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Interrelationships Among Pomological Traits and Selection of Medlar (*Mespilus germanica* L.) Types in Turkey

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Abstract

The objective of this study was to determine the pomological traits of selected medlar (*Mespilus germanica* L.) types and interrelationships among these pomological traits. This research was carried out on medlar types grown in the coastal area of Ordu, Giresun, Trabzon and Rize provinces in the Middle and East Black Sea Region of Turkey in 2000 and 2001. In this study, fruit weight was correlated with calyx basin width, calyx basin length, fruit width, fruit length, fruit volume, seed weight and seed volume, and total soluble solids was correlated with fruit length, seed weight, seed volume, pH, malic acid and total dry matter. Large positive correlation for fruit weight with fruit volume, and large positive correlation for total soluble solids with total dry matter was obtained. Fifteen medlar types were selected. In selected medlar types, fruit weight, seed weight, total soluble solids and total dry matter ranged from 16.51 g to 32.98 g, from 0.23 g to 0.68 g, from 13.00 % to 26.00 % and from 18.54 % to 38.07 %, respectively.

Introduction

The medlar (*Mespilus germanica* L.) is an interesting pome fruit, closely related to the *Malus* L. and the *Pyrus* L. The plant is an attractive shrub or small tree to a height of 20 feet, relatively cold hardy. It is propagated by budding on medlar seedlings. For dwarfing purposes it can be budded or grafted on pear, *Cydonia oblonga*, and hawthorn (*Crataegus oxyacantha*). The 1 to 2 inch diameter fruit is conspicuous by being open at the apex in contrast to apples and pears, which are closed (Fig. 1). The fruit matures in early fall, and should be allowed to hang until fully mature. It should then be ripened at warm temperatures for two weeks, when it can be used for flavoring and for jelly (1).

Mespilus is one of the genera of minor importance for their edible fruit but of possible use as rootstocks. Fruit of species such as medlar are usually used for making jellies, sauces or wines (2). This genus is used as a dwarfing rootstock for pear (3). Also, it is used as folk medicinal plant for cure of various illnesses. The fruits contain various sugars, organic acids, pectin, vitamin C and relatively less carotene (4).

Turkey has a large number of cultivated and wild fruit species with a great diversity of color, shape and flavor (5). On the shores of northern Turkey, many different local fruit species and varieties occur. Medlar fruit is consumed fresh, vinegar, pickle, boiled, pressed and dried fruit pulp in this region. Medlar trees are generally cultivated or grown singly or in border rows. Breeding by selection of medlar types is very important.

In a study that was carried out to observe the fruit traits of medlar types in Tokat Province, Turkey, in 12 medlar types, fruit weight, total soluble solids, total dry matter, pH, malic acid and number of seed ranged between 12-27 g, 17 %-24 %, 24 %-33 %, 2.89-3.22, 5.83-8.38 g/L and 4-5, respectively (6).

The use of path analysis provides a plausible explanation of observed correlations by modeling the cause-and effect relations between the variables. Thus, it is possible to analyze the correlation coefficient of variables in the form of variance and covariance (7).

The objective of this study was to determine the pomological traits of selected

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Table 1. Correlation coefficients for important physical and chemical traits of medlar fruit (FWE: Fruit weight, CBW: Calyx basin width, CBL: Calyx basin length, FW: Fruit width, FL: Fruit length, FV: Fruit volume, SN: Seed number, SWE: Seed weight, SV: Seed volume, TSS: Total soluble solids, MA: Malic acid, TDM: Total dry matter)

	FWE	CBW	CBL	FW	FL	FV	SN	SWE	SV	TSS	pH	MA
FWE												
CBW	0.706**											
CBL	0.624**	0.311ns										
FW	0.879**	0.818**	0.558**									
FL	0.635**	0.384*	0.444*	0.680								
FV	0.901**	0.699**	0.552**	0.945**	0.755**							
SN	0.152ns	0.250ns	-0.230ns	0.177ns	0.174ns	0.143ns						
SWE	0.524**	0.329ns	0.392*	0.579**	0.492**	0.630**	0.193ns					
SV	0.430*	0.303ns	0.183ns	0.506**	0.482**	0.548**	0.333ns	0.915**				
TSS	0.059ns	0.205ns	-0.022ns	-0.060ns	-0.378*	-0.121ns	-0.050ns	-0.422*	-0.484**			
pH	0.015ns	0.105ns	-0.118ns	-0.088ns	-0.071ns	-0.128ns	-0.115ns	-0.456*	-0.312ns	0.473*		
MA	-0.209ns	-0.122ns	-0.091ns	-0.271ns	-0.356ns	-0.353ns	0.015ns	-0.541**	-0.589**	0.391*	-0.082ns	
TDM	0.065ns	0.349ns	0.021ns	0.003ns	-0.341ns	-0.066ns	-0.149ns	-0.189ns	-0.300ns	0.589**	0.209ns	0.066ns

*: Significantly at P = .05, **: Significantly at P = .01, ns: not significant

medlar types and interrelationships among these traits.

Materials and Methods

This research was carried out on medlar types grown in the coastal area of Ordu, Giresun, Trabzon and Rize provinces in the Middle and East Black Sea Region of Turkey in 2000 and 2001.

Maturing dates ranged from early October to late November in selected types. At harvest, 25 fruit samples were picked from each genotype in both 2000 and 2001. From wild medlar populations 15 were selected and fruit size measured on genotypes with fruit size larger than 15 g.

Physical and chemical analysis were made 15 days after harvest dates to ripen the fruit. The important fruit traits such as fruit weight (FWE, g), calyx basin width (CBW, mm), calyx basin length (CBL, mm), fruit width (FW, mm), fruit length (FL, mm), fruit volume (FV, ml), seed number (SN), seed weight (SWE, g), seed volume (SV, ml), total soluble solids (TSS, % refractometer), pH, titrable acid as malic acid (MA, g/L) and total dry matter (TDM, %). The coefficients of correlation of all characteristics were calculated, and direct and indirect effects were studied using path analysis.

Results and Discussion

Interrelationships among fruit traits

Fruit weight is highly and positively correlated with calyx basin width, calyx basin length, fruit width, fruit length, fruit volume, seed weight and seed volume; large correlation for fruit weight with fruit vol-

Table 2. Pomological traits of 15 medlar selections (FWE: Fruit weight, CBW: Calyx basin width, CBL: Calyx basin length, FW: Fruit width, FL: Fruit length, FV: Fruit volume, SN: Seed number, SWE: Seed weight, SV: Seed volume, TSS: Total soluble solids, MA: Malic acid, TDM: Total dry matter)

Selections	FWE (g)	CBW (mm)	CBL (mm)	FW (mm)	FL (mm)	FV (ml)	SN	SWE (g)	SV (ml)	TSS (%)	pH	MA (g/L)	TDM (%)
1	22.82	16.85	10.49	34.52	34.65	23.70	4.93	0.43	0.28	20.75	4.06	5.83	23.16
2	16.66	14.93	9.13	31.52	32.18	16.90	4.80	0.38	0.33	15.25	5.48	4.15	20.87
3	18.09	18.87	5.70	33.04	33.92	17.60	6.18	0.46	0.50	15.00	4.20	6.70	18.54
4	21.34	19.81	11.08	35.86	37.01	19.80	5.00	0.37	0.30	14.00	3.96	5.53	23.95
5	19.71	16.16	9.07	34.95	36.35	21.00	4.74	0.46	0.38	15.50	4.28	5.61	22.73
6	18.59	17.72	9.93	34.07	36.20	22.00	4.50	0.48	0.40	14.50	4.59	2.01	22.76
7	28.72	18.14	9.46	35.93	40.97	28.00	5.00	0.68	0.50	13.50	3.62	1.91	25.91
8	19.89	17.47	8.03	33.52	31.64	20.00	5.00	0.34	0.32	19.25	4.55	3.64	23.52
9	26.86	19.77	9.10	38.19	36.82	29.00	4.80	0.34	0.30	13.00	4.30	3.08	22.49
10	23.04	17.75	7.90	34.81	39.59	23.60	5.00	0.32	0.28	19.50	4.80	3.02	25.17
11	24.06	20.89	10.55	35.21	33.56	22.00	4.80	0.31	0.28	19.00	4.60	8.71	25.00
12	32.95	27.71	9.59	42.44	32.10	31.25	5.00	0.64	0.51	26.00	4.60	2.81	38.07
13	19.95	16.46	9.98	31.55	35.45	19.00	5.00	0.35	0.28	16.50	4.70	5.23	27.91
14	16.51	19.29	7.81	32.68	36.41	17.00	5.00	0.26	0.21	20.50	4.40	7.84	22.69
15	17.76	18.71	7.80	34.07	34.10	22.00	5.00	0.23	0.18	19.50	4.50	4.29	23.98

correlation for fruit weight with fruit volume was obtained and expected (Table 1).

Total soluble solids is highly and positively correlated with total dry matter, pH and malic acid; highly and negatively correlated with seed volume, seed weight and fruit length, respectively.

The indirect effects of calyx basin width, calyx basin length, fruit width, fruit length, seed weight and seed volume due to fruit volume on fruit weight were higher than their direct effects on fruit weight. But, the direct effect of fruit volume on fruit weight was higher than its indirect effects. That is, effect of fruit volume on fruit weight was higher than other traits as expected. The direct effects of seed weight, seed volume, pH, malic acid and total dry matter on total soluble solids were higher than their indirect effects. But, the indirect effect of fruit length due to fruit volume on total soluble solids was higher than its indirect effect. In conclusion, direct effects of seed weight, seed volume, pH, malic acid and total dry matter were higher than other traits.

Selected medlar types

Fruit weight, seed weight, total soluble solids and total dry matter ranged from 16.51

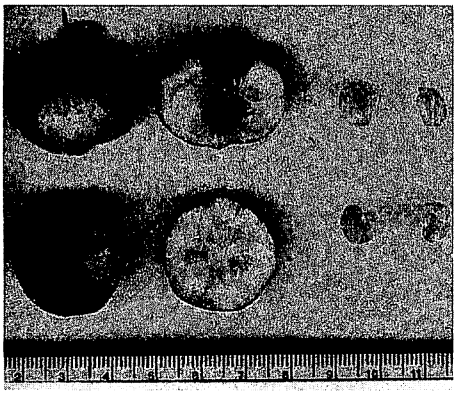

Figure 1. The fruit and seed of medlar

g to 32.98 g, 0.23 g to 0.68 g, 13.00 % to 26.00 % and 18.54 % to 38.07 %, respectively. Özkan *et al* (1997) determined values between 12.00-27.00 g for fruit weight, 0.17-0.31 g for seed weight, 17.00 %-24.00 % for total soluble solids and 24.00 %-33.00 % for total dry matter. It is clear that selections in the present status have larger size and higher total dry matter (Table 2).

In 15 selections, minimum, maximum, mean values and coefficients of variation for fruit weight were determined as 16.51 g, 32.95 g, 21.80 g and 15.75 %; for seed weight were determined as 0.23 g, 0.68 g, 0.40 g and 31.38 %; for total soluble solids were determined as 13.00 %, 26.00 %, 17.45 % and 20.49 %, and for total dry matter were determined as 18.54 %, 38.07 %, 24.45 % and 17.76 %, respectively. The highest coefficients of variation were determined for malic acid, seed volume and seed weight, respectively (Table 3).

In conclusion, the fruit weight and total soluble solids which are important medlar fruit characteristics were affected by some other fruit traits. Large positive correlation for fruit weight with fruit volume, and large positive correlation for total soluble solids with total dry matter was obtained and expected.

Table 3. The minimum, maximum and average values and coefficient of variation for 13 pomological traits of 15 medlar selections.

Traits	Min.	Max.	Mean	Cv(%)
Fruit weight (g)	16.510	32.950	21.797	15.7536
Calyx basin width (mm)	14.930	27.710	18.702	15.4195
Calyx basin length (mm)	5.700	11.080	9.043	21.6562
Fruit width (mm)	31.520	42.440	34.824	7.8319
Fruit length (mm)	31.640	40.970	35.397	7.5118
Fruit volume (ml)	16.900	31.250	22.190	19.5948
Seed number	4.500	6.180	4.983	7.2565
Seed weight (g)	0.230	0.680	0.403	31.3848
Seed volume (ml)	0.180	0.510	0.337	30.3051
Total soluble solids	13.000	26.000	17.450	20.4855
pH	3.620	5.480	4.443	9.5492
Malic acid (g/L)	1.910	8.710	4.691	43.6337
Total dry matter (%)	18.540	38.070	24.450	17.7582

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