Evaluation of Pear (*Pyrus* spp.) Germplasm under Temperate Region of Himachal Pradesh

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Fifteen pear accessions (European, Asiatic and hybrid types) were evaluated for important qualitative and quantitative characters with two checks namely EC 027810 (Flemish Beauty) and EC 126286 (Kieffer) under Shimla conditions. Coefficient of variation was highest for fruit weight (58.37%) followed by fruit length (38.25%) and width (33.99%) indicating considerable variability to exploit in breeding programme. Only one accession EC 038739, belonging to Asiatic types showed high productivity with agreeable quality characters also. Though low yielding, accessions *viz.* EC 552668, EC 027809, EC 552667 and EC 552676 showed their distinction for most of the fruit quality characters, hence may be used as breeding material for genetic improvement.

Key words: Pear, *Pyrus*, Evaluation, Germplasm

Pear occupies second position in area, production and popularity next to apple among the temperatc fruits of the world and India as well (FAOSTAT, 2005). European pears (involving mostly one species *Pyrus communis* L.) are the main pear of commerce in Europe, North America, Africa and Australia. They possess a buttery juicy texture with delicate flavour and aroma. On the other hand, Oriental or Asiatic pears includes many species such as *P. pashia* Buch. -Ham, *P. pyrifolia* (Burm. f.) Nakai, *P. ussuriensis* Maxim, and *P. bretschneideri* Rehd. that are preferred for crisp-textured and sweet flavored fruits. European pears are considered the most delicious, while Oriental pears vary a good deal in quality and none of them can compare with the European types, but have an advantage of growing in sub-mountain region whereas the European ones can be grown only in the hills (Singh and Sharma, 1973). The sand pear *(P. pyrifolia)* is the main cultivated species in central-southern China and Japan. In India, pear is cultivated sporadically in hills at 1700-2400 m msl in entire Himalaya and Kodaikanal and Nilgiri hills of Tamil Nadu. Low chilling pears have adapted to sub-tropical regions also. Being a hardy crop, it can be grown even on marginal lands where other crops are outright failure; also they are free from serious pests and diseases. Choice of the cultivar is of paramount importance for successful cultivation in particular area/ niche. Evaluation studies in mid hills and sub-tropics were done by few workers (Sharma *et al.*, 1999; Dhillon and Sandhu, 2005; Aulakh *et al.*, 2005). In high hills like Shimla, pear genetic resources management was started 40 years back but evaluation was done during 1982 (Rathore, 1982). Afterwards, many new accessions were added in pear germplasm procured through exotic and indigenous sources. Hence, the present study is an endeavor for the characterization and evaluation of pear genetic resources, thereby utilization either directly or for pear improvement work.

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Materials and Methods

The study was carried out at field gene bank of NBPGR Regional Station, Phagli, Shimla, Himachal Pradesh (31°05'924" N latitude, 77°09'580" E longitude; 1924 m msl). Fifteen genetically diverse pear accessions comprising of 11 exotic (from four countries) and four indigenous accessions were taken for present study. Out of 15 accessions studied, eight belong to Asiatic type, four to European type, one hybrid and two of unknown origin (Table 1). The plants were grafted on wild pear *Pyrus pashia (kainth)* rootstock. All the plants of the accessions were of 12-15 years age. Experimental trees were grown under similar soil and cultural conditions. EC 027810 (Flemish Beauty) and EC 126286 (Kieffer) were used as checks. 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 (cm), fruit width (cm), fruit weight (g), fruit shape, fruit ground color, fruit over colour, fruit surface texture, pulp texture, grittiness, pulp color pulp juiciness, pulp taste, total soluble solids (TSS) (using Digital Hand-held 'Pocket' Refractometer PAL-1) and productivity status. Descriptor states for qualitative characters were followed from the descriptors

Table 1. Important qualitative characters in pear accesions

Accession	Alternate Identity	Fruit shape	Fruit ground colour	Fruit over colour	Fruit suface texture	Pulp texture	Grittiness	Pulp colour	Pulp juiciness	Pulp taste	Productivity status*
EC552667	Battira Giffard[d]	Ovate pyriform	Green	Greenish yellow	Smooth	Medium	Medium	Creamy	Medium	Medium sweet	Low
EC552669	Chugeryony Shiki[d]	Globose	Yellow	Dark brown	Medium rough	Melting	Medium	White	High	Medium sweet	Low
EC280768	Whangkeum bae[b]	Round	Green-yellow	Yellow with brown russet	Medium rough	Medium	Medium	Creamy	Very high	Highly sweet	Medium
EC168557	Hood[c]	Oblong-ovate	Green	Yellowish-Green	Smooth	Hard	High	Creamy	High	Sub-acidic	Low
EC038740	Nijiseiki[b]	Globose	Yellow	Greenish-Yellow	Smooth	Medium	Medium	White	Medium	Sub—acidic	Low
EC038739	Shinsui[b]	Globose	Yellow	Yellow with Brown russet	Medium rough	Medium	High	Creamy	Medium	Medium	High
EC552675	Doynee-du-Commice	Pyriform with narrow neck	Green -yellow	Yellow with brown russet	Medium rough	Melting	Low	Creamy	High	Highly sweet	Low
EC552668	Max red Bartlett[a]	Ovate pyriform	Yellow	Yellow with pink tinge	Smoth	Melting	Low	Creamy	Very high	Sweet	Low
EC027809	Manning Elizabeth[a]	Pyriform	Green-yellow	Yellow with pink tinge	Smooth	Soft	Low	Creamy	Less	Highly sweet	Low
EC552676	Chinese Sandy Pear[b]	Ovate pyriform	Green-yellow	Greenish yellow	Medium rough	Medium	Medium	Creamy	High	Sweet	Low
EC126287	Moonglow[a]	Ovate Pyriform	Green-yellow	Yelow with brown russet	Smooth	Melting	Low	White	Medium	Medium seet	Low
EC020821	BDJ233[b]	Globose	Green	Greenish-Yellow	Smooth	Hard	Medium	White	Medium	Sub-acidic	Medium
IC020804	BDJ 179[b]	Globose	Green	Greenish-Yellow	Medium rough	Hard	Medium	White	Medium	Medium sweet	Medium
IC020814	BDJ 208[b]	Globose	Green	Greenish-Yellow	Medium	Hard	High	White	High	Sub-acidic	Medium
IC020808	BDJ 189[b]	Globose	Green	Brownish	Rough	Hard	High	Creamy	High	Medium Sweet	Medium
Flemish Beauty (check 1)		Pyriform	Green-yellow	Brownish	Smooth	Melting	Low	White	Medium	Sweet	High
Kieffer (check 2)		Oblong-	Green-yellow	Bright-yellow	Medium rough	Hard	Medium	White	Medium	Sub-acidic	High

[a] European type; [b] Asiatic type; [c] Hybrid; [d] Unknown type

* Low: <25kg/plant; Medium: 25-50kg/plant; High: >50kg/plant

developed by National Bureau of Plant Genetic Resources (Mahajan *et al.*, 2002). Fruit data were recorded by randomly selected ten fruits from each accession. Mean values of three years (2002-2004) data were taken to draw the conclusion. Variability parameters were also worked out.

Results and Discussion

Data relating to various qualitative characters on 15 accessions along with their alternate identity (Table 1) showed their diverse nature represented by most of the descriptor states as mentioned by Mahajan *et al.* (2002). Out of 15 accessions studied, seven exhibited globose fruit shape and seven had smooth-surfaced fruits. Desirable white pulp color was displayed by six accessions whereas high productivity (>40kg/plant) was recorded by only one accession (EC 038739) and medium productivity (20-40kg/plant) by five accessions. Three years pooled mean values were calculated for date of full bloom and harvest, days to harvest, fruit length, fruit width, fruit weight and TSS (Table 2). Date of full bloom ranged from 25th February to 7th April while a large difference of 91 days between the early (EC 027809) and late maturing (1C 020804) accessions was noticed. Earliest maturing accessions i.e. EC 027809 and EC 552667 bore matured fruits 96 and 92 days respectively after full bloom, while earliest maturing check (EC 027810) took 105 days for fruit maturity. Earliest maturing nature of EC 027809 (Manning Elizabeth) was also reported by Rathore (1982). A vast range of variation of 32.47-240.83g was exhibited by fruit weight. Coefficient of variation was highest for fruit weight (58.37%) followed by fruit length (38.25%) and fruit width (33.99%) indicating that there is enough potential to exploit the variability present in these characters (Table 2). Existing variability in the studied pear accessions for morpho-phenological and fruit characters might be due to involvement of both intra- and inter-specific level of diversity.

In European pears, the characters like butter flesh, fine texture, juiciness and flavour arc of fruit quality consideration. Apart from this, pyriform shaped fruits with 5-10 cm diameter, bright yellow color with red blush and high productivity are also desirable. In this context, all the European type of pears (4 nos.) exhibited soft/ melting pulp texture and low grittiness. Of them EC 552668 (Max Red Bartlett) and EC 027809 (Manning Elizabeth) had russet-free yellow skin color with pink tinge while the former also possessed high-juicy fruits. In spite of that, none of the European pears other than the check EC 027810 (Flemish Beauty) had high productivity of above 40 kg/plant. Rathore (1991) reported that it is a self-fertile as well as a good pollinizing cultivar.

Table 2. Pooled mean values of quantitative characters in 15 pear accessions

Accession	Date of full bloom	Date of fruit harvest	Days to fruit harvest	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	TSS (%)
EC552667	7/4	8/7	92	6.42	6.17	104.70	10.93
EC552669	12/3	14/7	124	6.77	7.13	139.56	8.77
EC280768	25/3	23/7	120	5.01	5.51	91.85	10.90
EC168557	12/3	21/7	131	6.59	6.57	147.77	11.73
EC038740	28/3	25/7	119	3.86	3.42	49.43	9.97
EC038739	22/3	24/7	124	4.34	5.01	49.23	13.80
EC552675	27/3	23/7	118	7.50	6.54	197.40	13.67
EC552668	2/4	1/8	121	8.22	7.94	240.83	11.10
EC027809	2/4	7/7	96	5.98	6.26	85.00	11.37
EC552676	24/3	4/8	133	7.89	5.77	91.74	14.07
EC126287	4/4	1/8	119	6.85	6.17	132.41	11.27
IC020821	1/3	9/8	189	1.94	2.42	32.47	9.00
IC020804	1/3	6/10	188	1.94	2.26	33.37	8.80
IC020814	27/2	4/9	189	2.78	2.57	49.56	9.77
IC020808	25/2	19/8	175	4.99	5.12	170.67	12.07
Flemish Beauty (checkl)	6.4	20/7	105	7.23	6.66	165.80	11.40
Kieffer (check 2)	17/3	1/8	137	7.28	6.30	125.00	11.30
Mean			135.87	5.41	5.26	107.73	11.15
Maximum Value			189	8.22	7.94	240.83	14.07
Minimum Value			92	1.94	2.26	32.47	8.77
S.E			8.47	0.53	0.46	16.24	0.45
CV (%)			24.16	38.25	33.99	58.37	15.60

In Asiatic pears, high yielding regular bearing cultivars with good fruit size, fruits with light yellow or light green skin colour, firm, juicy, fine-texture with relatively free from grit cells and sweet flavour are desirable for commerce. None of the accessions studied had all the above traits which warrant the need for introduction of more germplasm of good fruit quality along with high productivity. Nevertheless, EC0 38739 (Shinsui) can be of worth-mentioning due to its high productivity status (which is the prime requirement) and agreeable fruit quality characteristics namely medium pulp texture, medium juciness and medium sweet pulp taste (Table 1). Even though low yielding, EC 027809 (Manning Elizabeth), EC 552667 (Batirra Giffard), EC 552676 (Chinese Sandy Pear) and EC 552668 (Max Red Bartlett) showed their distinction for most of the fruit quality characters studied. Former two also adjudged as early maturing accessions under the present study. Hence, they can be used as breeding material for genetic improvement within or between the Asiatic and European types.

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