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Morphological evaluation of *Pyrus* genotypes of Kaghan Valley, Pakistan through quantitative parameters

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Abstract

In the present study, 14 genotypes of *Pyrus* were evaluated and compared for quantitative parameters viz. Petiole length, Leaf Area, Pedicle length, Fruit length, Fruit width and Fruit weight with the help of local names belonging to Kaghan Valley, Pakistan. The study revealed that the genotypes are highly significant with respect to above parameters except leaf area. Mean value shows that genotypes Kushbago, Atti Bating and Shardi Tanchi have maximum value while genotypes Black batangi and Glass batangi have minimum value while all others have intermediate values with respect to petiole length. For Pedicle length, genotypes Black batangi, Brown batangi, Nak Hard Skin, Shardi tanchi have minimum value (ranges 15-20 mm), genotype kushbago has maximum (65.5 mm), Tanchi and Glass batang have similar (55.8mm) values and all others ranges from 21.5-30 mm. Similarly for fruit length, genotypes Glass Batang has highest value fallowed by genotypes Kado and China batang while genotypes Black Batangi, Golden Batangi and Shardi have minimum value. For fruit weidth, genotype Chiana batang has highest value, genotypes black batangi, golden batangi and Shardi tanchi have the lowest value while genotypes Kado and Glass batang have similar values and all others genotypes have values ranges from 35.17-46.1 mm. For fruit weight, genotypes China and Glass batang have maximum value, followed by genotypes Kado, Kushbago and Nak Hard Skin batang while the minimum values showed by genotype black batangi, Golden batangi and Shardi Tanchi. From above discussion it is concluded that these parameters play an important role in the identification of these genotypes belonging to the genus *Pyrus*.

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Introduction

Pyrus belongs to the subfamily Pomoideae of family Rosaceae, with basic chromosome number x= 17 (Challiee and Westwood, 1973). Mostly they are deciduous trees, rarely armed particularly in the wild types. There are 22 widely recognized primary species which are distributed to Europe, Temperate Asia and mountainous area of northern Africa (Bell *et al*., 1996; Bailey, 1917). Most of them are worldwide commercially important fruit producing varities that has been cultivated in Europe and Asia for two to three thousand years. Presently more than 50 countries added to the commercial production of pear in the world (Bell, 1990; Bell *et al*., 1996). In Asia there are 25 species while in China 14 species having 8 species are endemic (Cuizhi and Spongberg, 2003). Among *Pyrus* species, only a few species have been domesticated for commercial production (Bell, 1990). On the bases of geographical distribution and morphological characters, most cultivated pears native to East Asia (Teng and Tanabe, 2004). It is a general convention that in Asia, *P. skinkiangensis* Yu has been introduced as a commercialized species (Peng and Iwahori 2000). The Japanese pear cultivars has been domesticated from wild *P. pyrifolia* occurring in Japan (Kikuchi, 1948). Pear is one of the most important fruits, planted worldwide from two to three thousand years. The genus *Pyrus* is believed to have arisen during the Tertiary period in the mountainous regions of western China. Dispersal and speciation of *Pyrus* is believed to have followed the mountain chains both east and west (Yamamoto *et al*., 2009).

Pears are commercially cultivated in temperate regions in more than 50 countries in the world. In 2005-2006 the World pear exports are estimated at 1.6 million tons and the export from northern hemisphere are expected to increase by 1 percent (Anony., 2006). According to World pear export production, the share of Argentina, China, Belgium, Netherland, USA, South Africa, Chili and other countries 18 %, 17%, 13 %, 12%, 10 %, 8 %, 7 %,16 % respectively to the world export (Anony., 2005).

In Pakistan, the total area under cultivation was 2115, 97, 44 ha in Khyber Pakhtunkhwa (KP), Baluchistan and Punjab respectively while the net production was 28343 tones, in which 27596, 431 and 316 tones produced by KP, Baluchistan and Punjab respectively with a net production of 28343 tons (MINFAL, 2006). Pears are the main sources of vitamins and fruit needs in the traditional communities and marginal farms in the northern Pakistan. Therefore varieties of *Pyrus* landraces domesticated in the northern Pakistan, are believed to came along the people who visited the area. In Asia, *P. skinkiangensis* has been introduced as a commercialized species (Peng and Iwahori, 2000). In Swat, Shawar valley having the total area 12,192 acres possess eight cultivated and eleven wild fruit plants. The cultivated species includes apples, persimmons, peaches and pears that annually produce 82,500, 290192, 17348 and 10412 boxes respectively. The total annual income from these sources is approximately Rs. 41.00 millions (Hussain *et al*., 2006). Although a large number of genotypes are present in the northern area of Pakistan. These genotypes are commonly cultivated on the fields boundaries and on the sides of water channels. Unfortunately, not even a single genotype of pears is properly identified/evaluated for morphological and yield related parameters. The present study is an attempt to document the wild and cultivated species of *Pyrus* from Northern KP, Pakistan.

Materials and methods

For collection of research materials field trips were arranged twice both for quantitative and yield parameters. The first trip was arranged in the last week of July while the second trip was arranged at the end of August, 2010 to collect maximum data with respect to quantitative and yield parameters. For quantitative parameters plant materials were collected from five different individuals of the same genotype belong to different locations. The plant materials were tagged, all the related information were recorded and pressed in news papers to dry

and press properly. The plant materials were then mounted on herbarium sheet for data collection.

Similarly for yield parameters fruits were collected from five different individual plants of different location of the same genotype. Then five fruits were randomly selected for yield parameters and all the related data were recorded with the help of venire clapper and meter rod. The fruit specimens were then preserved in plastic bottles for further information. All the research materials were submitted to the Herbarium Hazara University, Mansehra.

Results and discussion

The quantitative and yield parameters studied are given as follows:

Petiole length

Analysis of variance at 5% level of probability showed significant result (Table-2) with respect to petiole length which shows that all genotypes are different with respect to petiole length. Table of mean (Table -1) shows that the length of petiole ranges from 30.6 – 56.07 mm and the highest value of mean for petiole length is for genotypes, Kushbago (56.07) followed by Atti batang (49.00 mm) and Shardi Tanchi (48.47mm) while the lowest value of mean is of genotype Black batangi (30.60 mm). Franci batang (42.03) and Brown batangi (44.83) are very closely related values similarly Kado batang, Taunchi Batang and Nak batang have closely related values with respect to petiole length. The genotypes, China batang, Golden batang and Nak hard skin (35-37mm) have very closely related values with respect to petiole length. All these genotypes showed variation with respect to petiole length. The above data are correlated and agree with the result of the following data reported by different researchers in different time.

Boratynska (1990) reported 15–70 mm range of petiole length. Similarly Terpo (1960) and Peniastekova (1992) reported 20–70 mm of petiole length. According to Boucek (1954), petiole length ranges from 30–50 mm, Roloff (1998) reported 20-50 mm, Hofmann (1993) and Muller & Litschauer (1994) gave the values up to 60 mm for petiole length.

Leaf area

Analysis of variance (ANOVA) shows non-significant (0.1345) result at 5% level of significance (Table-2) showed that the genotypes are alike with respect to leaf area. Table of mean (Table-1) shows that the highest value of mean is for genotype, Brown batang (2672A), while all others genotypes have closely related values and fall in the same group- B. Therefore with respect to leaf area these genotypes are the same. Rittershoffer (1998) and Kuhn (1998) reported the same ratio of leaf length to leaf width, 0.9–1.59 mm. Similarly, Wagner (1995) also gave relative ratio of leaf length to its width which is equal to 1.00.

Pedicle length

ANOVA, Analysis of Variance (Table-2) shows that genotypes are highly significant at 5% level of probability (0.0000) with respect to pedicle length. Table of mean (Table -1) shows that highest value of mean for pedicle length is for genotypes, Kushbago (65.53) followed by Taunchi batang and Glass batang (50.87 B) (Table. 1A) while the lowest value ranges from 15-17, for genotypes Nak hard skin, shardi taunchi and Black batang. Others genotypes shows intermediate values with respect to pedicle length.

Terpo (1960) reported 21–50 mm range of pedicle length. According to Muller and Litschauer (1994) length of pedicle is longer than fruits. Kuhn (1998) reported 6–16 mm pedicle length, Hofmann (1993), Boucek (1954) and Boratynska (1990) observed 10–35 mm, 20–40 mm and 20–50 mm pedicle length respectively.

Fruit length

Analysis of variance (ANOVA), (Table -2) shows highly significant (0.0000) result at 5% level of significance so these genotypes are different from each other with respect to fruit length while the LSD

value at (5%) is 10.058. Table of mean (Table-1) shows that the lowest value of mean is for Genotypes, Black batangi (21.47), Shardi taunchi (23.30) and Golden batangi (23.80) respectively with respect to fruit length, while highest value is shown by Genotype, Glass batang (95.23A)followed by Kado Batang (73.17) and China batang (72.23) with respect to fruit length as compared to other genotypes, while Genotypes, Nak hard skin, Shakar batang, Mamosai and Atti batang showed intermediate values respectively.

Guleryuz and Ercisli (1997) reported 61-91 mm fruit length in pear cultivars. According to Terpo (1960) the length of fruits within taxon is 25-50 mm and depend on the variety. Similarly Peniastekova (1992) observed the range of fruit length from 30–50 mm in different cultivars.

Table 1. Mean values of six quantitative parameters of 14 genotypes of the genus *Pyrus*.

S. No	Genotypes	Pet. L. (mm)	Ped. L. (mm)	Fr. L. (mm)	Fr. Wdh (mm)	Fr. Wt. (mm)	Leaf Area(mm)
1	ATTI BATANG	49.00AB	23.57CD	37.53EF	46.17E	52.67	608.2B
2	BLACK BATANGI	30.60D	17.23D	21.47G	23.47H	8.700F	818.1B
3	BROWNBATANGI	44.83BC	20.83	40.60E	38.43FG	39.43DE	2472A
4	CHINA BATANG	35.90CD	21.57CD	72.23B	59.37 A	148.0A	623.5B
5	FRANCI BATANG	42.87BC	28.63C	65.50C	47.07DE	81.27C	715.6B
6	GLASS BATANG	30.67D	50.70B	95.23A	50.23CDE	163.7A	417.6B
7	GOLDEN ATANGI	36.60CD	28.63C	26.30G	25.93H	11.80F	444.5B
8	KADO BATANG	40.53BCD	30.73C	73.17B	50.50CD	113.2B	421.5B
9	KUSHBAGO	56.07A	65.53A	60.00D	54.03BC	109.2 B	698.9B
10	NAK BATANG	40.10BCD	25.53CD	38.47EF	40.27F	36.40DE	521.4B
11	NAK HARD SKIN	37.90CD	15.57D	60.33D	54.97B	108.5 B	653.0B
12	SHARDI TAUNCH	48.47AB	16.90D	23.80G	23.60H	9.320F	565.3B
13	TAUNCHI ATANG	40.37BCD	50.87B	34.07F	35.17G	26.17EF	530.9B
14	KALA BATANG	43.033BC	22.20 CD	23.30G	26.00 H	10.60F	460.7B

Fruit width

Analysis of variance (ANOVA), showed highly significant result (0.0000) (Table-2) with respect to fruit width at 5% level of significance, it means that the genotypes shows variation among each other with respect to fruit width. Table of mean (Table -1) shows that the highest value is for gennotype, China batang (59.37) followed by genotype, Nak hard skin (54.97) and lowest value is shown by genotypes, Black batangi (23.60) and Shardi taunchi (23.40) and golden batangi (25.93) respectively while genotypes, Kushbago, Kadobatang and Glass batang shows intermediate values with respect to fruit width. Similarly Edizer & Gunes (1997) reported 59 to 78 mm fruit width. Terpo (1960) gave the values of fruit width 25–50 mm and Peniastekova (1992) observed 30–50 mm fruit width.

Fruit weight

Analysis of variance (ANOVA), (Table-2) is highly significant (0.0000) at 5% level of probability with respect to fruit weight. Table of mean shows (Table-1) that genotypes, Glass batang (163.4gm), and China batang (148.0gm) have highest value followed by genotypes, Kado batang (113.2gm), Kushbago

(109.2gm) and Nak hard skin (108.5gm) while genotypes, Black batang and Shardi Tanchi possess lowest values (8.7, 9.3 gm) respectively with respect to fruit weight. Similarly genotypes, Franci batang and Atti batang have 81.27 and 52.67 possess intermediate values respectively with respect to fruit weight. Karadeniz and Sen (1990) reported 50 - 368 gm fruit weight in pear cultivars. Abe *et al.,* 1993 reported that the wild ancestor of the cultivated Japanese pear bears fruit weighing only a few grams, while a single fruit from a modern cultivar may weigh up to 2 kg (2000gm), a 100-fold increase in weight.

Table 2. Analysis of variance of six quantitative parameters of 14 genotypes of *Pyrus*.

S. No	Parameters	Degree of Freedom	Sum of Squares	Mean Square	F Value	Probability
1	Petiole Length	13	1919.403	147.646	4.0685	0.0011
2	Leaf Area	13	10582799.267	814061.482	4.0685	0.1345
3	Pedicle Length	13	8852.655	680.973	17.2392	0.0000
4	Fruit Length	13	20621.807	1586.293	187.6217	0.0000
5	Fruit Width	13	6133.518	471.809	79.7416	0.0000
6	Fruit Weight	13	114743.600	8826.431	54.7393	0.0000

Cluster analysis was carried out on the quantitative parameters using Minitab software; the dendrogram divided all the genotypes into two main groups, A and B. Group-A further divided into two subgroups A1 and A2. Subgroup A1 consisted of genotypes 2, 10, 4 and 11while sub group A2 consisted of genotype 5, 6, 9, 12, and 14. Group-B consisted of genotypes 3, 13, 8 and 7 (Figure-1).

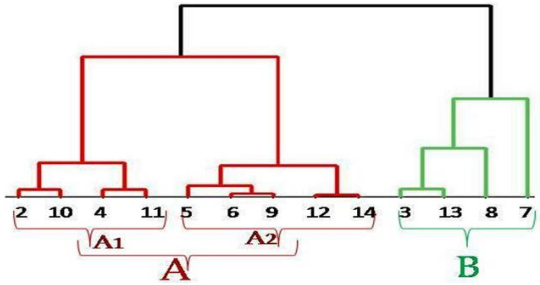

Fig. 1. Dendrogram showing genetic relationship among 13 genotypes of *Pyrus* using quantitative parameters.

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References

Abe K, Sato Y, Saito T, Kurihara A, Kotobuki K. 1993. The relationship of inheritance between maturation date and fruit weight in Japanese pear. Breeding **43**, 439–447.

Anonymous. 2005. China Shere of Global Pear Export, Ist Expanding Rapidly. Global Trade Atlas.

Anonymous. 2006. World Pears situation: Driven by growing out put in China, Global production continues increase. Horticultural and tropical Product Division. USDA/FAS.

Bailey LH. 1917. *Pyrus*, in. Standard cyclopedia of horticulture, Vol. V. Macmillan, New York.

Bell RL. 1996. Pears (*Pyrus*) in. Moore J. N., Ballington, J. R. (eds) Genetic Resources of Temperate Fruit and Nut Crops II. International Society for Horticultural Science, Acta Hort **290,** 657–697.

Bell RL. 1990. Pears (*Pyrus).* in. J. N. Moore and J. R. Ballington Jr. (Eds.), Genetics Resources of Temperate Fruit and Nut Crops **I,** 655-697.

Boratyňska K. 1990. Systematyka geograficzne rozmiesz-czenie. Grusza pospolita – *Pyrus communis* L. In: BIALOBOKS. (ed.), Dzikie drzewa owocowe. Poznaň, Arcadia: 81–91.

Boucek B. 1954. Hrusen. Lesn. Prace. **33,** 57–62.

Challiee JS, Westwood MN. 1973. Numerical Taxonomic studies of the genus *Pyrus* using both chemical and botanical characters. Bot. J. Linn. Soc. **67**, 80-83.

Cuizhi G, Spongberg SA. 2003. Flora of China. **9,** 173

Edizer Y, Gunes M. 1997. Some pomological properties of local apple and pear cultivars grown in Tokat region of Turkey. Proceedings of Pome Fruit Symposium. 259-266.

Guleryuz M, Ercisli S. 1997. Some pomological properties of local pearcultivars grown in Kagizman district of Turkey. Proceedings of Pome Fruit Symposium. 37-44.

Hofmann H. 1993. Zur Verbreitung und Ökologie der Wildbirne (*Pyrus communis* L.) in Süd-Niedersachsen und Nordhessen sowie ihrer Abgrenzung von verwilderten Kulturbirnen (*Pyrus domestica* Med.). Mitt. Dtsch Dendrol. Gesell., **81,** 27–69.

Hussain F, Islam M, Zaman A. 2006. Ethnobotanical Profile of plants of Shawar valley, District Swat, Pakistan. Int. J. Biol. Biotech. **3**, 301-307.

Kikuchi A. 1948. Horticulture of Fruit Trees. Vol. 1. Yokendo. Tokyo.

Kühn R. 1998. Wildobst und Naturschutz. In: Kleinschmit J., Soppa B., Fellenberg U. (eds.), Die Wildbirne, *Pyrus pyraster* (L.) Burgsd. Tagung zum Baum des Jahres am 17. and 18. 3. 1998 in Göttingen. Frankfurt am Main, J. D. Sauerländers. 18–31.

MINFAL. 2006. Ministery of Food and Agriculture, Islamabad.

Muller F, Litschauer R. 1994. Suche nach Wildformen von Walnub, Birne und Apfel. osterr. Forstz. **105**, 33.

Peng S, Iwahori S. 2000. Variety, distribution and major cultivars of domesticated *Pyrus* spp. In China. Agiculture and Horticulture **75**, 763-772.

Peniastekova M. 1992. *Pyrus* L. Hruska. In: Bertova L.(ed.), Flora Slovenska, IV/3. Bratislava, Veda: 381–388.

Rittershoffer B. 1998. Forderung eltener Baumarten im Wald. Auf den Spuren der Wildbirne. Allg. Forstz. /Der Wald, **16**, 860–862.

Roloff A. 1998. Der Baum des Jahres 1998: die Wildbirne (*Pyrus communis* L. sp. *pyraster* Gams.). In: Kleinschmit J., Soppa B., Fellenberg U. (eds.), Die Wildbirne, *Pyrus pyraster* (L.) Burgsd. Tagung zum Baum des Jahres am 17. und 18. 3. 1998 in Göttingen. Frankfurt am Main, J. D. Sauerländers: 9–15.

Teng Y, Tanaba K. 2004. Reconsideration on the origin of cultivated pears native to East Asia. Acta. Hortic. **634**, 175-182.

Terpo A. 1960. Magyroszagh vadkörtei (*Pyri hungariae*).Annales Academiae Horti et Viticulturae, Budapest, Mezö-gazdasagi Kiado **22**, 1–258.

Wagner I. 1995. Identifikation von Wildapfel (*Malus sylvestris* (L.) Mill.) und Wildbirne *(Pyrus pyraster* (L.) Burgsd. Forstarchiv **66**, 39–47.