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Documentation of field and postharvest performance for a mature collection of quince (*Cydonia oblonga*) varieties in Imathia, Greece

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Abstract In this study, the adaptation of 49 quince (*Cydonia oblonga*) varieties in Naoussa, northern Greece was investigated. All varieties bloomed after 6 April. Apart from the varieties 11107 and 11150, the ripening period of fruits for all varieties was between 27 September and 6 October. The most productive varieties were 11111, 11113, 11108, 11102, 11103, 11114, and 11115. Productivity ranged from 97 to 125 kg per tree. Apart from 11111, relatively low fruit drop percentage was observed for these varieties. Varieties 11111, 11113, 11108, 11102, 11103, 11114, and 11115 were relatively tolerant to natural infections from fire blight. After 4 months of cool storage (2–4°C), varieties 11111, 11113, 11108, 11102, 11103, 11114, and 11115 were moderately susceptible to bitter pit and breakdown. Varieties 11102, 11103, and 11113 were resistant to decay, whereas 11108, 11111, 11114, and 11115 were moderately resistant. Varieties 11102 and 11103 were resistant to scald, whereas varieties 11111, 11113, 11108, 11114, and 11115 showed moderate susceptibility to scald.

Keywords *Cydonia oblonga*; bitter pit; decay; breakdown; fire blight; productivity; scald; varieties

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INTRODUCTION

The common quince (*Cydonia oblonga* L.) originates from Asia. It grows in cooler subtropical areas (Razavi et al. 2000) and cold temperate regions (Maremukov et al. 2002; Taranenko 2002), and has a culture similar to that of apples and pears. Most soils are satisfactory except those that are light, shallow, and likely to dry out (Charlier & Sansdrap 2000).

Varieties of fruits show different storage requirements and different storage periods (KeLi 1988). The storage life, quality, and susceptibility of fruits to disease and physiological disorders can be modified greatly by weather, soil, and cultural conditions (Gautier 1984). Therefore, the choice of the best storage conditions requires information on how the cultivar behaves locally and what to expect of various lots grown under various cultural and soil conditions.

Quince is not a widely cultivated crop in Greece and very few studies have been done on the adaptation of this crop in northern Greece. The purpose of this work was to study the adaptation of 49 quince varieties and their postharvest behaviour when grown under the climatic and soil conditions of the Pomology Institute, Greece.

MATERIAL AND METHODS

In 1983, a quince orchard, which consisting of 49 varieties grafted onto clonal quince rootstock EMA (Table 1), was established at the Pomology Institute, department of the National Agriculture Research Foundation, Naoussa, Greece. These varieties were collected from different parts of Greece between 1980 and 1983 (mainly from home gardens).

The experimental design was completely randomised with three replications of two trees each. The last two trees of each row were not included in the experiments and were used as guard trees. The planting distance was 5 × 3 m and the trees were trained to the spindle bush system. All trees had

Table 1 Blooming, fruit maturity, yield, susceptibility to fire blight, and fruit drop of 49 quince (*Cydonia oblonga*) varieties planted in Naoussa, Greece (values are the mean of 8 consecutive years. Numbers in each column with the same letter do not differ ($P = 0.05$) according to Duncan's multiple range test).

Varieties	Bloom date	Maturity	Yield/tree		Fruit drop (%)		Fire blight* (0–10)	
11101	13 Apr	30 Sep	67	ef	11.6	hkl	3.2	d
11102	12 Apr	6 Oct	112	ab	1.81	q	1.67	hk
11103	10 Apr	6 Oct	103	abc	3.33	pq	1	lmn
11104	10 Apr	1 Oct	21	klm	62.5	b	3	de
11105	12 Apr	1 Oct	28	hkl	65.1	b	2	gh
11106	10 Apr	2 Oct	29	hkl	38	c	5.33	b
11107	13 Apr	20 Sep	33	hk	64.4	b	0.67	no
11108	10 Apr	4 Oct	114	ab	1.52	q	1	lmn
11109	12 Apr	2 Oct	65	ef	6.36	mnop	3	de
11110	11 Apr	30 Sep	13	lm	41.3	c	1	lmn
11111	13 Apr	30 Sep	125	a	28.4	d	1.33	klm
11112	12 Apr	27 Sep	16	klm	79.1	a	4	c
11113	10 Apr	6 Oct	117	ab	1.34	q	2.33	fgh
11114	12 Apr	1 Oct	99	bc	3.29	pq	1.67	hk
11115	11 Apr	1 Oct	97	bc	4.25	opq	1.33	klm
11116	12 Apr	28 Sep	11	lm	15.6	fgh	4	c
11117	17 Apr	1 Oct	33	hk	38.1	c	2.1	fgh
11118	11 Apr	2 Oct	59	fg	3.75	pq	1.5	hkl
11119	16 Apr	28 Sep	34	hk	29.7	d	4	c
11120	13 Apr	30 Sep	68	ef	3.17	pq	1.33	klm
11121	15 Apr	29 Sep	18	klm	22.3	de	1.33	klm
11122	12 Apr	1 Oct	22	klm	13.5	ghk	0.67	no
11123	12 Apr	2 Oct	85	cde	19.5	ef	2.8	def
11124	12 Apr	1 Oct	86	cde	17.9	efg	2.67	efg
11125	18 Apr	2 Oct	66	ef	16.6	efgh	1.6	hk
11126	10 Apr	28 Sep	69	ef	7.98	lmnop	0.4	o
11127	11 Apr	27 Sep	27	hkl	8.65	lmno	1.2	klm
11128	9 Apr	30 Sep	37	hk	6.41	ghk	3.1	d
11129	11 Apr	2 Oct	11	lm	13.6	ghk	1.8	hk
11130	12 Apr	1 Oct	31	hk	7.81	lmnop	2	gh
11131	10 Apr	29 Sep	43	gh	11	hkl	2	gh
11132	9 Apr	27 Sep	56	fg	21.6	def	1	lmn
11133	13 Apr	1 Oct	79	cdef	13	ghk	1	lmn
11134	12 Apr	28 Sep	6.5	m	81.8	a	2	gh
11135	13 Apr	3 Oct	30	hkl	6.84	mnop	6.5	a
11136	12 Apr	28 Sep	9.1	lm	23.3	de	4	c
11137	12 Apr	29 Sep	92	cd	27	d	0.33	o
11138	13 Apr	28 Sep	20	klm	5.88	nopq	5.6	b
11139	8 Apr	28 Sep	6.5	m	11.5	hkl	1	lmn
11140	12 Apr	29 Sep	16	klm	10.5	klm	1.7	hk
11141	8 Apr	27 Sep	23	hkl	22.2	de	0	o
11142	10 Apr	29 Sep	10	lm	17	efg	2	gh
11143	13 Apr	1 Oct	36	hk	9.28	klmn	2	gh
11144	9 Apr	1 Oct	31	hk	4.45	opq	2	gh
11145	15 Apr	1 Oct	71	def	5.45	nopq	0.5	no
11146	14 Apr	28 Sep	79	cdef	9.93	klm	1.5	hkl
11147	12 Apr	2 Oct	83	cde	4.22	opq	0.8	mn
11149	7 Apr	4 Oct	31	hk	16.5	efgh	0	o
11150	9 Apr	20 Sep	84	cde	9.27	klmn	0.67	no

*0 = resistant, 10 = susceptible.

Table 2 Postharvest behaviour of 49 quince (*Cydonia oblonga*) varieties planted in Naoussa, northern Greece (values are the mean of 2 consecutive years. Numbers in each column with the same letter do not differ ($P = 0.05$) according to Duncan's multiple range test).

Varieties	Decay (%)		Bitter pit*		Breakdown (%)		Scald (%)	
11101	60	ab	3	c	2.25	f	20	hk
11102	0	e	3	c	3.17	c	0	s
11103	0	e	3	c	2.44	e	5	qr
11104	0	e	3	c	1.33	lm	2	rs
11105	0	e	2	d	0.83	no	0	s
11106	20	cd	1	e	1.75	gh	13.3	lo
11107	20	cd	3	c	3.25	c	30	def
11108	25	c	3	c	3.25	c	20	hk
11109	0	e	3	c	2.83	d	35	cd
11110	0	e	3	c	1.53	hkl	40	c
11111	20	cd	3	c	3.33	c	23.8	gh
11112	0	e	3	c	1.58	hkl	33.3	de
11113	0	e	3	c	3.83	b	8.8	pq
11114	20	cd	3	c	3.44	c	16.7	kl
11115	10	d	2	d	2.04	f	26.3	fg
11117	0	e	2	d	3.08	cd	20	hk
11118	0	e	0	f	3	cd	50	b
11119	50	b	4	b	3.9	b	50	b
11120	0	e	3	c	2.89	d	48.3	b
11121	70	a	3	c	4.5	a	90	a
11122	0	e	2	d	1.72	gh	35	cd
11123	0	e	3	c	2.5	e	51	b
11124	0	e	3	c	3.37	c	29	efg
11125	0	e	2	d	2.43	e	25	fg
11126	10	d	3	c	1.98	fg	39	c
11127	0	e	1	e	2.25	f	7.6	pq
11129	20	cd	3	c	2.88	d	1	s
11130	30	c	3	c	2.67	e	8	pq
11131	0	e	2	d	4.21	a	10	op
11132	0	e	3	c	3.08	cd	0	s
11133	20	cd	5	a	3.83	b	32.5	de
11135	0	e	1	e	0.67	o	0.5	s
11136	0	e	2	d	1.28	lm	5	qr
11137	10	d	3	c	3.07	cd	0	s
11138	10	d	1	e	0.71	no	5	qr
11140	10	d	1	e	1.42	kl	40	c
11141	0	e	1	e	1.13	mn	6.3	q
11142	0	e	5	a	4.2	a	20	hk
11143	0	e	1	e	0.78	no	1	s
11144	10	d	2	d	1.56	hk	16.3	kl
11145	0	e	1	e	1.45	kl	0.8	s
11146	10	d	3	c	0.75	no	30	def
11147	0	e	4	b	2.92	d	30	def

*0 = no symptoms of bitter pit, 5 = symptoms of bitter pit throughout fruit.

similar tree size (c. 3 m in height) and similar tree vigour. Trees were maintained through standard commercial practices. After harvest, fruits were stored in a refrigerator (2–4°C) for 4 months.

Observations were made on bloom time, fruit maturity date, yield, susceptibility to fire blight (determined by field ratings, a schedule of 0–10 was used: 0 = healthy tree and 10 = dead tree), and fruit drop, for 8 consecutive years (1991–99). In addition, observations were made (50 fruits from each tree) on the postharvest behaviour of 43 varieties (susceptibility to scald, breakdown, and bitter bit) for

2 consecutive years (1997–99). The percentage of decayed fruits was recorded.

Data were analysed by one-way analysis of variance (ANOVA). To combine experiments, Bartlett's test of homogeneity of variance was used and treatment means were separated by Duncan's multiple range test ($P = 0.05$).

The altitude of the orchards was 120 m a.s.l. and the distance from the sea was c. 40 km. The soil was clay-loam and its pH value was high (20 cm, 7.2; 40 cm, 7.5; 60 cm, 7.8). Calcium ($CaCO_3$) was 4.7–7.8% and water permeability good. The mean air temperatures fluctuated from 4.54°C in January to 26°C in July.

RESULTS AND DISCUSSION

There were no significant differences in the results from year to year. All the varieties bloomed after 6 April (Table 1). Spring frost did not occur after 5 April (the last was 5 April) since 1950 (unpubl. data) except in 2003. Therefore, these varieties flower later than the last spring frosts in northern Greece. Apart from varieties 11107 and 11150, the ripening period of fruits for all varieties was between 27 September and 6 October (Table 1).

The results showed that the most productive varieties were 11111, 11113, 11108, 11102, and 11103 (Table 1). Varieties 11114 and 11115 did not differ significantly from 11113, 11108, 11102, and 11103. Their productivity was between 97 and 125 kg per tree. According to Baxter (1997), yields of 100–150 kg per tree are considered a heavy yield. Expected yields could vary as a result of the interaction of variety and location. Apart from 11111, relatively low fruit drop percentage was observed for these varieties. Varieties 11111, 11113, 11108, 11102, 11103, 11114, and 11115 were relatively tolerant to natural infectious from fire blight. Similarly, Bobev & Deckers (1999) reported quince varieties with different susceptibility to fire blight in Bulgaria.

The effects of different localities on the storage period of quince have been reported. Türk & Memiçoglu (1994) reported that high altitude had an adverse effect on eating quality (respiration rate, astringency, sweetness, sourness, juice content, firmness, flavour, and appearance) of quince. Varieties 11111, 11113, 11108, 11102, 11103, 11114, and 11115 were moderately susceptible to bitter pit and breakdown. Varieties 11102, 11103, and 11113 were resistant to decay, whereas 11108, 11111, 11114, and 11115 were moderately resistant. Varieties 11102 and 11103 were resistant to scald. Varieties 11111, 11113, 11108, 11114, and 11115 showed moderate susceptibility to scald (Table 2). It is possible that productivity of trees affects the susceptibility of quince on the physiological disorders scald, breakdown, and bitter bit and their susceptibility to decay.

In Greece, varieties 11118, 11120, and 11126 are considered good because their fruits are very attractive and can be more easily sold for fresh consumption. In this study, these varieties were much less productive than 11111, 11113, 11108, 11102, and 11103, but they had good postharvest behaviour.

The economic importance of quince growing in Mediterranean countries, the potential for increased production, and principal uses for quinces are described by Nuzzo et al. (1999). There has been an increased demand by the food processing industry for quince juice in the past few years as quince juice proved to be one of the best products. Based on this study, varieties 11111, 11113, 11108, 11102, 11103, 11114, and 11115 are well adapted in conditions of Imathia, northern Greece and should be considered as an alternative crop for Greek growers.

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