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FOUR NEW RECORDS OF THE GENUS PYRUS (ROSACEAE) FROM PAKISTAN

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ABSTRACT

The objectives of the present study were to explore, identify and document *Pyrus* (pears) species from Pakistan, their screening and recommendation for further breeding program. Extensive surveys were conducted during 2010-2011 to identify and document *Pyrus* (Pears) from Pakistan. Plant specimens were collected, processed and identified. Using established floristic keys for different countries and literature, four new records of the genus *Pyrus* L. (Rosaceae) viz., *P. ussuriensis, P. armeniacifolia, P. hopeiensis* and *P. communis* are reported for the flora of Pakistan. The detailed morphological description, flowering and fruiting duration, ecological notes, distribution, GPS coordinates, altitudes and voucher specimens of the taxa are reported in this paper, along with images, distribution map and a table of comparative differentiating characters of these taxa.

Key words: New Records, *Pyrus* (Pears), Rosaceae, Pakistan.

INTRODUCTION

Pyrus L. (pear group) belongs to the family Rosaceae and subfamily Rosoideae (Maleev, 1985; IAPT, 2012), while on the basis of molecular evaluation, *Pyrus* has been placed in subfamily Spiraeoideae by Potter *et al.* (2007) and Zheng *et al. (*2014). Internationally, members of this genus are mostly shrubs or trees and are pyramidal, umbrella or narrow-straight in shape (Cuizhi, 2003). Based on their geographical distribution, *Pyrus* has been divided in to two groups i.e. oriental and occidental pears (Bailey, 1917; Rubstov, 1944; Zhukovsky and Zeelinski, 1965). Approximately 12-15 species of oriental pears or Asian pears have been reported from China by Teng and Tanabe (2004) and 4 species are reported from Pakistan, mostely available in moist temperate region and rarely in sub tropical region (Islam *et al.,* 2016). Several cultivars of Pears belonging to Kashmir, Pakistan were evaluated for their fruits diversity, quality contolling traits and horticulture intrest by Ahmad *et al*. (2013) and Ahmad *et al.* (2017). Recently, diversity and production of pears were reported from northern Pakistan (Islam and Ahmad, 2018). On the other hand, 21 species of occidental pears have been reported, mostly from north Africa, Europe and Iran (Zamani *et al.,* 2009, 2010, 2012, and 2016). On the bases of morphological and chemical characters, *Pyrus* has been grouped into, the East Asian Pea Pears, the larger fruited East Asian Pears, the North African Pears and the European and West Asian Pears (Challice and Westwood, 1973).

Speciation and origin in *Pyrus* had been taken place during the tertiary period in the mountainous areas of the western and southwestern China and spread both in east and West (Rubstov, 1944; Bell *et al*., 1996; Yamamoto and Chevreau, (2009) nearly all Asian pear species originated from five primitive genepools (Jiang *et al.,* 2016). In East Asia, the commercial pear cultivars are sorted into five groups, among these, Ussurian pear and Chines sand pear have been originated from *P. ussuriensis* Maximowicz and *P. pyrifolia* (N. L. Burman), respectively (Teng and Tanabe, 2004). For commercial production, of these, only few species and more than 3000 cultivars have been developed (Pu and Wang, 1963 and Bell 1991). The commercilized species have been originated from a wild species *P. pyrifolia* Nakai (Kikuchi, 1948) in Asia, *P. sinkiangensis* T. T. Yu has been introduced as a commercial species (Peng and Iwahori, 2000).

Historically, the study area has been visited by a large number of invaders, visitors, traders and pilgrims etc. of different origins. Archeological remains, ruins, inscriptions and petroglyphs are scattered throughout the area. A brief historical sketch of the inhabitants of the area is Islam (799 A.D), Turkish Shahi (666-822 A.D) and Hindu Shahi (822-977A.D) (Ahmad, 2014). Besides cultural and other biological resources, these people had introduced a variety of crops into the area, some of which like the pears are still available in the traditional agricultural farmlands, kitchen gardens and field boundaries of the subsistence farms of the area and its fruits are used as solid, soft drinks and also used as root stock for grafting. Among these pear resources, only four species have been reported from different parts of Pakistan (Islam *et al*., 2016) while the remaining are unexplored and need exploration, evaluation and scientific identification. Keeping in view, both the

scientific and commercial importance of *Pyrus* resources, a scientific endeavor was undertaken for taxonomic exploration and characterization of the available diversity of *Pyrus* belonging to northern Pakistan.

Review of the available literature shows that different authorities in different time reported number of species for the genus *Pyrus* (Rehder, 1915; Yu, 1963; Terpo and Franco, 1968; Temesy, 1969; Maleev, 1985 and Cuizhi, 2003). However, only two species, *P. communis* L. and *P. pashia* D. Don have been reported in the Flora of British India (Hooker, 1878). Later, these two species and *P. lindleyi* Rehder were also reported by Stewart, (1972). In the near past, four species viz., *P. pashia* D. Don*, P. calleryana* Decaisne*, P. bretschneideri* Rehder and *P. pyrifolia* Nakai have been reported from Pakistan (Islam *et al.,* 2016). Beside these, large number of undocumented and unidentified wild and cultivated species, varieties and cultivars of *Pyrus* are available in the temperate region of Pakistan. However, the genus *Pyrus* and its associated species belonging to the occidental pears are not genetically tagged nor taxonomically reported for the Flora of Pakistan (Landrein *et al*., 2009). The objective of the present work is to describe and provide the detailed morphological characters of species belonging to the occidental pears, reported as new records for the Flora of Pakistan.

MATERIALS AND METHODS

The plant materials of the current research work were collected during 2010-2011 from various locations of District Swat and Mansehra, Khyber Pakhtunkhwa, Pakistan (Fig. 01). The specimens were collected in flowering, fruiting and in med sessions. The relevent field information such as collection numbers, date of collection, location, name of the collector, tagging and geographical coordinates of each specimen were recorded at the spot. The specimens were processed and pasted on the herberium sheets. Specimens were checked and identified with the help of field notebook, photographs and to the relevent literatue of Rehder (1915); Maleev (1985); Yu (1963); Temesy (1969); Terpo and Franco (1968); Hooker (1878); Kalkman (1998); Nakai (1926) and Cuizhi (2003). The voucher specimens and duplicate specimens have been deposited in the Herbarium Hazara University (HUP), Mansehra, KP, Pakistan.

Diagnostic key to the Species
Key to the Species

1+ Pome without persistent sepals, rarely few persistent Pome present and style 2-5 in number…………………......2
-Pome with persistent sepals and style 3-5 in number…..6
2+Leaf margin spiny serrate…………………….......…..3
-Leaf margin non-spiny serrate……………………...…..4
3+Pome yellow; leaf basally cuneate
………………………… ……………4. *P. bretschneideri*
- Pome brown; Leaf basally sub-cordate or rounded ………...3. *P. pyrifolia*
4+Leaf margin sharply serrate……...….5. *P. phaeocarpa*
- Leaf margin obtusely serrate…………………………. 5
5+Leaves are corymb glabrous; stamens 20 and styles 2 or 3……………………………...…....2. *P. calleryana*
-Leaves and corymb initially pubescent; stamens 25-30 and styles 3-5………………………………...1. *P. pashia*
6+Leaf margin spiny serrate…………………...….…..…7
- Leaf margin serrulate or obtusely serrate and without spins……….……..……...… 8
7+ Leaf blade long spiny-serrate; styles 5; pome yellow…………………………….……..7.*P. ussuriensis*
- Leaf blade short spiny-serrate; styles 4; pome brown ………………………………...…..…..9. *P. hopeiensis*
8+ Leaf margin serrate……………………….……..…..… 9
-Leaf margin seteso or obtusely serrate………….......…10
9+Pome yellowish green, ovoid or obovoid, 5-loculed; fruiting pedicel 4-5 cm and
thickened distally……………………10. *P. sinkiangensis*
-Pome brown sub-globose or obovoid, 3-4 loculed; fruiting pedicel 3-4 cm and not
Thickened distally…………...………...…..8. *P. serrulata*
10+ Leaf margin seteso serrate……….…...11. *P. ovoidea*
-Leaf margin seteso or obtusely serrate……………….…11
11+Fruit thick-skinned and with numerous grit cells……………………………...…...12. *P. turcomanica*
-Fruit not as above……………………….………... 12
12+Pome yellowish green……………………......…..13
- Pome brown………...…………..……....….…….....…14
13+Pome 1.5-2.5 cm in diam; 5-7 flowers; stamens 25 styles 3-4..………...………………….....6. *P. pseudopashia*
- Pome 1-1.5 cm in diam; 3-6 flowers; stamens 25; styles 5(4)……………………………………...…13. *P. xerophila*
14+ Pome obovoid or sub-globose; leaf blade elliptic to ovoite; petiole thin, 1.5-5 cm long……...14. *P. communis*
-Pome depressed globose; leaf blade broadly ovate to suborbicular; petiole thick, 2-3 cm
long…………………………….….15. *P. armeniacifolia*

RESULTS AND DISCUSSION

The present research work comprised of comprehensive morphological description, citations, synonyms, data of the examined specimens, vernacular name and distribution of each of the four new records of the genus *Pyrus* (Rosaceae) viz. *P. ussuriensis* Maximowicz, *P. armeniacifolia* T.T. Yu, *P. hopeienses* T.T. Yu, *P. communis* L. and their details are presented here.

1. ***Pyrus ussuriensis*** Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg, Ser. 2, 15: 132. 1856; Proc. Amr. Acad. Arts and Sci. 50: 227. 1915; Fl. of U. S. S. R. 9: 265. 1985; Cuizhi, Fl. China. 9: 174. 2003.

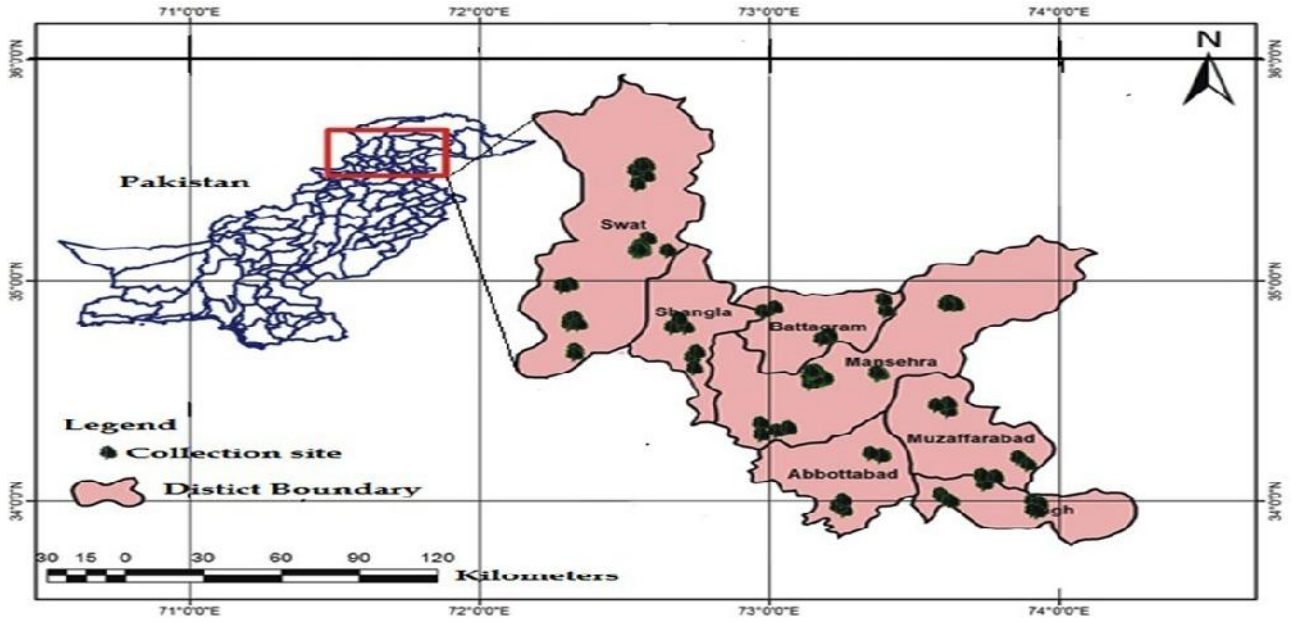

Fig. 01. Map showing collection sites of *Pyrus* species

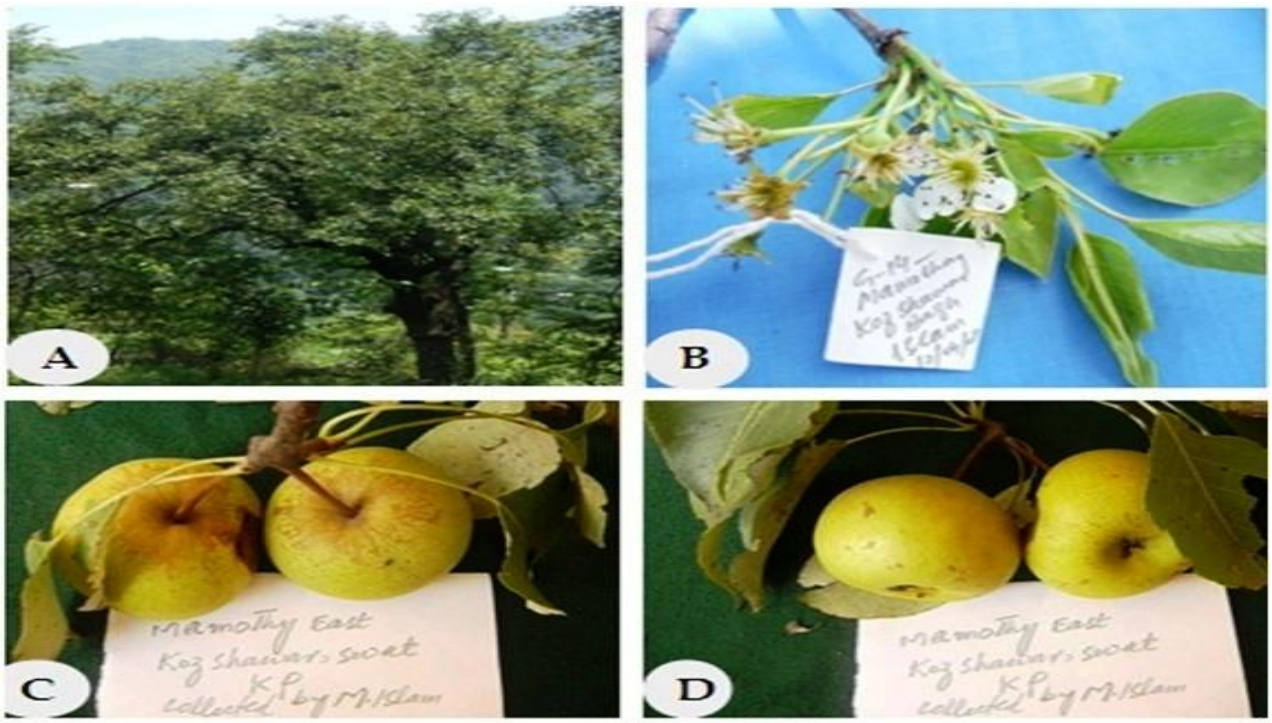

Fig. 02: *Pyrus ussuriensis*: A, Habit B, front view of inflorescence D, upper view and E, side view of fruits. Location Site: Kuz Shawar, Swat.

Pyrus communis Bunge, Enumer. Plantarum, quas in China boreali collegit anno, 1833. *Pyrus sinensis* Decaisne, Jard. Fruit. I. t. 5. (1872); *Pyrus simonii* Carrier in Rev. Hot. 28. 1872.

Tree 10-15 m tall, small young branches yellowish gray to purplish brown, mature branches yellowish gray to yellowish brown, Stipule caduceus, linear lanceolate, apex acuminate, young petiole densely hairy, soon hairless; leaf blade ovate to broadly ovate, glabrous or thickly hairy when young, soon glabrescent, base rounded or sub-cordate or sometime cordate, lustrous green above, margin long spinulose serrate, apex

shortly acuminate or long tapering acute apex. Hypanthium campanulate, abaxially hairless or rarely tomentose. Inflorescence corymb, 5-7 flowered; peduncle tomentose in young condition, quickly hairless; Hypanthium campanulate, abaxially hairless or rarely tomentose. Sepals triangular-lanceolate, sparsely pubescent above and adaxially tomentose, margin initially glandular, denticulate, apex acuminate. Petals white, obovate or broadly ovate and glabrous. Stamens 20, shorter than petals. Ovary 5 loculed, 2 ovules per locule. Styles 5, same level with stamens. Fruit, pome, yellow, sub-globose and sepals persistent. Fruit become reddish in color and less tasty. Fl. April. Fr. Aug- Oct.

Distribution: China, Russia, Korea and Pakistan.

Specimens examined: Pakistan, **B-7** Swat Dist. Kuz Shawar 34° 40. 014'N and 72° 19. 621' E, 4850 ft., 20.6.2010, *M. Islam* 47 (HUP); Kuz Shawar 34° 40. 014'N and 72° 19. 621' E, 4850 ft., 12.4.2011, *M. Islam* 91 (HUP).
Vernacular name: Mamothay (Pashto).

2. *Pyrus armeniacifolia* T. T. Yu, Pl. XXVII, 2; Yu. Acta Phytotax. Sin. 8: 231. 1963; Cuizhi, Fl. of China 9: 176. 2003.

Fig.03. *P. armeniacifolia:* A, front view and B, dorsal view of inflorescence, C, front view of fruits and D, side view of fruits. Collection Site: Sangar, Balakot, Mansehra.

Tree pyramidal, 8-12 m; branches slightly angular, purple-dark brown lenticels, glabrous; young branches outside wavy with fairly long soft straight hairs except glabrous. Leaves wide ovate or sub orbicular, thick, 4-5 cm long and wide, acute and obtuse, base rounded and ending suddenly, margin crenulate-serrate or near to dentate, on the upper side dark green, glabrous. petioles 2-3 cm. long, glabrus. Inflorescence, umbel-raceme, 8-10 flowered, pedicel initially tomentose, become glabrous. Hypanthium bell shaped. Sepals

triangular, apex acute, white wooly hairs on both sides. Petals white, narrow at the base, lobed-rounded above. Stamens 18-20, in single circle, ½ of the petals. Styles 5 (or 4), pome depressed-globose, green, 3-4 in group, calyx persistent crown, sepals ovate oblong with pome, 5-locules; similar to *P. xerophila* Yu, but the fruits of *P. armeniacifolia* are depressed globose, leaves sub orbicular or almost orbicular or broadly ovate; fruit depressed-globose.

***Distribution*:** Pakistan, China (N. Xinjiang).

Specimens examined: Pakistan, **B-7** Mansehra Dist. Balakot-Sangar, 34°, 34. 986' N and 073°, 22. 201' E, 5505 ft., 3.4.2011, *M. Islam* 66 (HUP); Balakot-Sangar, 34°, 34. 621' N and 073°, 22. 818' E, 5505 ft., 28.3.2010, *M. Islam* 51 (HUP); Balakot-Sangar, 34°, 34. 62' N and 073°, 22. 812' E, 5505 ft., 28.3.2010, *M. Islam* 12-B (HUP).
Vernacular name: Atti Batang (Hindko), Qualperang Tango (Pashto).

3. *Pyrus hopeiensis* T.T**.** Yu, Acta Phytotax. Sin. 8: 232. 1963; Cuizhi, Fl. of China 9: 174. 2003.

Fig. 04. *P. hopeiensis*: A, Front view and D, Dorsal view of inflorescence. Collection site: Kuz Shawar, Matta, Swat.

Trees 6-8 m tall. Branchlets dark purple or purplish brown, branches are flexible and have capacity to bear load: Stipules caduceus, linear-lanceolate, petiole 2-4.5 cm, sparsely pubescent or glabrous; leaf blade ovate, or sub orbicular, glabrous, base rounded or subcordate, margin shortly spinulose-serrate, apex long or shortly acuminate. Inflorescence raceme umbel-like, 6-8 flowered; peduncle subglabrous; peduncle subglabrous; Pedicel 1.2-1.5 cm long, abaxially thickly tomentose and sparsely pubescent. Flower 2.5-3 cm in diam. Hypanthium copular or plate like, sub glabrous. Sepals triangular-ovate, elongated, abaxially sparsely pubescent, adaxially densely pubescent, margins denticulate, apex acuminate. Petals white, elliptic-obovate, ca 8x6 mm, narrow and shortly clawed at base. Stamens 20, (rarely 17-19) less than ½ as long as petals, filament white while anthers are pinkish, bending to the center. Ovary 4 or 5-loculed, with 2 ovules per locus; styles 5 (or 4), nearly as long as stamens, glabrous, sometime three short and two long. Pome brown, spotted, globose or ovoid, 4 (or 5)-loculed; fruiting pedicel 1.5-3 cm, glabrous; sepals persistent. Fl. Apr, fr. Aug- Sep.
Specimens examined: Pakistan, **B- 7** Swat Dist. Malawooch, Kuz Shawar, 35° 50. 045'N and 72° 19.561' E, 4855 ft*.,* 17.6.2010, *M. Islam* 44 (HUP); Malawooch, Kuz Shawar, 35° 56. 341'N and 72° 20.782' E, 5300 ft*.,* 11.4.2011, *M. Islam* 44 (HUP).
Vernacular name: Pykhawary Tango (Pashto)

4. ***Pyrus communis*** L. Sp. pl. 479, 1200. 1753; Prodr. 2: 643. 1825; Fl. Ind. Ed. 2, 2: 391-394. 1832; Decaisne, Jard. Fruit. 1: 340, pl.1. 1872-74; Rehder, Man., ed. 2: 403. 1940; Terpo and Franco, Fl. Europaea 2: 66. 1968; Fl. Brit. Ind. 2: 374. 1978; Maleev, Fl. USSR. 9: 261. 1985; Cuizhi, G., Fl. China 9: 175. 2003.

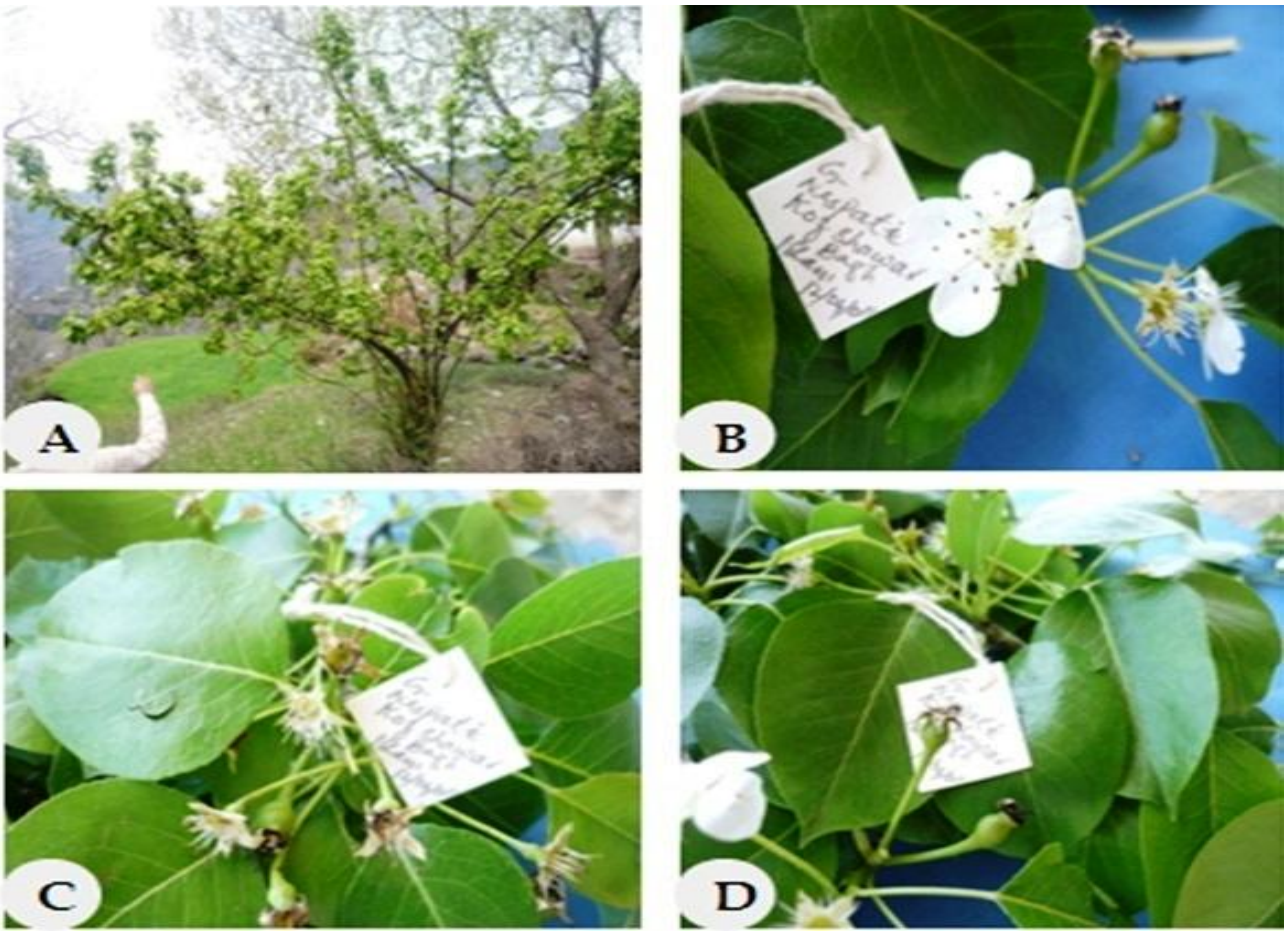

Fig. 05. *Pyrus communis*: A, Habit B, Front view of inflorescence C & D, Front view of inflorescence with young fruits. Collection Site: Kuz Shawar, Matta, Swat.

Trees 5-15 m tall, branchlets grayish brown to dark brownish, sometime with or without spines, rising on young. young twigs stout, reddish-brown, soon becoming glabrous and shining. Stipules non-persistent, linear lanceolate; Petiole 1.5-5 cm.

slender, slightly pubescent when young, soon glabrescent; Leaf blade ovate or sub-rounded to elliptic, 2-5 (7)x 1.502.5 cm, young pubescent, soon abaxially pubescent along midvein, base broadly cuneate to sub-rounded, margin obtusely serrate, serrulate, cuneate, crenate, rarely entire, apex acute or shortly acuminate, lustrous green above and light green below. Inflorescences, raceme umbel like, corymb, 5-9 flowered, 2.5- 3.0 cm across; Peduncle glabrous or subglabrous; Pedicel 2-3.5 cm, white hairy, subglabrous and become glabrous at maturity. Flowers 2.5-3 cm in diam. Hypanthium bell shaped, Calyx persistent, Sepals triangular-lanceolate, both surfaces pubescent, margin sparsely glandular denticulate when young, apex acuminate. Petals white or pink, obovate, 1.3- 1.5x 1x1.3 cm, base, 3-5 x 1.5-2 cm, base narrow, shortly clawed, suborbicular or obovate, spreading, glabrous. Stamens 20, filament white, same level when mature.

Ovary 5-loculed, style 5 (or 4) nearly as long as stamens, pubescent basally. Fruit, pome, oblong, pyriform, obovoid or sub-globose, 5-loculed, green or yellow when ripe, rarely reddish, dotted; sepals persistent. Fl. Apr., fr. Jul—Aug.

Distribution: China, Bhutan, Vietnam; South Asia, Europe, North Iran, Central Asia, Central and South Europe, Turkey, Russia, Pakistan, Afghanistan and India.

Specimens examined: Pakistan, **B-7** Swat Dist. Madyan, Chail, 35° 08. 192’ N and 72°, 32.960’ E, 5149 ft., 19.4.2010, *M. Islam* 22-A (HUP); Kuz Shawar, 34° 49.025’ N and 72° 18. 680’ E, 4818 ft. 19.4.2010, *M. Islam* 20 (HUP); Kuz Shawar, 34° 59.068’ N and 72° 18. 609’ E, 4785 ft. 18.4.2010, *M. Islam* 18 (HUP); Kuz Shawar, 34° 59.064’ N and 72° 18. 654’ E, 4788 ft. 12.4.2011, *M. Islam* 92 (HUP); **B-7** Mansehra Dist. Batal, 34° 32.927’ N and 73° 08.749’ E, 4540 ft., *M. Islam* 36-C (HUP); Batal, 34° 32.946’ N and 73° 08.758’ E, 4541 ft., 23.5.2010, *M. Islam* 34-A (HUP); Batal, 34° 32.343’ N and 73° 08.622’ E, 4280 ft., 23.5.2010, *M. Islam* 34 (HUP); Balakot, Sanger, 34° 34.700’ N and 73° 22.396’ E, 5200 ft., 03.4.2011, *M. Islam* 72 (HUP).

Vernacular name: Pear (English), Bagugosha (Kashmir), China Batang (Hindko), Neshpati (Urdu and Pashto).

Several taxa of the genus *Pyrus* have been reported from 53 countries around the world by Postman (2008), among these, 22-26 are widely recognized primary species, (Bailey,1917). From different geographical regions and countries of the world, different taxa of *Pyrus* have been reported by different authorities. Among these, 12 species have been reported by Temesy (1969), 15 species have been reported by Cuizhi (2003) and 24 species have been reported in different time by Zamani *et al*. (2009; 2010; 2012 and 2016) for the flora of Iran. Most of these species are not yet reported from Pakistan except *P. pashia* which is common for both the countries, (Zamani *et al*., 2009 and Islam *et al.,* 2016), 14 species have been reported by Islam (2015). Moreover, in present work, most of the taxa belonging to *Pyrus* were described and evaluated with the help of flora of China (Cuizhi, 2003) as new records for the flora of Pakistan. Similarly, the original description of different species of *Pyrus, (*Rehder, 1915) are fruitful for description and evaluation of *P. ussuriensis* and *P. communis. Pyrus armeniacifolia* and *P. hopeiensis* are the two among the six species which were for the first time reported from China (Yu, 1963). *Pyrus ussuriensis* and *P. communis* were reported for the flora of USSR (Maleev, 1985). Similarly, 4 species have been reported by Hooker (1878). Further (Stewart, 1972) enlisted the name of the 2 species of *Pyrus* without description and detail records, in the annotated catalogue of the vascular plants of West Pakistan and Kashmir. However (Islam *et al*., 2016) reported 4 species of *Pyrus* viz. *P. pashia*, *P. calleryana, P. bretschneideri* and *P. pyrifolia* as new records from Pakistan.

Table 1. Main morphological differences among four new *Pyrus* records.

Characters	*P. ussuriensis*	*P. armeniacifolia*	*P. hopeiensis*	*P. communis*
Tree height	10-15 m	8-12 m	6-8 m	5-15 m
Leaf blade	ovate to broadly ovate	wide ovate	Ovate or sub orbicular	Ovate or sub-rounded to elliptic
Leaf base	rounded or sub-cordate	rounded and ending suddenly	rounded or sub-cordate	broadly cuneate to sub-rounded
Leaf margin	long spinulose serrate	crenulate-serrate or near to dentate	shortly spinulose-serrate	obtusely serrate, serrulate, cuneate,
Inflorescence	5-7 flowered	8-10 flowered	6-8 flowered	5-9 flowered
Stamens	20, shorter than petals	18-20, ½ of the petals	20, less than ½ of the petals	20, same level
Fruit	Sub-globose	depressed-globose	globose or ovoid	oblong, pyriform, obovoid,
Fruit color	Yellow	Green	brown	Green

Table 02. Comparison of new records of *Pyrus* with previously reported species of *Pyrus.*

Characters	New Records of *Pyrus*			Previously reported species of *Pyrus*			
	P. ussuriensis	*P. armeniacifolia*	*P. hopeiensis*	*P. communis*	*P. pashia*	*P. calleryana*	*P. bretschneideri*	*P. pyrifolia*
Tree Height	10-15 m	8-12 m	6-8 m	5-15 m	5-12 m	5-8 m	5-8 m	7-20 m
Leaf margin	long spinulose serrate	crenulate-serrate or near to dentate	shortly spinulose-serrate	obtusely serrate, serrulate, cuneate	obtusely serrate	initially glandular serrate	spinulose-serrate	spinulose-serrate
Inflorescence	5-7 flowered	8-10 flowered	6-8 flowered	5-9 flowered	6-10 flowered	6-12 flowered	7-10 flowers	6-9 flowered
Stamens	20 shorter than petals	18-20, ½ of the petals	20, less than ½ of the petals	20, same level	27-31 slightly shorter than petals	20 slightly shorter than petals	20 ½ of the petals	20 or 23-25 as long as petals
Fruit	Sub-globose	depressed-globose	globose or ovoid	oblong, pyriform, obovoid	Sub-globose	globose	globose-ovoid,	Sub-globose

Conclusion: Northern parts of Pakistan are rich sources of plant biodiversity. The area possesses diverse types of *Pyrus* taxa, which are neither genetically tagged nor taxonomically identified. In the present work, four new

records of the genus *Pyrus i.e P. ussuriensis, P. armeniacifolia, P. hopeiensis and P. communis* are reported here and would contribute to the flora of Pakistan specifically and overall update the knowledge with respect to *Pyrus*.

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