unknown	1	0.70	1	1.32	0	0.00	1	0.86
Total	142	100.00	76	100.00	94	100.00	116	100.00

Allele	Group					
	Other		OSU ² Releases		Total	
	Count	Percentage	Count	Percentage	Count	Percentage
1	7	7.45	13	28.26	53	9.33
2	8	8.51	5	10.87	79	13.91
3	3	3.19	9	19.57	35	6.16
4	0	0.00	1	2.17	34	5.99
5	5	5.32	1	2.17	41	7.22
6	15	15.96	1	2.17	30	5.28
7	1	1.06	0	0.00	3	0.53
8	3	3.19	3	6.52	13	2.29
9	5	5.32	0	0.00	13	2.29
10	3	3.19	1	2.17	48	8.45
11	1	1.06	1	2.17	24	4.23
12	1	1.06	1	2.17	9	1.58
13	0	0.00	0	0.00	1	0.18
14	0	0.00	0	0.00	16	2.82
15	2	2.13	4	8.70	21	3.70
16	1	1.06	0	0.00	6	1.06
17	2	2.13	0	0.00	15	2.64
18	0	0.00	0	0.00	6	1.06
19	3	3.19	0	0.00	4	0.70
20	10	10.64	0	0.00	21	3.70
21	2	2.13	2	4.35	7	1.23
22	0	0.00	1	2.17	12	2.11
23	4	4.26	0	0.00	14	2.46
24	0	0.00	0	0.00	6	1.06
25	1	1.06	0	0.00	16	2.82
26	6	6.38	3	6.52	10	1.76
27	1	1.06	0	0.00	3	0.53
28	1	1.06	0	0.00	1	0.18
29	1	1.06	0	0.00	1	0.18
30	3	3.19	0	0.00	4	0.70
31	0	0.00	0	0.00	9	1.58
32	4	4.26	0	0.00	4	0.70
33	0	0.00	0	0.00	3	0.53
unknown	1	1.06	0	0.00	4	0.70
Total	94	100.00	46	100.00	568	100.00

² Oregon State University

Table 6. S-alleles in hazelnut selections originating from seeds collected in several countries. Shown for each S-allele are the counts of the number of seedlings with that allele.

Allele (no.)	Country									Total		Countries in which present (no.)
	Turkey	Georgia	Azerbaijan	Armenia	Russia	Ukraine	Iran	Other	Count	Percentage		
1	8	4	0	1	3	0	0	0	16	1.53	4	
2	40	10	6	6	7	6	10	1	86	8.24	8	
3	16	2	2	4	5	3	0	0	32	3.07	6	
4	156	19	29	9	40	1	1	1	256	24.52	8	
5	12	2	1	0	14	1	0	4	34	3.26	6	
6	4	2	1	1	7	1	0	4	20	1.92	7	
7	2	1	3	2	2	0	0	1	11	1.05	6	
8	51	3	1	1	5	1	2	0	64	6.13	7	
9	11	1	1	3	3	4	0	6	29	2.78	7	
10	51	8	14	0	16	11	0	3	103	9.87	6	
11	1	2	0	0	5	1	0	0	9	0.86	4	
12	55	0	2	1	1	0	0	1	60	5.75	5	
13	1	1	0	0	1	0	0	0	3	0.29	3	
14	18	3	2	0	8	3	0	1	35	3.35	6	
15	1	0	0	1	6	0	0	3	11	1.05	4	
16	22	0	1	2	2	2	0	1	30	2.87	6	
17	3	1	0	0	6	1	0	0	11	1.05	4	
18	3	2	7	2	5	0	0	1	20	1.92	6	
19	5	4	3	0	6	1	0	1	20	1.92	6	
20	2	7	0	2	4	0	0	0	15	1.44	4	
21	9	1	0	1	1	2	0	2	16	1.53	6	
22	7	0	1	0	2	2	0	2	14	1.34	5	
23	0	0	0	0	3	1	0	1	5	0.48	3	

Table 6 (cont'd). S-alleles in hazelnut selections originating from seeds collected in several countries. Shown for each S-allele are the counts of the number of seedlings with that allele.

Allele (no.)	Country									Total		Countries in which present (no.)
	Turkey	Georgia	Azerbaijan	Armenia	Russia	Ukraine	Iran	Other	Count	Percentage		
24	2	1	4	1	20	2	0	1	31	2.97	7	
25	11	1	1	2	2	4	0	2	23	2.20	7	
26	5	0	0	3	5	0	0	0	13	1.25	3	
27	2	4	0	2	0	0	0	1	9	0.86	4	
28	0	0	0	0	0	0	0	0	0	0.00	0	
29	0	0	0	0	1	0	0	0	1	0.10	1	
30	9	2	1	2	1	0	0	1	16	1.53	6	
31	0	5	18	6	4	0	0	0	33	3.16	4	
32	3	0	0	0	2	0	0	0	5	0.48	2	
33	1	0	0	0	0	0	5	0	6	0.57	2	
Unknown	5	0	0	0	1	1	0	0	7	0.67	3	
Sum	516	86	98	52	188	48	18	38	1044	100.00		

S-allele	Country								Total		No. countries in which present
	Turkey	Georgia	Azerbaijan	Armenia	Russia	Ukraine	Iran	Other	Count	Percentage	
1	8	4	0	1	3	0	0	0	16	1.53	4
2	40	10	6	6	7	6	10	1	86	8.24	8
3	16	2	2	4	5	3	0	0	32	3.07	6
4	156	19	29	9	40	1	1	1	256	24.52	8
5	12	2	1	0	14	1	0	4	34	3.26	6
6	4	2	1	1	7	1	0	4	20	1.92	7
7	2	1	3	2	2	0	0	1	11	1.05	6
8	51	3	1	1	5	1	2	0	64	6.13	7
9	11	1	1	3	3	4	0	6	29	2.78	7
10	51	8	14	0	16	11	0	3	103	9.87	6
11	1	2	0	0	5	1	0	0	9	0.86	4
12	55	0	2	1	1	0	0	1	60	5.75	5
13	1	1	0	0	1	0	0	0	3	0.29	3
14	18	3	2	0	8	3	0	1	35	3.35	6
15	1	0	0	1	6	0	0	3	11	1.05	4
16	22	0	1	2	2	2	0	1	30	2.87	6
17	3	1	0	0	6	1	0	0	11	1.05	4
18	3	2	7	2	5	0	0	1	20	1.92	6
19	5	4	3	0	6	1	0	1	20	1.92	6
20	2	7	0	2	4	0	0	0	15	1.44	4
21	9	1	0	1	1	2	0	2	16	1.53	6
22	7	0	1	0	2	2	0	2	14	1.34	5
23	0	0	0	0	3	1	0	1	5	0.48	3
24	2	1	4	1	20	2	0	1	31	2.97	7
25	11	1	1	2	2	4	0	2	23	2.20	7
26	5	0	0	3	5	0	0	0	13	1.25	3
27	2	4	0	2	0	0	0	1	9	0.86	4
28	0	0	0	0	0	0	0	0	0	0.00	0
29	0	0	0	0	1	0	0	0	1	0.10	1
30	9	2	1	2	1	0	0	1	16	1.53	6
31	0	5	18	6	4	0	0	0	33	3.16	4
32	3	0	0	0	2	0	0	0	5	0.48	2
33	1	0	0	0	0	0	5	0	6	0.57	2
Unknown	5	0	0	0	1	1	0	0	7	0.67	3
Sum	516	86	98	52	188	48	18	38	1044	100.00	

Table 7. Frequency of S-alleles in hazelnut selections originating in eight seed lots collected in Turkey.

Allele no.	Turkish selection group no.								Total		Groups present (no.)
	1	2	3	4	5	6	7	8	No.	%	
1	1	1	0	1	1	0	0	4	8	1.55	5
2	1	0	17	3	1	1	5	12	40	7.75	7
3	0	0	1	2	0	1	0	12	16	3.10	4
4	9	5	15	16	12	26	8	65	156	30.23	8
5	2	0	1	1	1	0	0	7	12	2.33	5
6	0	0	1	0	0	0	1	2	4	0.78	3
7	0	0	0	0	0	0	1	1	2	0.39	2
8	4	9	3	11	1	14	2	7	51	9.88	8
9	1	1	0	0	0	1	2	6	11	2.13	5
10	2	0	1	11	4	0	8	25	51	9.88	6
11	0	0	0	0	0	0	0	1	1	0.19	1
12	1	1	2	6	7	1	1	36	55	10.66	8
13	0	0	0	0	0	0	0	1	1	0.19	1
14	0	1	0	1	2	14	0	0	18	3.49	4
15	0	1	0	0	0	0	0	0	1	0.19	1
16	0	0	2	4	0	0	2	14	22	4.26	4
17	0	1	0	0	0	0	0	2	3	0.58	2
18	0	1	0	1	0	0	0	1	3	0.58	3
19	0	0	1	0	0	3	0	1	5	0.97	3
20	0	0	1	0	1	0	0	0	2	0.39	2
21	0	0	2	2	0	0	1	4	9	1.74	4
22	0	1	0	0	0	0	2	4	7	1.36	3
23	0	0	0	0	0	0	0	0	0	0.00	0
24	1	0	0	1	0	0	0	0	2	0.39	2
25	0	1	1	1	4	0	1	3	11	2.13	6
26	0	0	0	1	0	0	2	2	5	0.97	3
27	0	0	0	0	0	0	0	2	2	0.39	1
28	0	0	0	0	0	0	0	0	0	0.00	0
29	0	0	0	0	0	0	0	0	0	0.00	0
30	0	0	0	0	0	0	0	9	9	1.74	1
31	0	0	0	0	0	0	0	0	0	0.00	0
32	0	0	0	0	0	0	0	3	3	0.58	1
33	0	0	0	0	0	0	0	1	1	0.19	1
Unknown	0	1	0	0	0	1	0	3	5	0.97	3
Sum	22	24	48	60	34	62	36	228	516	100.00	

Table 8. Frequency of S-alleles in hazelnut selections originating in six seed lots collected in Georgia.

Allele no.	Georgian selection group no.						Total		Groups present (no.)
	1	2	3	4	5	6	No.	%	
1	0	2	0	0	2	0	4	4.65	2
2	3	3	2	1	1	0	10	11.63	5
3	0	0	1	1	0	0	2	2.33	2
4	3	6	5	0	2	3	19	22.09	5
5	0	0	1	0	1	0	2	2.33	2
6	2	0	0	0	0	0	2	2.33	1
7	0	0	0	0	1	0	1	1.16	1
8	0	0	1	0	2	0	3	3.49	2
9	1	0	0	0	0	0	1	1.16	1
10	3	0	3	0	0	2	8	9.30	3
11	0	1	0	1	0	0	2	2.33	2
12	0	0	0	0	0	0	0	0.00	0
13	0	1	0	0	0	0	1	1.16	1
14	0	1	2	0	0	0	3	3.49	2
15	0	0	0	0	0	0	0	0.00	0
16	0	0	0	0	0	0	0	0.00	0
17	0	0	0	0	0	1	1	1.16	1
18	0	0	0	2	0	0	2	2.33	1
19	1	0	2	0	0	1	4	4.65	3
20	1	1	1	1	2	1	7	8.14	6
21	0	0	1	0	0	0	1	1.16	1
22	0	0	0	0	0	0	0	0.00	0
23	0	0	0	0	0	0	0	0.00	0
24	0	0	0	0	0	1	1	1.16	1
25	0	1	0	0	0	0	1	1.16	1
26	0	0	0	0	0	0	0	0.00	0
27	0	2	0	0	1	1	4	4.65	3
28	0	0	0	0	0	0	0	0.00	0
29	0	0	0	0	0	0	0	0.00	0
30	1	1	0	0	0	0	2	2.33	2
31	1	1	3	0	0	0	5	5.81	3
32	0	0	0	0	0	0	0	0.00	0
33	0	0	0	0	0	0	0	0.00	0
Unknown	0	0	0	0	0	0	0	0.00	0
Sum	16	20	22	6	12	10	86	100.00	

Table 9. Frequency of S-alleles in hazelnut selections originating in three seed lots collected in Azerbaijan.

Allele no.	Azerbaijan group			Total	
	no.			No.	%
	1	2	3		
1	0	0	0	0	0.00
2	1	0	5	6	6.12
3	1	1	0	2	2.04
4	15	6	8	29	29.59
5	0	0	1	1	1.02
6	0	0	1	1	1.02
7	1	1	1	3	3.06
8	1	0	0	1	1.02
9	1	0	0	1	1.02
10	4	3	7	14	14.29
11	0	0	0	0	0.00
12	0	1	1	2	2.04
13	0	0	0	0	0.00
14	1	1	0	2	2.04
15	0	0	0	0	0.00
16	1	0	0	1	1.02
17	0	0	0	0	0.00
18	7	0	0	7	7.14
19	0	2	1	3	3.06
20	0	0	0	0	0.00
21	0	0	0	0	0.00
22	1	0	0	1	1.02
23	0	0	0	0	0.00
24	2	0	2	4	4.08
25	1	0	0	1	1.02
26	0	0	0	0	0.00
27	0	0	0	0	0.00
28	0	0	0	0	0.00
29	0	0	0	0	0.00
30	0	0	1	1	1.02
31	15	1	2	18	18.37
32	0	0	0	0	0.00
33	0	0	0	0	0.00
Unknown	0	0	0	0	0.00
Sum	52	16	30	98	100.00

Table 10. Frequency of S-alleles in hazelnut selections originating in eight seed lots collected in Russia.

Allele no.	Russian selection group no.								Total		Groups present (no.)
	1	2	3	4	5	6	7	8	No.	%	
1	1	0	0	0	0	0	0	2	3	1.60	2
2	2	0	4	1	0	0	0	0	7	3.72	3
3	0	1	2	0	0	1	1	0	5	2.66	4
4	3	13	11	4	9	0	0	0	40	21.28	5
5	0	0	0	0	4	0	1	9	14	7.45	3
6	1	1	2	0	0	0	1	2	7	3.72	5
7	1	0	0	1	0	0	0	0	2	1.06	2
8	0	1	1	1	0	0	0	2	5	2.66	4
9	0	0	2	1	0	0	0	0	3	1.60	2
10	4	3	1	5	0	0	2	1	16	8.51	6
11	1	0	1	0	0	2	1	0	5	2.66	4
12	0	0	1	0	0	0	0	0	1	0.53	1
13	0	0	1	0	0	0	0	0	1	0.53	1
14	0	3	0	0	0	0	0	5	8	4.26	2
15	1	0	0	0	0	0	1	4	6	3.19	3
16	0	1	0	0	0	0	0	1	2	1.06	2
17	0	0	0	0	0	0	0	6	6	3.19	1
18	0	1	0	4	0	0	0	0	5	2.66	2
19	0	3	1	0	0	0	1	1	6	3.19	4
20	0	2	0	1	0	0	0	1	4	2.13	3
21	0	0	0	0	0	1	0	0	1	0.53	1
22	0	1	0	0	0	0	1	0	2	1.06	2
23	0	2	1	0	0	0	0	0	3	1.60	2
24	1	2	6	2	9	0	0	0	20	10.64	5
25	0	1	0	0	0	0	0	1	2	1.06	2
26	0	1	2	0	2	0	0	0	5	2.66	3
27	0	0	0	0	0	0	0	0	0	0.00	0
28	0	0	0	0	0	0	0	0	0	0.00	0
29	0	0	0	0	0	0	1	0	1	0.53	1
30	0	0	0	0	0	0	1	0	1	0.53	1
31	1	0	0	0	0	2	1	0	4	2.13	3
32	0	0	0	0	2	0	0	0	2	1.06	1
33	0	0	0	0	0	0	0	0	0	0.00	0
Unknown	0	0	0	0	0	0	0	1	1	0.53	1
Sum	16	36	36	20	26	6	12	36	188	100	

Table 11. Differences in the frequency (%) of S-alleles in hazelnut cultivars and selections. Alleles are ranked from largest negative to largest positive difference.

Allele no.	Cultivars (n=284)	Selections (n=522)	Difference	Comment
4	5.99	24.52	-18.54	Black Sea selections
12	1.58	5.75	-4.16	Turkish selections
8	2.29	6.13	-3.84	Turkish selections
24	1.06	2.97	-1.91	Russian selections
16	1.06	2.87	-1.82	Turkish selections
31	1.58	3.16	-1.58	
10	8.45	9.87	-1.42	
19	0.70	1.92	-1.21	
18	1.06	1.92	-0.86	
30	0.70	1.53	-0.83	
14	2.82	3.35	-0.54	
7	0.53	1.05	-0.53	
9	2.29	2.78	-0.49	
27	0.53	0.86	-0.33	
21	1.23	1.53	-0.30	
13	0.18	0.29	-0.11	
33	0.53	0.57	-0.05	
Unknown	0.70	0.67	0.03	
29	0.18	0.10	0.08	
28	0.18	0.00	0.18	
32	0.70	0.48	0.23	
26	1.76	1.25	0.52	
25	2.82	2.20	0.61	
22	2.11	1.34	0.77	
17	2.64	1.05	1.59	
23	2.46	0.48	1.99	
20	3.70	1.44	2.26	Other & Central European cultivars
15	3.70	1.05	2.64	Central European cultivars
3	6.16	3.07	3.10	English cultivars
11	4.23	0.86	3.36	English cultivars
6	5.28	1.92	3.37	Other & Spanish-Italian cultivars
5	7.22	3.26	3.96	Central European cultivars
2	13.91	8.24	5.67	Spanish-Italian cultivars
1	9.33	1.53	7.80	Spanish-Italian cultivars

Table 12. Most common S-alleles in hazelnut cultivars and selections by group.

Cultivar			Seedling		
group ^z	Allele ^y	Frequency (%)	group ^x	Allele ^x	Frequency (%)
Spanish-Italian (n= 71)	2	30.28	Turkey (n=258)	4	30.23
	1	14.08		12	10.66
	10	9.15		8	9.88
	22	7.75		10	9.88
	17	6.34		2	7.75
Central European (n=38)	5	21.05	Georgia (n=43)	4	22.09
	15	14.47		2	11.63
	25	13.16		10	9.30
	20	11.84		20	8.14
	11	9.21		31	5.81
English (n=47)	3	19.15	Azerbaijan (n=49)	4	29.59
	11	13.83		31	18.37
	1	12.77		10	14.29
	14	12.77		18	7.14
	2	11.70		2	6.12
	10	9.57			
Black Sea (n=60)	4	26.67	Armenia (n=26)	4	17.31
	10	15.83		2	11.54
	2	10.00		31	11.54
	5	8.33		3	7.69
	31	7.50		9	5.77
OSU ^w Releases (n=22)	1	29.55	Russia (n=94)	26	5.77
	3	20.45		4	21.28
	2	11.36		24	10.64
	8	6.82		10	8.51
	15	6.82		5	7.45
	26	6.82			
Other (n=45)	6	16.67	Ukraine (n=24)	10	22.92
	20	11.11		2	12.50
	1	7.78		9	8.33
	2	6.67		25	8.33
				3	6.25
	26	6.67		14	6.25

Table 12 (cont'd). Most common S-alleles in hazelnut cultivars and selections by group.

Cultivar			Seedling			
Group ^z	Allele ^y	Frequency (%)	Group ^x	Allele ^x	Frequency (%)	
Total (n=283)	2	13.96	Iran (n=9)	2	55.56	
	1	9.36		33	27.78	
	10	8.48		8	11.11	
	5	7.24		4	5.56	
	3	6.18		Other (n=19)	9	15.79
	4	6.01		5	10.53	
			6	10.53		
			10	7.89		
			15	7.89		
			Total (n=522)	4	24.66	
				10	10.07	
				2	7.94	
				8	5.46	
				12	5.29	

^z Number of cultivars or seedlings in each group is shown (n)

^y Alleles in cultivars with frequencies >6%

^x Alleles in seedlings with frequencies >5%

^w Oregon State University