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Full Length Research Paper

Wild apricot (*Prunus armeniaca* L.) plus trees: A Correlation study

***Amartya V. Shankar, Shah D. Ravi and Amitab Rukh**

Department of Plant Breeding and Seed Technology, Faculty of Agricultural Science, University of Madras, Chennai, India.

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Wild apricot seeds collected from 167 selected trees were evaluated and considerable genetic variation for oil content, stone and kernel characters were recorded. Oil content ranged from 50.05 - 57.97%, while range of stone length, breadth and thickness was from 14.64 - 26.48, 12.26 - 21.49 and 8.63 - 14.65 mm, respectively. Stone and kernel weight varied between 66.60 - 295.10 and 18.20 - 68.18 g. Kernel size (length, breadth and thickness) and weight are most desirable characters which affect oil percentage. On the basis of the correlation studies, it was found that kernel thickness (0.292) and kernel weight (0.236) was positively and highly significantly correlated with the oil content along with the stone thickness (0.211). However, kernel weight has positive and highly significant correlation with all the stone and kernel characters.

Key words: Wild apricot, *Prunus armeniaca*, genetic variation, correlation, stone, kernel.

INTRODUCTION

Shortage of edible oils in India has stimulated studies on tree borne oilseeds. *Prunus armeniaca* L. family Rosaceae includes many varieties of cultivated and wild apricots which grow in the western Himalayas up to an elevation of 3000 amsl. The importance of the plant is well realized specially in dry temperate region for fuel, fodder, feed and small timber. It is one of the important multipurpose trees in the region under existing system of agro-forestry (Singh and Chaudhary, 1993). The fruit of wild apricot is unfit for table purpose due to high acids and low sugars. The seed yields 27% of kernels and the kernels yields about 47% of oil. Kernels are bitter in taste which is due to the presence of a cyanogenic glycoside amygdalin (Montgomery, 1969). Oil has 94% unsaturated fatty acids (Gandhi et al., 1997) and contains 75% oleic acid (Aggarwal et al., 1974) and linoleic acids. The oil is utilized for cooking, body massage and as raw material for cosmetic and pharmaceutical industry (Parmar and Sharma, 1992) . Kernel weight which is directly related with oil yield is a complex character and it is dependent on a number of nut components. Information on the association of different characters among themselves and their relationship with kernel weight is of paramount importance for making the selection.

*Corresponding author. E-mail: Prof.shankar12@unom.ac.in

MATERIAL AND METHODS

In the present study, a sample of (n = 167) of wild apricot seedling trees were selected from different districts of Himachal Pradesh on the basis of growth, vigour, insect- pest incidents. Informal inter-views were also conducted to collect information collected from the owners on the individual selected trees. From each individual tree, more than 500 g seeds were collected and data was recorded on the stone and kernel characters as following; stone per cent, stone and kernel length (from base to apex), breadth (edge wise from centre of the stone), thickness (from middle of the stone), weight of stone and kernels (100 stone/kernels) and stone: kernel ratio. Out of 500 g seed, 150 g seed was sent to the Energy Research Institute (TERI) for oil analysis (%) . Stones recorded > 50% oil from its kernels when correlated with the different stone and kernel characters. Data analysis was performed following Gomez and Gomez (1984).

RESULTS

Data pertaining to oil percentage, stone and kernel length, breadth and thickness, weight of 100 stones and kernels and stone/kernel ratio in Table 1 represents the minimum and maximum range with their mean values. Reports received from the TERI revealed that > 62% of the trees have > 50% oil content. Among them, maximum (57.97%) oil content was recorded in Bg-02 which was closely followed by Bg-05 (57.23%), Sc-19 (57.49%), Sc-15 (57.05%), Sc-14 (57.87%), Sc-13 (57.32%), Ku-11 (57.18%), however, minimum (50.05%) was recorded in

Table 1. Variation in oil content and different stone and kernel characters of wild apricots plus trees.

Accession No.	Oil content (%)	Stone (%)	Stone size (mm)			Weight of 100 stones(g)	Kernel size (mm)			Weight of 100 kernels(g)	Stone /kernel ratio
			Stone length	Stone breadth	Stone thickness		Kernel length	Kernel breadth	Kernel thickness		
Sh-03	50.64	17.65	20.18	17.37	10.55	153.40	15.09	9.99	5.79	44.36	3.51
Sh-18	53.45	12.95	20.29	16.26	10.11	133.00	13.94	9.69	5.57	33.34	4.61
Sh-24	56.95	14.43	20.24	16.01	11.40	114.20	14.22	9.26	5.19	34.30	3.33
Sh-37	52.10	11.95	23.02	16.93	10.31	151.20	16.22	9.69	5.80	48.20	3.16
Sh-39	51.57	10.86	20.69	16.30	10.80	153.20	14.83	9.25	6.05	42.22	3.66
Sh-41	52.24	9.30	19.72	15.77	9.80	120.60	13.99	11.84	8.83	36.00	3.37
Sh-46	52.82	14.47	19.35	15.68	10.14	125.50	13.41	8.34	6.00	31.24	3.98
Sh-47	52.05	16.16	20.88	16.75	10.62	144.30	15.24	9.9	5.87	42.80	3.44
Ka-02	50.40	11.85	21.35	16.01	10.05	141.10	14.65	9.59	5.61	41.50	3.42
La-04	52.61	12.94	17.61	14.71	10.60	118.50	13.06	8.77	6.85	38.50	3.09
La-09	50.05	9.99	16.72	13.86	10.21	101.60	11.74	8.21	6.74	32.00	3.16
La-12	50.82	7.41	23.98	18.41	9.87	180.80	15.50	9.65	4.12	54.26	3.33
Pa-02	53.07	16.05	24.20	17.57	10.67	185.20	17.40	10.58	5.86	54.44	3.45
Pa-04	50.20	11.99	19.91	14.70	10.09	126.00	14.58	8.85	5.94	38.88	3.32
Ho-01	52.92	13.60	15.86	14.43	11.55	99.20	11.56	9.65	8.07	43.22	2.28
Ho-05	50.24	11.72	22.69	18.03	12.17	213.00	15.83	9.34	6.50	47.30	4.53
Da-10	53.45	12.32	18.58	15.74	9.92	113.30	13.79	9.63	5.72	36.60	3.14
Bd-01	55.65	15.18	20.06	17.83	11.44	199.50	12.75	9.52	6.07	33.40	6.03
Bd-02	54.54	9.89	25.35	20.65	13.23	295.10	16.80	11.20	6.25	53.20	5.57
Bd-04	52.97	9.56	24.69	18.45	10.72	206.80	15.54	10.16	5.87	41.10	5.02
Bd-05	53.39	12.68	21.94	17.88	10.44	172.30	16.17	10.62	4.79	45.06	3.82
Ss-01	51.87	11.52	19.55	15.83	10.41	140.20	14.06	9.08	5.30	40.04	3.50
Ss-04	51.87	11.04	21.51	18.05	9.73	168.10	13.92	9.64	4.75	32.90	5.25
Ss-06	50.83	9.33	26.48	19.18	11.64	209.20	17.80	11.53	5.92	65.80	3.21
Ss-07	54.84	9.93	21.59	17.00	10.03	154.30	15.73	9.29	5.15	37.50	4.16
Ss-11	52.94	10.33	18.41	14.35	10.36	114.50	13.28	9.08	6.03	35.44	3.26
Sa-01	50.83	16.03	22.75	16.12	9.93	182.80	16.13	8.52	5.53	38.66	4.79
Kh-02	52.66	11.49	20.08	17.26	10.90	160.10	13.25	9.88	6.42	44.20	3.64
Shl-04	51.06	13.13	20.96	16.77	10.78	168.00	14.53	10.45	5.93	49.32	3.42
Kt-01	51.63	17.54	24.69	17.51	12.09	234.00	16.24	10.10	6.27	56.10	4.18
Mu-01	53.32	8.01	14.89	14.24	10.27	91.20	11.47	8.82	6.64	29.10	3.14
Mu-03	50.29	8.39	20.36	16.70	10.81	175.60	14.45	10.82	5.24	47.16	3.72
Mu-04	52.03	15.07	20.61	16.14	10.43	153.20	13.35	10.12	5.88	38.12	4.03
Ku-01	53.86	10.31	21.26	16.94	10.83	165.60	15.00	10.37	6.52	47.30	3.51
Ku-02	50.76	11.80	17.73	13.17	9.78	85.30	12.62	8.71	6.44	34.40	2.50
Ku-03	53.86	9.18	21.73	15.04	8.95	112.40	14.94	9.12	5.05	33.50	3.39
Ku-04	56.72	13.78	16.23	15.16	9.53	102.90	12.29	9.03	5.92	29.20	3.52
Ku-06	54.62	12.46	21.42	16.93	11.40	177.00	14.25	10.35	6.15	45.22	3.93
Ku-07	56.97	7.30	17.73	14.05	9.52	100.40	13.40	8.61	6.14	33.50	3.03
Ku-08	54.19	9.86	20.20	17.08	9.71	145.50	14.11	10.67	5.64	42.82	3.45
Ku-09	51.82	8.24	17.44	15.78	10.87	117.30	12.27	9.58	6.10	38.64	3.08
Ku-10	53.82	14.15	19.39	14.36	10.54	116.00	13.60	9.40	7.21	42.66	2.76
Ku-11	57.18	12.10	21.40	17.49	9.78	150.20	14.31	10.57	5.33	39.96	3.85
Ku-14	55.34	11.85	17.59	16.64	11.31	141.60	13.11	10.52	6.70	44.30	3.20
Ku-18	50.66	14.13	17.66	14.03	8.98	89.20	13.55	9.00	5.50	32.30	2.78
Ku-19	52.52	11.26	17.61	13.86	9.87	98.10	13.89	9.11	5.60	33.20	2.97
Bt-01	51.26	9.87	19.65	15.91	9.79	124.00	14.60	9.96	5.39	36.22	3.44
Bt-07	51.06	11.12	16.71	14.87	10.29	118.30	12.55	9.33	6.79	37.50	3.19

Table 1. Contd.

Bt-11	53.82	9.57	18.98	13.77	9.68	115.00	14.07	8.76	6.37	35.00	3.28
Bt-14	50.63	6.58	20.29	16.63	11.33	156.50	14.68	9.39	7.17	46.10	3.43
Bt-15	50.42	10.37	18.36	15.66	10.64	119.20	12.55	9.76	6.26	36.02	3.31
Bt-17	52.89	10.73	18.17	16.10	10.78	129.00	12.66	9.68	6.40	37.06	3.49
Km-01	52.50	13.37	18.24	16.77	12.02	158.00	13.05	9.68	6.97	41.00	3.85
Km-04	50.63	11.73	21.04	16.34	10.57	139.20	13.90	9.67	6.58	43.50	3.23
Km-05	51.52	8.75	21.20	17.42	9.61	158.50	15.34	10.68	5.25	42.80	3.76
Km-07	52.83	12.77	21.82	19.33	10.88	179.50	14.91	12.10	5.89	52.88	3.44
Rk-02	51.07	5.71	21.50	14.95	9.21	117.00	14.83	8.83	4.58	30.20	3.90
Rk-07	51.80	5.33	16.44	14.21	10.41	197.10	12.78	8.87	7.17	40.28	2.42
Rk-08	52.59	5.79	18.71	15.35	10.14	117.20	13.75	9.89	6.44	41.38	2.85
Sr-10	56.42	12.94	16.32	14.04	9.96	144.60	11.76	9.54	7.04	56.24	2.57
Sr-21	53.16	13.22	18.28	15.11	11.51	109.90	14.48	10.32	7.14	39.26	2.79
Sc-01	50.57	11.81	16.50	14.76	10.41	103.50	11.87	9.60	6.95	38.22	2.71
Sc-11	51.17	9.79	21.64	15.99	11.26	141.00	14.81	9.89	7.39	46.00	3.06
Sc-12	51.61	14.78	19.77	17.17	11.85	150.70	14.29	10.67	6.45	44.10	3.41
Sc-13	57.32	12.43	22.26	16.62	10.65	149.30	14.84	9.88	6.49	43.02	3.46
Sc-14	57.87	11.42	20.49	18.15	12.33	176.20	13.68	11.04	8.62	60.30	2.93
Sc-15	57.05	14.90	17.23	14.64	10.43	101.50	11.78	8.71	6.79	32.34	3.16
Sc-18	52.65	16.49	19.85	16.43	10.57	131.80	14.07	10.30	6.08	43.22	3.05
Sc-19	57.49	12.39	19.02	15.31	10.31	114.40	13.47	9.81	5.74	36.66	3.17
Shi-01	52.14	13.33	19.14	15.36	11.09	131.30	13.33	9.66	6.22	42.20	3.12
Shi-02	56.48	10.96	17.94	16.02	10.14	99.60	12.44	10.94	7.76	33.10	3.00
Th-01	52.28	11.65	20.77	15.98	10.12	124.90	13.98	9.39	6.34	38.04	3.26
Th-04	50.68	9.30	16.40	18.23	12.22	172.20	13.56	10.95	8.37	56.00	3.07
Th-06	54.40	16.24	16.17	15.13	9.71	90.00	15.75	11.09	6.85	53.22	1.70
Th-10	51.70	10.69	19.78	16.99	11.19	151.00	13.69	10.46	6.48	45.30	3.35
Th-17	51.75	13.03	21.82	21.49	14.65	271.20	13.74	12.16	8.78	63.40	4.30
Th-21	54.19	11.44	19.29	16.48	10.22	134.30	13.31	9.55	6.41	38.50	3.53
Bg-01	51.31	8.99	16.36	14.81	9.98	122.20	11.82	9.54	6.86	40.60	3.05
Bg-02	57.97	15.36	18.37	15.02	10.92	139.00	14.32	10.40	6.86	41.10	3.39
Bg-03	54.48	12.28	20.11	19.04	12.44	114.00	13.51	9.88	6.76	35.24	3.26
Bg-04	55.22	13.34	19.81	16.39	10.59	116.30	13.44	10.26	6.89	37.62	3.14
Bg-05	57.23	14.56	16.36	13.92	10.04	141.60	12.32	9.66	6.59	40.44	3.52
Bg-06	56.46	9.91	15.92	13.39	9.04	154.40	11.97	7.71	6.82	47.24	3.28
Bg-08	50.32	10.55	18.57	16.01	10.82	104.00	13.41	9.46	7.23	34.32	3.06
Bg-10	53.60	11.26	21.11	19.14	14.02	149.50	15.16	9.62	7.15	45.34	3.31
Bs-08	50.57	13.40	20.57	17.31	10.39	143.90	14.43	11.04	5.83	44.82	3.25
Bs-10	53.75	15.51	18.70	14.75	10.65	105.40	14.13	10.25	6.41	40.20	2.63
Bs-12	51.87	14.27	23.82	20.30	11.86	217.20	16.88	12.48	6.55	68.18	3.19
Ku-26	51.56	11.42	14.64	12.26	8.63	66.60	10.08	6.85	5.01	18.20	3.67
Ku-27	53.34	10.56	17.08	16.68	12.00	135.30	12.98	11.23	8.53	59.30	2.29
Ku-31	54.71	13.62	17.70	14.16	10.43	104.50	12.59	8.94	6.63	34.24	3.06
Ku-36	52.34	14.18	21.07	14.69	9.46	111.40	15.56	9.37	5.65	38.74	2.92
Da-06	50.29	8.92	16.76	15.01	10.11	134.60	11.21	9.28	6.81	39.24	3.44
Pn-02	53.59	15.91	18.39	16.99	11.29	119.30	13.61	9.12	6.79	34.62	3.50
Pn-04	50.78	17.82	19.42	15.19	11.64	136.80	13.33	9.64	7.14	41.64	3.32
Pn-05	52.07	14.42	16.27	14.81	10.14	111.20	12.18	8.17	6.96	36.60	3.08
Le-04	52.27	12.72	23.28	16.73	10.11	142.00	14.85	10.52	5.95	44.80	3.23
Le-10	52.68	10.65	21.71	18.64	11.06	178.40	14.01	10.75	5.91	43.90	Le-10
Le-11	53.88	12.24	24.89	19.88	11.64	218.10	16.70	11.81	5.53	54.92	Le-11
Le-12	51.72	15.09	18.01	15.53	11.26	118.90	12.04	8.93	6.67	35.00	Le-12

Table 1. Contd.

Le-13	51.01	10.19	21.51	16.37	9.24	131.30	15.05	10.03	5.19	40.20
Le-14	50.76	14.50	17.33	14.28	9.92	97.20	11.43	8.41	6.32	31.30
Le-18	51.94	11.19	18.99	15.19	10.01	106.00	13.25	9.11	6.05	35.10
Le-21	51.83	9.71	17.20	15.20	9.57	95.20	12.31	9.46	5.42	31.40

Table 2. Estimates of range, mean, STD and CoV in different characters of wild apricot.

Characters	Range	Mean	Std	CoV
Oil content	50.05 - 57.97	52.87	2.08	3.93
Stone percentage	5.33 - 17.82	11.94	2.64	22.08
Stone length	14.64 - 26.48	19.66	2.45	12.46
Stone breadth	12.26 - 21.49	16.12	1.78	11.04
Stone thickness	8.63 - 14.65	10.67	1.13	10.56
Stone weight	66.60 - 295.10	140.78	38.73	27.51
Kernel length	10.08 - 17.80	13.89	1.44	10.39
Kernel breadth	6.85 - 12.48	9.77	0.93	9.57
Kernel thickness	4.12 - 8.83	6.34	1.00	15.71
Kernel weight	18.20 - 68.18	41.41	8.38	20.23
Stone/kernel ratio	1.70 - 6.03	3.41	0.63	18.57

La-09 with the mean value of 52.87% and coefficient of variation was 3.93. The stone percentage varied between 5.33 (Rk-07) to 17.82% (Pn-04) with the mean value of 11.94% and coefficient of variation was 22.08. Maximum stone length (26.48 mm) was recorded in Ss-06 whereas maximum stone breadth (21.49 mm) and thickness (14.65 mm) was recorded in Th- 17. Minimum stone length (14.64 mm), breadth (12.26 mm) and thickness (8.63 mm) was recorded in Ku-26 accession. Mean values for stone length, breadth and thickness was 19.66, 16.12 and 10.67 mm, respectively. However, coefficient of variation was 12.46, 11.04 and 10.56, respectively. Weight of 100 stones ranged between 66.60 (Ku-26) and 295.10 g (Bd-02) with a mean value of 140.78 and coefficient of variation was 27.51. Kernel length varies from 10.08 (Ku-26) to 17.80 mm (Ss- 06), kernel breadth varies from 6.85 (Ku-26) to 12.48 mm (Bs-12) and kernel thickness varies from 4.12 (La-12) to 8.83 mm (Sh-41). Mean values for kernel length, breadth and thickness was 13.89, 9.77 and 6.34 mm, respectively and coefficient of variation was 10.39, 9.57 and 15.71, respectively. Weight of 100 kernels varied from 18.20 (Ku-26) to 68.18 g (Bs-12) with the mean value of 41.41 g and coefficient of variation was 20.23. Maximum stone/kernel ratio was 6.03 (Bd-01) with the mean of 3.41and coefficient of variation was 18.57 whereas minimum stone/kernel ratio was 1.70 (Th-06).

Correlation among oil percentage and various stone and kernel characters were worked out at phenotypic level and presented in Table 2. Oil content was found positively and highly significantly correlated with kernel thickness (0.292) and significantly correlated with stone thickness (0.211) and kernel weight (0.236) . Stone percentage (0.155), kernel breadth (0.071) and stone/kernel ratio (0.012) was positively correlated with oil content, however, stone length (-0.112), stone breadth (-0.034), stone weight (-0.050), kernel length (-0.092) was negatively correlated with oil content. Stone length and breadth was highly significantly and positively correlated with all the stone and kernel characters except kernel thickness (-0.310, -0.016) which is negatively correlated. Stone weight and kernel weight was positively and highly significantly correlated with all other stone characters and kernel weight was positively and highly significantly correlated with all the stone and kernel characters. Kernel thickness was negatively and highly significantly correlated with stone/kernel ratio. Table 3

DISCUSSION

Differences between the variations among stone and kernel characters along with oil content of different locations may be attributed to genetic constitution of particular seedlings, environmental conditions at a particular locality (Sharma and Sharma, 2001). The oil percentage recorded low coefficient of variance whereas other stone and kernel characters scored higher variance. The observations on the oil percentage and stone-kernel samples of wild apricot from seedling populations in temperate region of Himachal Pradesh indicate that there is a greater scope for selection of superior types. The present studies are inconformity with those of Singh and Chaudhary (1993), who also observed a marked variation in stone

Table 3. Correlation between oil content and different stone and kernel characters of wild apricot.

Characters	Oil content	Stone % age	Stone length	Stone breadth	Stone Thickness	Stone weight	Kernel length	Kernel breadth	Kernel Thickness	Kernel weight
Stone percentage	0.155									
Stone length	- 0.112	0.038								
Stone breadth	- 0.034	0.046	0.719**							
Stone thickness	0.211*	0.132	0.233*	0.411**						
Stone weight	- 0.050	- 0.008	0.703**	0.766**	0.498**					
Kernel length	- 0.092	0.076	0.869**	0.618**	0.159	0.587**				
Kernel breadth	0.071	0.091	0.499**	0.718**	0.451**	0.572**	0.523**			
Kernel thickness	0.292**	0.017	- 0.310**	- 0.016	0.367**	- 0.012	- 0.285**	0.084		
Kernel weight	0.236*	0.054	0.491**	0.624**	0.475**	0.710**	0.545**	0.740**	0.228*	
Stone/kernel ratio	0.012	0.041	0.519**	0.472**	0.180	0.607**	0.287**	0.068	- 0.305**	- 0.040

Significant at * 0.05% and ** 0.01% levels.

length, breadth and thickness; stone weight, kernel weight and stone to kernel ratio, while working on 25 plus trees of wild apricot in three districts of Himachal Pradesh. Sen et al. (1995) while working with wild apricot in the Adilcevaz plains observed variation in seed weight from 2.53 to 4.33 g. Similarly, Bostan et al. (1995) observed variation in seed weight (1.49 to 5.09 g) and kernel weight (0.35 to 1.34 g) in Darende plains. Singh and Chaudhary (1993) also reported a positive and significant correlation between kernel weight and different stone and kernel characters of wild apricot.

Marked variation was recorded in the evaluated wild apricot seedling trees for size and weight of stone and kernel and many of the superior selections out of these evaluated wild apricot seedling trees could find their way in large scale cultivation and production of high oil yielding strains which can be helpful in improving the status of tree borne oil seed industry in the country.

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