Distribution and Ecotypic Differentiation of *Fragaria chiloensis* in Chile

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Two botanical forms of *F. chiloensis* ssp. *chiloensis* have been recognized in Chile (Staudt, 1962): *f. patagonica* (referred to as Lahueñe in Chile), for the wild taxon with red small fruit common in Chile and Argentina, and *f. chiloensis* (previously referred to as Quelghen or Kellen in Chile), for the cultivated taxon of white and large fruit size, which is found in Chile, Peru, Ecuador and Colombia, probably carried from Chile by the Spanish conquerors (Hancock et al., 1999). The latter was domesticated by ancient inhabitants of Chile before the arrival of Spanish conquerors, and is still cultivated in small plantings [e.g. at Buchupureo (lat. 36°S), Cañete (lat. 37°30'S), Puerto Saavedra (lat. 38°46'S), Carahue (lat. 38°43'S)] along the coast of central-south Chile, in Mediterranean type climates.

F. chiloensis f. patagonica is distributed in a wide range of climatic and ecological conditions, along the coastal lands and the Andes mountains, between lat. 35°30'S and 47°33'S and between sea level and 1850 m elevation (Lavín et al., 2000). It is found in Mediterranean, marine and polar type climates, and in various soil types and plant communities. *F. chiloensis f. chiloensis* is generally found near water between sea level and 500 m (Lavín et al., 2000).

Materials and Methods

A morphometric analysis of 66 Chilean accessions of *Fragaria chiloensis* (L.) Duch. was performed to assess phenotypical differences among them. Accessions were collected in expeditions in 1993 between 41° and 47°S. Plants were planted in plastic bags and placed in raised beds outdoors. A selection of eleven vegetative, four inflorescence and five fruit

Table 2. Length of the flowering period, and number and percentage (in parentheses) of 56 accessions of *F. chiloensis* in each category. The study was conducted between September 1994 and August 1995.

Length of the flowering period (months)	Accessions (%)
11–12	7 (12.5)
9–10	10 (17.9)
7–8	8 (14.3)
5–6	11 (19.6)
3–4	9 (16.1)
1–2	5 (8.9)
<1	6 (10.7)

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Table 1. Mean values ($\pm$ SE) of relevant characters related with the two first principal components (PCs), and accessions of each cluster (PCs).

Character	Cluster no. ^z				
	1 (11)	2 (28)	3 (3)	4 (3)	5 (3)
First PC					
Length of the stipule	1.4 $\pm$ 0.06	1.1 $\pm$ 0.04	1.5 $\pm$ 0.09	0.9 $\pm$ 0.15	1.3 $\pm$ 0.29
Length of leaflets	3.8 $\pm$ 0.09	3.1 $\pm$ 0.07	3.1 $\pm$ 0.09	2.7 $\pm$ 0.23	4.4 $\pm$ 0.26
Width of leaflets	3.3 $\pm$ 0.08	2.6 $\pm$ 0.06	2.7 $\pm$ 0.06	2.3 $\pm$ 0.09	3.8 $\pm$ 0.26
Length of petioles	8.1 $\pm$ 0.50	7.1 $\pm$ 0.33	5.5 $\pm$ 0.29	5.1 $\pm$ 0.20	11 $\pm$ 1.70
Fruit polar diameter	1.7 $\pm$ 0.07	1.7 $\pm$ 0.04	1.7 $\pm$ 0.17	1.6 $\pm$ 0.23	2.8 $\pm$ 0.23
Fruit equatorial diameter	1.5 $\pm$ 0.06	1.4 $\pm$ 0.04	1.4 $\pm$ 0.09	1.3 $\pm$ 0.19	2.3 $\pm$ 0.12
Fruit yield	11.1 $\pm$ 2.32	13.0 $\pm$ 1.05	4.9 $\pm$ 0.89	2.5 $\pm$ 0.82	35.7 $\pm$ 4.19
Fruit weight	1.3 $\pm$ 0.06	1.3 $\pm$ 0.06	1.4 $\pm$ 0.30	1.0 $\pm$ 0.23	5.5 $\pm$ 0.30
Second PC					
Number of fruit per plant	9.2 $\pm$ 2.02	9.9 $\pm$ 0.78	4.0 $\pm$ 1.18	2.5 $\pm$ 0.82	5.7 $\pm$ 0.95

^zValues in parenthesis are the number of accessions in each cluster.

Table 3. Photosynthetic capacity ($A_{\max}$), stomatal conductance (g_s) and internal concentration of CO₂ (C_{int}) of accessions of *Fragaria chiloensis* and *Fragaria ×ananassa*. Values are mean of eight measurements.

Subspecies or species	Accession	$A_{\max}$ ($\mu\text{mol CO}_2/\text{m}^2/\text{s}$)	g_s ($\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$)	C_{int} (ppm)
<i>F. chiloensis</i> spp. <i>chiloensis f. patagonica</i>				
	2PAL1A	20.5	0.54	270.8
	2MAR1A	18.2	0.38	261.3
	2PAL2A	18.2	0.43	259.8
	2BAK1A	17.4	0.52	278.6
	2BAK2A	16.5	0.50	279.2
	2MAL2A	16.0	0.39	262.1
	2COC6A	15.9	0.38	253.1
	93CH11	15.0	0.40	273.9
	2TOR1A	14.5	0.68	299.8
	2YEL1A	14.4	0.50	284.9
	2FUT4A	14.0	0.32	255.7
	2CAM1A	14.0	0.34	263.9
	2CAR1A	13.0	0.22	226.4
	2CIS1A	13.4	0.31	261.4
	2BAL1B	12.6	0.20	231.9
	2PAL2C	12.5	0.24	250.4
	2COC8A	12.4	0.26	249.3
	2COC4A	12.3	0.26	240.7
	2CPU2A	10.6	0.15	277.1
	2GBN1A	10.4	0.21	246.3
	2TAP4B	9.1	0.14	238.1
	2VAL1A	8.7	0.21	229.6
	2BER1A	7.0	0.29	287.3
	2GRA1A	6.4	0.15	258.4
<i>F. chiloensis</i> spp. <i>chiloensis f. chiloensis</i>				
	3HUE1A	16.8	0.52	250.1
	3ARQ1A	16.4	0.49	247.2
	3COB1A	15.4	0.49	253.9
	94BAU	14.5	0.34	248.5
	94CAY1	14.7	0.32	253.6
	2LTS1A	12.5	0.27	235.6
	3BUC1A	12.2	0.40	244.9
	94CAY1	10.5	0.30	235.2
	2BRA1A	9.9	0.24	234.5
<i>F. ×ananassa</i>				
	094MAD1	16.3	0.40	264.8
	2QUI1A	13.5	0.29	260.1
	2BAR1A	12.7	0.34	268.1
	2SIM1A	12.4	0.26	253.5
	2CHO1A	12.2	0.25	255.4
	'Selva'	12.1	0.28	274.6
LSD _{0.05}		3.4	0.14	14.9

quantitative characteristics were evaluated in ten plants of each accession; mean values (of the 10 plants) were used in a principal component and cluster analysis.

Results and Discussion

The first two principal components (PCs) explained 37.6% and the next five PCs, with eigenvalues >1, explained 36.2% of the total variation. Cluster analysis identified four groups of *F. chiloensis* f. *patagonica* (cluster 1 to 4), suggesting that important phenotypical differences exist among accessions of the wild taxon (Table 1). Three accessions of the cultivated taxon of *F.*

chiloensis (f. *chiloensis*) formed a fifth cluster at great distance from clusters containing the wild taxons. The other 18 accessions did not form any cluster. Flowering period differed greatly among accessions of *F. chiloensis* f. *patagonica* (Table 2). A high percentage of accessions (28.6%) showed flowering periods of >9 months, which suggests a day-neutral response to photoperiod. The fruit production period of these accessions lasted 6 months (from October to April). Other accessions exhibited shorter flowering period (1 to 2 months).

Accessions of *F. chiloensis* also showed large differences in leaf photosynthetic capacity ($A_{\max}$). Larger values of $A_{\max}$ were observed in

accessions of *F. chiloensis* f. *patagonica* where seven accessions showed greater $A_{\max}$ than *F. ×ananassa* (Table 3).

Literature Cited

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