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Pomological Characteristics of Hawthorns Species Found in Van Region

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Abstract: Hawthorns have not gained adequate importance in both Turkey and the World yet. This study aimed to determine the hawthorn species of the region of Van in Turkey to analyze fruit characteristics. Ninety eight hawthorn genotypes were determined by pre- selection in Gevaş and Edremit towns of Van. However, fruit samples were only 31 types from Gevaş and 18 types from Edremit, respectively. Fruit characteristics such as width, length, weight, color, dry weight of fruits; and seed characteristics such as weight and number of seeds were determined and measured; pH, acidity, soluble solid and vitamin C content of fruits were analyzed. The hawthorn species of *Crataegus orientalis*, *Crataegus curvisephala* and *Crataegus pentagyna*; the hawthorn subspecies of *Crataegus monogyna* subsp. *azarella* and *Crataegus monogyna* subsp. *monogyna* were found to be native in Van region. According to the results, it was established that the species *Crataegus orientalis* and *Crataegus pentagyna* can be used as a fresh. All hawthorn species and subspecies, in particular *Crataegus monogyna* subsp. *monogyna* can be recommended usage for ornamental usage in both rural and urban landscape arrangements.

Key words: Hawthorn, fruit

Van Yöresinde Yetişen Alıç Türlerinin Pomolojik Özellikleri

Özet: Alıçlar Türkiye’de ve dünyada henüz yeterince tanınmamıştır. Bu çalışma Türkiye’nin Van yöresinde yetişen alıç türlerini tesbit etmek ve meyve özelliklerini analiz etmek amacıyla yürütülmüştür. Van’ın Edremit ve Gevaş ilçelerinde yapılan ön seleksiyon çalışmasında doksan sekiz genotip tespit edilmiştir. Gevaşta 31, Edremit’te 18 genotipte meyve özellikleri incelenmiştir. Meyve özellikleri örneğin genişlik, uzunluk, renk, meyvenin kuru ağırlığı; tohum özellikleri örneğin ağırlık ve tohum sayısı tespit edilmiş ve ölçülmüştür; pH asitlik suda çözünür kuru madde ve C vitamini tayini analiz edilmiştir. Van yöresinde *Crataegus orientalis*, *Crataegus curvisephala* ve *Crataegus pentagyna* türleri; *Crataegus monogyna* subsp. *azarella* ve *Crataegus monogyna* subsp. *monogyna* alt türleri bulunmuştur. Sonuçlara göre *Crataegus orientalis* ve *Crataegus pentagyna* türleri meyvede taze tüketim için uygun bulunmuştur. Bütün alıç tür ve alt türlerinin, özellikle *Crataegus monogyna* subsp. *monogyna*’nın kırsal ve kentsel peyzaj düzenlemelerinde kullanımı önerilir.

Anahtar kelimeler: Alıç, meyve

Introduction

Hawthorns included in the division of *Spermatophyta*, the subdivision of *Angiospermae*, the class of *Dicotyledonea*, the family of *Rosaceae*, the order of *Crataegeae*, the genus of *Crataegus* (Özçağıran et. al., 1991; Bates and Niemiera, 1996) are deciduous and thorny trees or bushes which have plentiful and conspicuous flowers in bunches; have yellowish, orange or reddish fruits in autumn; have lobbed leaves which also turn similar colors as fruits in fall (Browicz, 1976; Ürgenç, 1992).

There are 200 species of hawthorns grown in Turkey and in the world, and the important hawthorn species spreading thorough out in Turkey and world are *C. monogyna*, *C. orientalis*, *C. curvisephala*, *C. pentagyna*, *C. oxycantha*, *C. azaralus*, *C. Prunitifolia* (Browicz, 1976; Öztürk and Özçelik, 1991; Alp, 1999).

Although there are some cultivated species of hawthorns in the world (Guo, 1995; Payne and Krewer, 1990), hawthorns often found wild (Mason and Mc Donald, 1991), and are called with different local names such as alıç

yemşen alıç, gühüşk and haziran in Van region. They usually found in countryside, inside and along the roads and sometimes at the formation of the orchard fences.

It is known that hawthorns are used in different purposes. They are used intensively as an alternative medicine (Baytop, 1984; Demiray, 1986). Moreover as an ornamental plant, they are used in the landscape arrangements of the roads, parks and gardens or in the fences (Browne and Ward, 1979). They are suitable for playgrounds because of nonpoisonous plant parts.

Hawthorns which grow easily in shallow, sandy or stony soil can also be utilized as rootstocks for some fruit species such as pears and apples (Özbek, 1978; Yapıcı, 1992). White elite clones are grafted on the seedling of *C. oxycantha* (Kaşka and Yılmaz, 1990), hawthorns are usually reproduced by seeds which have approximately 50% of germination rate (The Forest Service US Department of Agriculture, 1948; Saatçioğlu, 1961).

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Hawthorns do not always have the required fruit size and taste when they are grown in unprotected areas of Van because of the pests, inadequate management and drought. By selecting the best genotypes among them, it will be possible to obtain the more prolific and higher quality hawthorns.

This study aims: 1) to evaluate some pre-determined hawthorn genotypes 2) to find out the best ones and 3) to discover their usage and their value for different areas. By widespread growing of the selected hawthorn, the market value of this species will increase. Therefore, an alternative living source will be obtained for the farmers and the abundant high-quality curative fruits will be supplied to the consumers. Furthermore, hawthorn plants, which are resistant to harsh soil and climatic condition, will be grown in steep and poor soil. Therefore, these unproductive areas will be gained to the agriculture and the soil erosion will be kept at minimum.

Materials and Methods

Materials

The study was carried out in Gevaş and Edremit towns of Van where hawthorns are densely populated. A total of 98 hawthorn genotypes were pre-determined in early spring, but fruits were obtained in only 49 genotypes because of periodicity.

The province of Van is located in East of Turkey, at the latitude of 30° 28' and at the longitude of 43° 21' and 1725 m of altitude. There is relatively mild temperate winter condition because of the softening effect of the Lake Van. The average sunny day in Van is high as 7' 36" (Çelik, 1986). Edremit and Gevaş are located 17 and 38 km away southwest of Van.

Methods

The study started on March during the tree activation time. Pre-determined trees were labeled and observed during the leaf emergence, flowering, fruiting and harvest time. Besides the identification of the species, fruit characteristics were measured and analyzed (Cemeroğlu, 1992).

Three replicates of ten fruits in each genotype were measured or analyzed for the size, weight total, soluble solid, pH, ascorbic acid of the fruits and the size and the number of the seeds. GLM command of MINITAB used in the analysis of the variance and Duncan's multiple range test was used for the discrimination of each group.

Results and Discussion

There were 5, 7, 14 and 5 genotypes of *C. orientalis*, *C. curvisepala*, *C. monogyna* subsp. *monogyna* and *C.*

monogyna subsp. *azarella* in Gevaş, respectively and those were 3, 3, 2 and 9 respectively in Edremit. Moreover, there was a unique genotype, a representative of *C. pentagyna*, in Edremit (Table 1).

There were significant differences among hawthorn species in terms of the size, weight, soluble solids and dry matter of fruits and the seed weight. The fruit height (14.68mm) width (17.81mm) and weight (2.34g) of *C. orientalis* were the highest among of the all species while those of *C. monogyna* subsp. *monogyna* were the lowest, 11.05mm, 10.35mm and 0.71g respectively. While *C. monogyna* subsp. *azarella* and *C. orientalis* had the lowest TSS values (25.39 and 23.34) respectively, *C. monogyna* subsp. *monogyna* had the highest TSS value of (35.37), *C. monogyna* subsp. *monogyna* and *C. curvisepala* had higher SSC values than the others. *C. orientalis* had the lowest seed weight (0.08g) of all. Moreover *C. orientalis* had the highest seed number (4.47) and the seed number of *C. orientalis* was higher in Gevaş than in Edremit.

C. monogyna subsp. *monogyna* had the highest pH value and was followed by *C. monogyna* subsp. *azarella* and *C. curvisepala* and *C. orientalis*, respectively. Moreover, pH values of hawthorn fruits in Gevaş were higher than those of Edremit. Acidity values of hawthorn fruit were higher in Edremit than those of Gevaş. There was no significant difference in terms of vitamin C.

The existence of *C. orientalis*, *C. curvisepala*, *C. monogyna* subsp. *monogyna*, *C. monogyna* subsp. *azarella* and *C. pentagyna* in Van region was established. Although Browicz (1976) had only mentioned the existence of *C. orientalis* in Van region, we determined that there were four more different species.

There were distinct morphological traits used in the diagnosis of species such as fruit size, fruit color seed number, taste.

While *C. curvisepala* and *C. monogyna* subsp. *monogyna* had dark red fruits, *C. orientalis* had orange fruits and *C. pentagyna* had dark violet fruits. On the other hand *C. monogyna* subsp. *azarella* had light red fruits. *C. curvisepala* had bigger fruits and more seeds than those of *C. monogyna* subsp. *monogyna* although both have dark red fruits. Shoots and leaves of *C. orientalis* were obviously downier than others. *C. orientalis*' shoots and leaves were a little bit downier than those of *C. monogyna* subsp. *azarella*.

Flowering in *C. orientalis* was later than others. The study of Alp (1999) carried out in the Van city, is compatible with our results. However, the fruit sizes of our study were lower than those of the study carried out in China (Guo, 1995).

Table 1. Pomological characteristics of 49 hawthorn genotypes in Gevaş and Edremit towns of Van

Region*	Species*	Genotype number	Fruit Height (mm)	Fruit Width (mm)	Fruit Height/Width	Fruit Weight (g)	Seed Weight (g)	Seed Number	Fruit Flesh Ratio (%)	Fruit Dry matter (%)	Fruit SCC (%)	Fruit pH	Fruit Acidity (mg/100 g)	Vitamin C (mg/100 g)
G	O	1	12.98	15.26	0.85	1.57	0.090	4.20	75.92	32.74	18.50	3.67	0.49	61.13
G	O	2	15.26	16.40	0.93	2.26	0.083	4.20	84.56	22.12	11.66	3.60	0.55	
G	O	3	13.70	16.59	0.83	1.61	0.073	4.50	79.59	19.87	15.00	3.57	0.57	68.29
G	O	4	19.30	21.70	0.89	4.21	0.082	4.20	91.82	24.32	14.67	3.61	0.54	
G	O	5	12.53	15.15	0.83	1.55	0.062	4.07	83.22	17.41	16.33	3.61	0.54	
	Average		14.75	17.02	0.87 c**	2.24	0.078	4.23 b	83.02	22.73	15.23	3.61 c	0.54	67,71
G	C	1	12.43	13.35	0.93	1.30	0.140	1.70	81.69	32.22	18.00	3.62	0.61	
G	C	2	14.89	15.20	0.97	1.92	0.176	1.80	83.50	26.47	18.33	3.95	0.44	
G	C	3	12.44	12.81	0.97	1.20	0.150	1.70	78.75	43.00	18.35	3.93	0.44	52.60
G	C	4	12.45	12.72	0.98	1.10	0.160	2.20	68.00	30.90	18.66	3.81	0.51	
G	C	5	13.16	12.82	1.03	1.20	0.210	1.03	81.97	29.16	18.67	3.84	0.49	
G	C	6	12.66	10.72	1.18	0.82	0.310	1.06	59.93	31.71	18.00	3.82	0.52	
G	C	7	12.02	12.06	0.99	1.47	0.340	1.00	76.87	25.17	24.00	3.84	0.48	49.25
	Average		12.86	12.81	1.01 b	1.29	0.212	1.50 c	75.82	31.23	19.14	3.83 b	0.50	50,92
G	A	1	10.95	12.26	0.89	0.90	0.090	2.03	79.70	21.83	16.17	3.82	0.57	
G	A	2	11.70	13.13	0.89	1.11	0.120	1.70	81.62	33.69	16.17	3.85	0.58	48.36
G	A	3	11.95	14.69	0.81	1.37	0.210	1.20	81.60	26.56	13.83	3.84	0.57	39.87
G	A	4	11.96	14.18	0.84	1.01	0.170	1.60	73.07	21.83	19.33	3.85	0.56	
G	A	5	12.44	13.52	0.92	1.16	0.180	1.00	84.48	21.83	16.60	3.83	0.58	
	Average		11.80	13.56	0.87 c	1.11	0.154	1.51 c	80.09	25.15	16.42	3.84 b	0.57	44,11
G	M	1	10.56	10.52	1.00	0.69	0.120	1.00	82.61	31.40	29.16	3.96	0.53	21.61
G	M	2	10.95	10.70	1.02	0.74	0.066	1.17	89.56	34.87	25.00	4.02	0.54	
G	M	3	9.70	9.41	1.03	0.53	0.050	1.03	90.28	34.72	22.33	3.92	0.54	29.86
G	M	4	10.09	9.82	1.03	0.56	0.076	1.13	84.66	19.64	20.67	4.06	0.56	21.61
G	M	5	9.54	9.74	0.98	0.69	0.210	1.20	63.76	42.60	22.17	4.09	0.48	29.87
G	M	6	10.64	11.13	0.90	0.70	0.100	1.00	85.71	33.57	21.90	3.89	0.56	30.38
G	M	7	8.75	8.35	1.05	0.47	0.160	1.00	65.96	53.40	23.40	4.00	0.54	19.55
G	M	8	7.96	7.32	1.09	0.29	0.150	1.00	48.28	27.58	22.00	3.98	0.52	
G	M	9	9.96	10.53	0.95	0.69	0.170	1.00	75.36	33.04	19.80	4.02	0.53	
G	M	10	8.34	8.00	1.04	0.30	0.047	1.00	83.33	41.66	20.83	3.96	0.51	
G	M	11	11.26	11.38	0.99	0.95	0.180	1.02	81.05	34.90	20.43	3.99	0.52	
G	M	12	12.74	12.26	1.04	1.10	0.260	1.00	76.36	39.52	16.66	3.96	0.54	
G	M	13	12.00	12.80	0.94	1.17	0.044	1.00	96.24	34.87	22.43	3.99	0.53	
G	M	14	12.60	13.24	0.95	1.11	0.034	1.00	96.94	32.28	23.86	4.02	0.49	
	Average		10.36	10.37	1.00 b	0.70	0.120	1.04 d	80.67	35.29	22.16	3.99 a	0.53	26.25

(Table 1 continued)

Region	Species	Genotype number	Fruit Height (mm)	Fruit Width (mm)	Fruit Height/Width	Fruit Weight (g)	Seed Weight (g)	Seed Number	Fruit Flesh Ratio (%)	Fruit Dry matter (%)	Fruit SCC (%)	Fruit pH	Fruit Acidity (mg/100 g)	Vitamin C (mg/100 g)
E	O	1	14.74	22.78	0.65	3.07	0.092	5.00	70.54	23.19	15.17	3.12	0.96	86.15
E	O	2	14.32	17.92	0.80	2.85	0.090	4.90	84.52	16.70	13.50	3.15	0.86	26.15
E	O	3	14.78	15.10	0.98	1.41	0.063	4.80	78.55	31.34	17.16	3.18	0.76	24.67
	Average		14.61	18.60	0.81	2.44	0.082	4.90 a	77.87	23.74	15.28	3.15 c	0,86	45,66
					c**									
E	C	1	11.64	13.73	0.85	1.27	0.108	1.70	85.54	31.73	24.83	3.28	0.91	
E	C	2	12.83	13.64	0.94	1.29	0.120	1.10	89.76	28.06	21.83	3.12	0.79	16.92
E	C	3	13.22	15.24	0.87	1.65	0.160	1.33	87.10	24.60	18.83	3.20	0.85	
	Average		12.56	14.20	0.89 c	1.40	0.129	1.38 c	87.47	28.13	21.83	3.20 e	0,85	16,92
E	A	1	12.70	15.86	0.80	1.78	0.140	1.37	89.22	21.63	21.17	3.51	0.99	
E	A	2	12.85	15.87	0.81	1.85	0.130	1.73	87.84	16.65	22.17	3.61	0.90	30.76
E	A	3	12.36	15.01	0.82	1.62	0.140	1.70	85.31	25.06	19.26	3.31	0.88	
E	A	4	13.28	14.80	0.90	1.42	0.180	1.20	84.75	29.29	17.17	3.40	0.85	15.38
E	A	5	12.02	14.60	0.82	1.48	0.130	1.60	85.95	25.41	19.25	3.25	0.72	
E	A	6	12.66	14.04	0.90	1.48	0.150	1.40	85.81	30.00	19.33	3.42	0.80	
E	A	7	13.40	14.66	0.91	1.72	0.170	1.27	87.45	23.43	18.33	3.39	0.86	
E	A	8	11.89	13.24	0.90	1.17	0.110	1.67	84.30	34.18	13.50	3.40	0.83	
E	A	9	12.65	11.58	0.84	1.39	0.120	1.73	85.06	25.06	19.17	3.42	0.83	
	Average		12.65	14.79	0.86 c	1.55	0.141	1.52 c	86.19	25.63	18.82	3.41 d	0,85	23,06
E	M	1	13.02	9.08	1.12	0.94	0.200	1.00	78.72	35.90	19.66	3.40	0.88	27.65
E	M	2	10.47	15.04	1.15	0.49	0.170	1.00	65.31	35.00	21.33	3.50	0.84	46.15
	Average		11.75	10.33	1.14 a	0.72	0.185	1.00 d	72.01	35.45	20.49	3.45 d	0,86	36,90
E	P	1	14.49	14.69	0.99	1.69	0.090	3.35	83.14	21.18	22.80	3.57	0.72	
	Average of O		14.68 a	17.81 a	0.84 c	2.34 a	0.080 b	4.57 a	80.45	23.24 b	15.25 b	3.38 d	0,70	55,18
	Average of C		12.71 b	13.51 b	0.95 b	1.35 b	0.171 a	1.44 b	81.64	29.68 ab	20.49 a	3.52 c	0,67	33,92
	Average of A		12.22	14.17 b	0.86 c	1.33 b	0.148 a	1.51 b	83.14	25.39 b	17.62 b	3.63 b	0,71	33,59
					bc									
	Average of M		11.05 c	10.35 c	1.07 a	0.71 c	0.152 a	1.02 c	76.34	35.57 a	21.33 a	3.72 a	0,69	31,58
	Average of G		12.45	13.44	0.94	1.33	0.141	2.07	79.90	28.60	18.24	3.82 a	0,53 a	46,50
	Average of E		12.89	14.48	0.92	1.53	0.134	2.20	80.89	28.24	19.10	3.30 b	0,86 b	30,63

*: E: Edremit. O: *Crataegus orientalis*. C: *Crataegus curvisepala*. A: *Crataegus monogyna* subsp. *azarella*. M: *Crataegus monogyna* subsp. *monogyna*.

P: *Crataegus pentagyna*.

** : Mean separation by Duncan's multiple range test (P<0.01)

It is thought that genotypes of *C.monogyna* subsp.monogyna with small fruit may be suitable for landscape rearrangements. *C. monogyna* subsp. *monogynais* abundant in Gevaş. It was observed that GM4 was a fruitful genotype and GM8 had very small fruits, and a decorative crown.

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