The Clonal Selection Breeding of Akça Pear (*Pyrus communis* l.) in Aegean Region of Turkey

M. KUBİLAY ÖNAL and BÜLENT TOPCUOĞLU

***Abstract*— The clonal selection studies were conducted in İzmir, Aydın and Manisa provinces of Aegean region of Turkey.on early-ripening Akça pear cultivar (*Pyrus communis* L.) As a result of selection studies conducted by over the two years period, 28 types were selected in the first step. In the second step, 12 out of them were found as promising ones by pre-evaluation studies and were taken into an adaptation trial at the same condition. Pomological and phenological observations were performed on those types during the experimental period, regularly. Types were evaluated on the basis of some characteristics such as yield, fruit size and earliness employing 'weighed-ranked' method. As a result of evaluation studies it was determined that type no 2036 has taken the first place in rank and others viz. no. 2051 and 2103 have followed it.**

***Keywords*— Phenological and pomological observations, weighed-ranked' method**.

I. INTRODUCTION

The pear originated in prehistoric times as a fruit crop. Cultivar development has been continuous since early days and a high level of improvement has been achieved. Pears are now grown in all temperate regions of the world [1].

Species of pear belong to the genus *Pyrus*, the sub-family Pomoideae and the family Rosaceae. The genus *Pyrus* is believed to have arisen during the Tertiary period in the mountainous regions of Western China and to have evolved as it spread along the mountain chains to the east and west [2].Three centers of diversity for the genus have been identified by Vavilov [3]: the Chinese, the Central Asian and the Near Eastern / Asia Minor Centers. The Near Eastern Center is of special importance because it is believed that the domesticated forms of european pear (*Pyrus communis* L.) form which the modern cultivars are derived originated there.

Pear has been widely commercialized throughout the world. Production and commercialization of local pear varieties are also considered a good way to increase the incomes of local producers. The accurate analysis of those components enables us to observe the differences in akça pear cultivars.

Kubilay Önal, is with Vocational School of Technical Sciences, Akdeniz University; Antalya, Turkey;
Bülent Topcuoğlu, is with Vocational School of Technical Sciences, Akdeniz University; Antalya, Turkey.

During long time course, many local pear cultivars that show different degrees of improvement or adaptability developed in Turkey [4,5,6]. Akça (*Pyrus communis* L) is the earliest ripenig pear cultivar in Turkey and has several different types [7].

In this research, the aim was to determine different types of Akça pear by surveying and select candidate types having high-yielding capacity and better fruit characteristics and adaptable to the conditions of Aegean Region of Turkey.

II. MATERIAL AND METHODS

The clonal selection studies were conducted in the villages and counties of İzmir, Aydın and Manisa provinces of Aegean Region of Turkey on early-ripening Akça pear cultivar (*Pyrus communis* L.). As a result of selection studies 28 types were selected in the first step. In the second step, 12 out of them were found as promising ones by pre-evaluation studies and were taken into an adaptation trial at the Aegean Agricultural Research Institute (AARI) located near Menemen county of İzmir province.

Budwoods were taken from each of original trees and budded on Quince A (QA) rootstocks.The experiment was established with 7 budded trees of each type of Akça cultivar at 6x6 spacing in a randomized block design. Akça cultivar has been already planted in orchard of Aegean Agricultural Research Institute (AARI) was used as a control in the experiment.For evaluation of those types, phenological and pomological characteristics were observed and yield efficiency (productivity) values were scored.

Bud burst, first blossoming, full bloom, last blossoming and harvesting date were used as criteria for phenological observations.

The shape, size and weight of fruit, length and thickness of fruit stalk, taste, juiciness, texture and firmness of fruit flesh, ground and overcolour of fruit skin, russet amount in fruit skin, skin thickness, Total Soluble Solids (TSS) (%), aroma and eating quality of fruit were characteristics used for pomological evaluation [8,9]. and were scored as an average of 20 fruit samples taken 7 trees of each type, randomizely. For determination of colours, Methuen handbook of colour was used [10].

In last year of the experiment, morphological characteristics of trees were observed and trees were classified as upright, semi-upright and spreading for tree habit and weak, intermediate and vigorous for tree vigor.

Yield efficiency = productivity (kg / cm^2) were obtained by dividing cumulative yield of each tree to 1 cm^2 of trunk cross-sectional area.

'Weighed-ranked' method was employed in evaluating values [11].The characteristics such as yield, fruit size and earliness and their relative points, class values and class points were used as criteria in evaluation of types (Table 1). Total points of types were obtained by multiplying relative points with class points of characteristics

III. Results And Discussion

According to average of four-year phenological observations, dates for bud burst, first blossoming, full bloom and last blossoming were determined as 10-17/3, 23-29/3, 3-9/4, and 9-18/4, respectively. It was observed that harvesting dates of types varied between 13/6-7/7.

It was observed that there was no big difference for fruit shape among types. Fruit characteristics such as fruit width, fruit length, fruit stalk length, fruit stalk thickness, and fruit flesh firmness were determined as 35.7-54.1 mm, 51.8-71.2 mm 24.7-48.5 mm 3.0-5.6 mm and 9-12 lb/cm^2. Fruit characteristics such as fruit weight and total soluble solids were determined as 29.4-90.2g and 11-15 %, also (Table 2).

There was no difference for characteristics such as taste, juiciness, texture and firmness of fruit flesh, ground and overcolour of fruit skin, russet amount in fruit skin, skin thickness and aroma and eating quality of fruit among types.

Habit and vigour of trees in experiment was found as upright, semi-upright and spreading and weak, medium and vigorous, respectively. The height and width of canopy were determined as 2.38-5.55m ad 1.61-4.11m, respectively.

Cumulative yield varied between 9.112-78.912kg/tree. Yield efficiency (productivity) was found as 0.077-0.350 kg/cm^2 among types (Table 2).

The ranking of types in respect, to points obtained by 'weighed-ranked ' method is given at table 3. The types having high points at the table, viz. nos 2036, 2051 and 2103, were chosen as promising types suitable to the conditions of Aegean Region of Turkey.

The pear flavor and quality is affected by many factors, such as, fruit variety, region specialty, climate factors, soil condition, orchard managing mode, etc. So we cannot make an arbitrary decision about which kind of pear fruit is of the best quality, but our research can provide pear chemical composition characteristics and further research on the chemical composition of other pear fruit should be conducted to enable food technologists to select excellent pear varieties with improved nutritional quality, and to develop more processed pear products.

Acknowledgment

This study was supported by Akdeniz University. The authors wish to thank the Management of Vocational School of Technical Sciences and Aegean Agricultural Research Institute for their valuable contribution and technical support.

References

[1] Layne, R.E.C. and Quamme, H.A. 1975. Pears. In: "Advances in Fruit Breeding", eds. J.Janick and J. N. Moore, pp. 38-70. Purdue University Press, West Lafayette, Indiana, USA.

[2] Rubzov, G.A. 1944. Geographical distribution of the genus *Pyrus* and trends and factors in its evolution. Amer. Nat. 78: 358-366. https://doi.org/10.1086/281206

[3] Vavilov, N.I. 1951. The Origin, Variation, Immunity and Breeding of Cultivated Plants. Ronald Press, NewYork, USA. https://doi.org/10.1097/00010694-195112000-00018

[4] Brovicz, K. 1972. *Pyrus* L. *In*: Flora of Turkey and The East Aegean Islands .Ed.P.H.Davis, Vol. 4. pp. 160-169. Edinburgh University Press.

[5] Özbek, S. 1947. Pear Culture in Turkey and Important Turkish Pear Cultivars(in Turkish). A Agriculture Instutute Publication.

[6] Özbek, S. 1978. Special Fruit Production (in Turkish). Agriculture Faculty of Çukurova University Publ. No:128.

[7] Ergun, M. 1989. A Report of Marketing Problems of Pear Production (in Turkish) Yalova, Turkey.

[8] UPOV. 1974. Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability. Pears. UPOV / TG / 15 / 1.

[9] IBPGR. 1983. Descriptor List for Pear (*Pyrus*). AGPG: IBPGR / 82 / 57.

[10] Kornerup, A. and Wanscher, J.H. 1978. Methuen Handbook of Colour. London, UK.

[11] Büyükyılmaz, M., Bulagay, A.N. and Burak, M. 1992. Report of Clonal Selection on Akça and Ankara Pear Cultivars (in Turkish) (Marmara Region of Turkey), Yalova, Turkey.

TABLE I. THE RELATIVE POINTS, CLASS VALUES AND CLASS POINTS OF CHARACTERISTCS USED IN 'WEIGHED-RANKED' METHOD FOR EVALUATING OF AKÇA PEAR TYPES.

Characteristics	Relative points	Class values of characteristics	Class points of characteristics
Yield	40	Cumulative yield per 1 cm^2 cross-sectional area of trunk (kg /cm^2)	
		0.350-0.324	10
		0.323-0.296	9
		0.295-0.268	8
		0.267-0.240	7
		0.239-0.212	6
		0.211-0.184	5
		0.183-0.156	4
		0.155-0.128	3
		0.127-0.100	2
		0.099-0.072	1
Fruit weight	30	Average fruit weight (g)	
		90.20-84.12	10
		84.11-78.03	9
		78.02-71.94	8
		71.93-65.85	7
		65.84-59.76	6
		59.75-53.67	5
		53.66-47.58	4
		47.57-41.49	3
Earliness	30	13/6 (Early)	10
		20/6 (Medium)	7
		29/6 (Late)	4
		7/7 (Very late)	1

TABLE II.YIELD AND SOME QUALITY CHARACTERISTICS OF AKÇA PEAR TYPES (1991-1994).

Type	Cumulative yield	Cumulative yield per 1 cm^2 cross-sectional area of trunk (	Average fruit weight	Total soluble solids
2036	27.939	0.260 bcd	90.20 a	11.0
2039	17.662	0.107 de	49.75 defg	13.0
2042	15.608	0.089 e	54.50 cde	13.2
2043	23.333	0.077 e	29.40 g	12.5
2045	60.621	0.236 abc	62.50 bcd	13.2
2051	78.912	0.350 a	73.40 abc	13.0
2099	16.532	0.087 e	51.70 def	13.5
2100	22.216	0.119 de	31.30 fg	11.0
2101	9.112	0.077 e	49.20 defg	12.5
2102	10.635	0.097 de	62.00 bcd	11.0
2103	57.724	0.338 a	81.40 ab	15.0
2104	32.115	0.136 cde	37.20 efg	11.2
Akça (**C**)	28.628	0.264 ab	54.00 cde	11.5

C. Control

TABLE III. THE RANKING OF AKÇA PEAR TYPES IN RESPECT TO THEIR TOTAL POINTS BY 'WEIGHED- RANKED' METHOD.

Types	Yield	Fruit weight	Earliness	Total
2036	280	300	210	790
2051	400	240	120	760
2103	400	270	30	700
Akça (**C**)	280	150	120	550
2045	240	180	120	540
2104	120	60	300	480
2100	80	30	300	410
2039	80	120	210	410
2042	40	150	210	400
2102	40	180	160	380
2101	40	120	210	370
2043	40	30	300	370
2099	40	120	210	370

C.Control