

## Evaluation Studies on Plum Germplasm under Temperate Region of Himachal Pradesh

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Seventeen plum accessions were evaluated for important qualitative and quantitative characters under Shimla conditions with two checks, 'Burbank Grand Prize' and 'Methley'. Qualitative characters expressed large variation for various character states proving the variability in the germplasm. Highest Coefficient of Variation was observed for fruit weight (53.87%) followed by percentage of stone in fruit (50.73%) and stone weight (37.84%) indicating that there is enough potential for exploiting the variability present in these characters. Like the check 'Burbank Grand Prize', EC034052 (Tarrol), EC552694 (Blackamber) and EC552684 (Fortune) had high productivity along with acceptable fruit size and weight and minimum percentage of stone in the fruit (<3.0). Meanwhile they ripen 1-3 weeks before the above mentioned checks, bestowed to attract early market. None of the accessions studied could surpass the check 'Methley', which had the rare blend of fruit quality traits and productivity.

**Key Words:** Plum, *Prunus*, Evaluation, Germplasm

### Introduction

The most important commercial species of plum belong to only two groups viz., the European and Japanese types. The European plums are *Prunus domestica* L. and related forms have hexaploid chromosome number. Within *Prunus domestica* L., several groups of cultivars are recognized, such as Green Gage and Prunes. Its *insititia* subspecies include bullaces, damsons, mirabelles and St. Julien types. The term 'Japanese plum' covers not only *Prunus salicina* Lindl., but a wide range of plums developed by intercrossing various diploid species. Plum ranks fourth in importance and production and is widely cultivated in the hilly terrains lying between 1500 to 2200 m msl in India. In Himachal Pradesh, plums occupy a significant place both in respect to acreage and production next to apple (Sharma, 2005). Chanana (2001) suggested that plum can be grown in a wide range of subtropical and warm temperate climate. Plum species and cultivars are quite diverse in fruit characters such as fruit size, shape, color, texture, aroma and quality. On the other hand, plums exhibit limited capacity for adaptation, and as a result, in each area only specific cultivars are grown with an exception to few major cultivars. Evaluation studies in mid hills and subtropical plains of Northern India were done by few workers (Lal and Mishra, 1980; Tripathi *et al.*, 1984; Dhatt *et al.*, 1992; Singh *et al.*, 2002). In high hills like Shimla, similar work was lacking at least in the last two decades. Hence, the present study is an endeavor for the characterization and

evaluation of plum genetic resources, thereby utilization either directly or for plum improvement work.

### Materials and Methods

Present study was carried out at field gene bank of NBPGR Regional Station, Phagli, Shimla (31° 05' 924" N latitude, 77° 09' 580" E longitude; 1924 msl). Seventeen plum accessions comprising 14 exotic (from four countries) and three indigenous were taken into account. Well known and recommended varieties for high hills such as 'Methley' (Japanese type) and 'Burbank Grand Prize' (European type) were considered as checks. All the plants of the accessions were of 8-10 years age. Out of 17 accessions studied, nine belong to Japanese type, two to European type and six of unknown origin (Table 1). The plants were grafted on wild *Prunus armeniaca* (*chuli*) rootstock. Experimental plants were grown under similar soil and cultural conditions. Observations were recorded on date of full bloom (when 80% flowers open) and fruit harvest (eating-ripe stage), days to fruit harvest (from date of full bloom), fruit length (mm), fruit width (mm), fruit weight (g), fruit shape, fruit color, fruit bloom intensity, pulp texture, fruit juiciness, fruit taste, stone adherence to pulp, total soluble solids (TSS) (using Digital Hand-held 'Pocket' Refractometer PAL-1), stone weight, percentage of stone in the fruit, and productivity status. Descriptor states for qualitative characters were followed from the descriptor developed by NBPGR (Mahajan *et al.*, 2002). Fruit data were recorded by randomly selecting ten fruits from each accession. Mean values of three years (2002-2004) data

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were taken to draw the conclusion. Variability parameters were also worked out.

### Results and Discussion

Qualitative characters on 17 accessions studied are mentioned in Table 1 along with their alternate identity. Their diverse nature was represented by most of the descriptor states as mentioned by Mahajan *et al.* (2002). Out of 17 accessions studied, six exhibited dark-violet/violet fruit color while nine had fruits with fine-textured pulp. As like the checks, there was no completely free-stone accession available in the germplasm. Partially clinging nature of stone with pulp was displayed by four accessions. About half the accessions recorded high/medium productivity.

Date of full bloom ranged from 3<sup>rd</sup> March to 19<sup>th</sup> March while a difference of 26 days between the earliest (EC393740 and EC552689) and latest (EC552682 and EC552692) maturing accessions was noticed. The welcome situation is that the high yielding cultivars were ripening at a week interval satisfying the need for a long and continuous supply of fruits for market. All the four accessions showing high productivity status (EC552684, EC034052, EC552694 and EC552689) ripened 1-3 weeks before the check 'Burbank Grand Prize'. Tripathi *et al.* (1984) reported that the cultivar 'Settler' is early in ripening under Chaubattia (Uttaranchal) conditions. The present study reveals that out of 17 accessions 10 were

earlier than both the checks studied, which indicates the scope for genetic improvement for earliness. A vast range of variation was exhibited by the characters 'fruit weight' (6.41-69.03 g) and 'percentage of stone in fruit' (1.58-11.06%). Bal (2003) also reported a wide range of variability of 8.36 to 28.5 g for fruit weight in 20 indigenous collections of plum. Coefficient of Variation (CV) was highest for fruit weight (53.87%) followed by percentage of stone in fruit (50.73%) and stone weight (37.84%) indicating that there is enough potential for exploiting the variability present in these characters (Table 2). Variability, both in intra- and inter-specific level might have contributed to the above diversity.

In plum, deep red/violet color with large size fruits (>40 mm), sweet pulp, small and free-stone are desirable characters. All these characters along with high productivity and earliness impart huge demand and command premium price. It is quite impossible to get all the desirable attributes in single cultivar. Like the check 'Burbank Grand Prize', EC034052 (Tarrol), EC552694 (Blackamber) and EC552684 (Fortune) had high productivity along with acceptable fruit size and weight and minimum percentage of stone in the fruit (<3.0). Later two had fine textured pulp. Even though, EC552689 (Red Plum) registered high productivity and earliest ripening, its unacceptable fruit size and weight may hinder the commercial aspect (Table 2). Fruit thinning experiments may help in increasing fruit size in this cultivar.

**Table 1. Important qualitative characters on plum accessions studied**

S.No.	Accession	Alternate identity	Fruit shape	Fruit color	Fruit bloom intensity	Pulp texture	Fruit taste	Fruit juiciness	Stone adherence to pulp	Productivity status
1	EC552684	Fortune <sup>b</sup>	Ovate	Dark violet	Low	Fine	Acidic	Less juicy	Cling	High
2	EC552682	Plum Black <sup>c</sup>	Elliptic	Violet	Low	Fine	Sub acidic	Less juicy	Cling	Low
3	EC034048	Settler <sup>c</sup>	Round	Greenish violet	Medium	Coarse	Sub acidic	Less juicy	Partially-cling	Low
4	EC552695	Japan Plum <sup>b</sup>	Cordate	Yellow	Low	Intermediate	Medium sweet	juicy	Cling	Low
5	EC552688	Yellow Plum <sup>b</sup>	Ovate	Reddish yellow	Medium	Fine	Medium sweet	juicy	Cling	Low
6	EC034052	Tarrol <sup>b</sup>	Oblong	Dark violet	Low	Intermediate	Medium sweet	Less juicy	Cling	High
7	EC552692	Green Gage <sup>a</sup>	Elliptic	Red	Medium	Intermediate	Sub acidic	juicy	Cling	Low
8	EC552694	Blackamber <sup>b</sup>	Round	Dark violet	Low	Fine	Acidic	Less juicy	Cling	High
9	EC382626	Au-Rosa <sup>b</sup>	Ovate	Red	Low	Fine	Sub acidic	Less juicy	Cling	Medium
10	EC393740	Azar Shah <sup>a</sup>	Round	Yellow	Medium	Fine	Acidic	juicy	Cling	Low
11	EC552687	Santa Rosa <sup>b</sup>	Elliptic	Dark violet	Low	Coarse	Sub acidic	juicy	Cling	Medium
12	EC552689	Red Plum <sup>c</sup>	Elliptic	Violet	Low	Coarse	Sweet	juicy	Partially-cling	High
13	EC382624	Au-Cherry <sup>b</sup>	Elliptic	Red violet	Low	Fine	Acidic	Less juicy	Cling	Medium
14	EC552685	Kubo <sup>c</sup>	Round	Red violet	Low	Intermediate	Medium sweet	juicy	Partially-cling	Low
15	IC020827	BDJ-228 <sup>c</sup>	Round	Red violet	Low	Fine	Sweet	juicy	Partially-cling	Low
16	IC020085 <sup>c</sup>	—	Round	Red	Low	Intermediate	Sweet	juicy	Cling	Medium
17	Kohinoor <sup>b</sup>	—	Round	Red violet	Low	Fine	Sweet	juicy	Cling	Low
Burbank Grand Prize <sup>a</sup> (Check 1)			Round	Red	Low	Fine	Sweet	Less juicy	Cling	High
Methley <sup>b</sup> (Check 2)			Round	Red violet	Low	Fine	Sweet	juicy	Partially-cling	Medium

<sup>a</sup>European type

<sup>b</sup>Japanese type

<sup>c</sup>Unknown

Table 2. Pooled mean values of quantitative characters in plum accessions studied

S.No	Accession	Date of full bloom	Date of fruit harvest	Days to fruit harvest	Fruit length (mm)	Fruit width (mm)	Fruit weight (g)	TSS (%)	Stone weight (g)	Percentage of stone in fruit
1	EC552684	11/3	21/6	102	40.23	38.74	41.62	11.80	0.99	2.38
2	EC552682	18/3	4/7	108	31.80	31.96	25.81	18.17	1.65	6.39
3	EC034048	13/3	22/6	101	26.94	25.17	16.75	19.47	0.61	3.64
4	EC552695	19/3	12/6	85	34.41	32.52	23.51	15.27	0.80	3.40
5	EC552688	9/3	22/6	105	43.94	43.16	46.17	14.27	1.33	2.88
6	EC034052	10/3	14/6	96	45.80	45.43	69.03	15.63	1.09	1.58
7	EC552692	14/3	4/7	112	30.36	30.97	25.93	15.07	1.18	4.55
8	EC552694	12/3	14/6	94	36.77	39.76	31.74	12.07	0.82	2.58
9	EC382626	18/3	22/6	96	40.48	38.59	31.74	14.73	1.58	4.98
10	EC393740	9/3	8/6	91	20.40	22.01	6.41	11.70	0.61	9.52
11	EC552687	8/3	13/6	97	32.91	33.33	24.61	17.97	1.50	6.10
12	EC552689	3/3	8/6	97	29.42	31.72	21.41	16.60	1.29	6.03
13	EC382624	12/3	23/6	103	42.50	40.95	34.77	12.53	1.59	4.57
14	EC552685	9/3	12/6	95	31.01	29.65	18.55	15.90	0.67	3.61
15	IC020827	10/3	13/6	95	33.89	31.74	20.81	16.97	1.16	5.57
16	IC020085	12/3	15/6	95	31.75	30.49	17.09	11.23	1.89	11.06
17	Kohinoor	8/3	9/6	93	26.26	27.88	10.81	20.13	0.44	4.07
Burbank Grand Prize (Check 1)		27/3	29/6	94	42.80	45.36	57.13	13.30	1.01	1.77
Methley (Check 2)		15/3	20/6	97	34.42	33.92	22.44	16.13	1.18	5.26
Mean				97.94	34.05	33.77	27.46	15.27	1.13	4.88
Maximum value				112.00	45.80	45.43	69.03	20.13	1.89	11.06
Minimum value				85.00	20.40	22.01	6.41	11.23	0.44	1.58
S.E				1.59	1.66	1.55	3.59	0.67	0.10	0.60
CV (%)				6.71	20.08	18.95	53.87	18.11	37.84	50.73

None of the accessions studied could surpass the check 'Methley', which had the rare blend of fruit quality traits and productivity. Barring the productivity, IC020827 (BDJ-228) and 'Kohinoor' showed their distinction for most of the fruit quality characters studied. They were also early maturing with high TSS under the present study. Hence they can be used as breeding material for genetic improvement.

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