Results of the study of aboriginal varieties of pear in the Guba region of Azerbaijan

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ABSTRACT

Research was conducted to study local pear varieties of folk selection in the mountain and foothill villages of the Guba region of the Republic of Azerbaijan. The biodiversity, adaptation to local environmental conditions and potential of local varieties and forms of pear in the Guba region were studied. The native pear varieties discovered during our research have been described, propagated, and will soon be included in the genetic collection of our institute. About thirty varieties and forms of pears of folk selection were discovered. Most of these varieties are known to very few people due to their rarity. The majority of them have not yet had their biomorphological and economic characteristics described. Taking into account their uniqueness, rarity and economic contribution to the lives of local farmers and rural communities, we carried out a primary pomological description of 11 varieties, some of which were described for the first time. Most of these varieties are resistant to biotic and abiotic stress factors of the environment, very productive, the fruits have excellent taste qualities. They store well, are transportable, and are used fresh as well as for making dried fruits, jams and compotes. In the future, they can be used in the selection of new varieties as donors.

Keywords: Breading, Guba region, landraces, pear, productivity

INTRODUCTION

The Guba region is one of the main horticultural regions of the Republic of Azerbaijan. Here, various fruit plants, including numerous varieties, forms, and their wild ancestors, are grown by farmers on garden plots and are naturally widespread. These varieties and forms, which constitute the living history of our nation's agriculture, are distinguished by high productivity, quality, disease and pest resistance, drought and soil adaptability, and the ability for long-term fruit storage. They are used by the local population not only fresh but also for making jams, fruit syrups and dried fruits, which provide additional income (Hasanov and Aliev 2011). However, the number of indigenous varieties and forms, which represent a rich genetic resource of the local population, has sharply declined in recent years. Therefore, the collection, preservation, study, passportization, expansion of collections, and utilization of cultural and natural genetic diversity of fruit plants in the Guba region, alongside varieties of other fruit crops, is one of the most important and urgent tasks of today(Musayev and Akparov 2014).

Studying the genetic diversity of pear plants in the Guba region allows for the identification of

positive forms that can serve as donors in breeding new, high-yielding, and resilient cultivated varieties. Therefore, the collection and evaluation of existing genetic resources of fruit plants in this region, as well as enhancing the number of valuable agronomic traits applicable in agriculture, are key issues of contemporary importance. Musayev and Hajiyev **(**2023) reported that among 27 Caucasian pears, 19 pear species are growing in Azerbaijan flora and they have a number of natural hybrids in nature and courtyards.

Economic and biological indicators of efficiency, such as high yield, large fruits with superior taste quality, ability to ripen at different times, relative resistance to various biotic and abiotic stress factors, and suitability for various uses, have been evaluated for different pear varieties using modern methods to describe their pomological characteristics. Researching the genetic diversity of all fruit plants in the Guba region will not only help answer some phylogenetic questions but also enable the use of discovered forms with positive biological and agronomic characteristics, as well as resistance to various biotic and abiotic factors, as parental and donor forms for breeding new, productive, and resilient varieties. The abundance of pear species and locally selected varieties in Azerbaijan confirms that this region is the primary center of origin and domestication of this crop (Maghradze *et al*., 2012).

MATERIALS AND METHODS

The materials for the study were aboriginal varieties and forms of pears of folk selection in the orchards of local farmers in the Guba region. Phenological phases, growth, biomorphological description and productivity, fruit quality traits, resistance to disease and pests were studied by using the common description methods of fruit plants as described by (Lobanov, 1980; Sedova and Ogoltsova 1999). Farmers cultivating pears were invited to participate in the study. Samples of fruits and leaves were collected from various pear varieties and forms. Samples were collected at different times during the ripening season to encompass a wide range of phenotypic characteristics. Analysis of biomorphological features such as fruit shape and size, leaf shape and size, above-ground structure, etc., was conducted. Data on morphological differences between different pear varieties and forms were recorded. Assessment of the resistance of collected samples to major pear diseases and pests. Fruit quality assessment was conducted based on external characteristics (color, shape), organoleptic properties (taste, aroma). Interviews and surveys with farmers were conducted to gather additional information on the cultivated pear varieties and forms, their adaptation to local conditions, and the challenges faced by farmers during cultivation. These methods provided a comprehensive understanding of the biodiversity, adaptation, and potential of local pear varieties and forms in the Guba area.

RESULTS AND DISCUSSION

The geographic coordinates of the cultivated areas, biological and economic indicators, pomological features of local varieties of folk selection of pear plants, discovered in the territory of the Guba region of the Republic of Azerbaijan are presented below.

Garpyz armud (Synonyms: Unknown):
An ancient Azerbaijani variety of folk selection, widespread in the foothill villages of the Guba and Gusar regions of the Republic of Azerbaijan. Geographical coordinates of cultivation - N 41°22.5290', E 48°21.7570', at an altitude of 1002.1 meters above sea level. The trees are tall with a drooping crown shape. Fruits of this variety are small-sized, weighing 50-55 grams, and are yellow or yellow-pink in color, elongated-oval in shape. The flesh is white and juicy. The fruits have a pleasant watermelon-like flavor, which is the origin of the variety's name. It is a highly productive variety, with an average yield of 300-400 kg per tree. The fruit ripening period begins from

the second decade of September depending on the climatic conditions of the growing season. 'Garpyz armud' fruits are consumed fresh. **Advantages of the variety**: disease resistance, high fruit quality and good productivity. **Disadvantage of the variety**: small fruit size.

Dagur armud (Synonyms: Unknown):
An ancient Azerbaijani variety of folk selection, found in the foothill villages of the Guba and Gusar regions of the Republic of Azerbaijan. Geographical coordinates of cultivation - N 41°22.5310', E 48°21.7630', at an altitude of 985.1 meters above sea level. The trees are tall with a drooping crown shape. The fruit is small, round in shape, weighing 130-150 grams. The average yield per tree is 300-400 kg. The fruit ripens from the second decade of August depending on the climatic conditions of the growing season. Besides being consumed fresh, 'Dagur armud' fruits have been traditionally used by the local population to make dried fruits, jams, various compotes, and "Doshab" (a type of local fruit preserve). **Advantages of the variety**: disease resistance, high fruit quality and good productivity. **Disadvantage of the variety**: small fruit size.

Gefeyi armud (Synonyms: Unknown):
It is an ancient Azerbaijani variety of folk selection. Common in the foothill villages of the Guba and Gusar regions of the Republic of Azerbaijan. Geographical coordinates of cultivation - N 41°22.5280', E 48°21.7670', at an altitude of 992.1 meters above sea level. The trees are tall with a drooping crown shape. The fruit is very large, oval in shape, weighing 350-400 grams. The trees are highly productive, with an average yield of 300-400 kg per tree. The fruit ripens from September 10-30 depending on the climatic conditions of the growing season. In addition to being consumed fresh, 'Gefeyi armud' fruits have been traditionally used by the local population to make jams, various compotes, and "Doshab". **Advantages of the variety**: disease resistance, high fruit quality and good productivity.

Abbasbegi armud (Synonyms: Agagermaz', 'Bal armud):
An ancient Azerbaijani variety of folk selection, widely grown in the lowland and foothill regions of the Republic of Azerbaijan. Geographical coordinates of cultivation - N 41°22.5240', E 48°21.7630', at an altitude of 999.1 meters above sea level. The trees are tall, long-lasting, and have a spherical crown shape. The fruits are elongated-pear-shaped. The skin is thin, smooth, light green, turning yellowish, and lemon-colored when fully ripe. The flesh is white, very juicy, melting, sweet, refreshing, and very tasty. The fruits are medium-sized, with a height of 105 mm, width of 57 mm, fruit stalk length of 55 mm, and weight of 90-110 grams. The fruits do not drop. The fruit ripening period starts from the second decade of August depending on the climatic conditions of the growing season. The flesh does not darken when stored. It is a highly productive variety, with an average yield of 250-350 kg per tree. In addition to being consumed fresh, 'Abbasbegi' fruits have been traditionally used by the local population to make dried fruits, jams, various compotes, and "Doshab". **Advantages of the variety**: excellent fruit quality, abundant and annual fruiting. **Disadvantage of the variety:** susceptible to powdery mildew.

Jirnadiri (Synonyms: Unknown):
An ancient Azerbaijani variety of local selection. Developed in the Guba-Khachmaz zone of Azerbaijan. Widely spread in the lowland and foothill villages of the Azerbaijan Republic, especially in the foothills of the Guba and Kusar regions. Geographical coordinates of the cultivation site - N 41022.5390 E 48021.7550 at an altitude of 1000.6 meters above sea level. Trees of this variety are tall, long-lived, with an oval crown, densely leafy and densely branched. The fruits are small, relatively sweet in taste, with crisp flesh, elongated pear-shaped, 42 mm in length, 40 mm in width, 28 mm fruit stalk length, fruit weight 55-60 g on average. The fruits ripen in the second to third decade of August

depending on the climatic conditions of the growing season. The skin of the fruits is greenish-yellow. When fully ripe, they turn yellow with a weak red blush on the sun-exposed side. Very productive, with an average yield of 200-300 kg per tree. Highly resistant to diseases. The fruits do not drop prematurely. Besides fresh consumption, 'Jirnadiri' fruits have been traditionally used by the local population for making dried fruits, jams, etc. **Advantages of the variety**: disease resistance, longevity of the tree, high productivity, good quality of dried fruits. **Disadvantage of the variety:** small fruit size.

Ahmadgazi armud (Synonyms: Unknown):
An ancient Azerbaijani variety of folk selection. Developed in the Guba-Khachmaz zone of Azerbaijan. It is widespread in the lowland and foothill villages of the Azerbaijan Republic, particularly in the foothills of the Guba and Kusar regions. Trees of this variety are medium-sized, with a wide pyramidal crown. The fruits are of medium size, 90 mm in length, 55 mm in width, with a fruit stalk length of 40 mm, and weigh between 120-170 g. The fruits are elongated pear-shaped, with smooth, yellowish skin and a pale pink blush on the sunny side. The flesh is white with a creamy tint, sweet-tart in taste, juicy, aromatic, crisp, and free of stone cells. 'Ahmadgazi armud' is a fast-growing variety of pear that ripens in summer, but later than 'Abbasbayi' and 'Jirnadiri'. It is very productive, with an average yield of 150-200 kg per tree. The fruit ripens after the third decade of August depending on the climatic conditions of the growing season. The fruits do not drop prematurely. 'Ahmadgazi armud' fruits are primarily used fresh.
Advantages of the variety: resistance to pear scab and leaf spot, high fruit quality, and good productivity.

Dash armud (Synonyms: 'Gish armudu'):
An ancient Azerbaijani variety of folk selection. Developed in the Guba-Khachmaz zone of Azerbaijan. It is widespread in the lowland and foothill villages of the Azerbaijan Republic, particularly in the foothills of the Guba and Kusar regions districts. Geographical coordinates of the cultivation site - N 41022.5340 E 48021.7430 at an altitude of 994.3 meters above sea level. Trees of this variety are tall, with a weeping crown shape. The fruit is very large, 95 mm in height, 80 mm in width, with a fruit stalk length of 15 mm, and an average fruit weight of 280-320 g. It is a highly productive variety, with an average yield of 150-300 kg per tree. The fruits ripen after the third decade of November depending on the climatic conditions of the growing season. 'Dash armud' fruits are consumed fresh. The fruits do not drop prematurely. They are highly suitable for long-term storage and can be stored until the following spring.
Advantages of the variety: disease resistance, high fruit quality, good storability, and productivity.

Sapyburma armud (Synonyms: 'Uzunsaplaqli armud'):
An ancient Azerbaijani variety of folk selection. Developed in the Guba-Khachmaz zone of Azerbaijan. It is widespread in the mountainous villages of the Guba region of the Azerbaijan Republic. Geographical coordinates of the cultivation site - N 41022.5220 E 48021.7540 at an altitude of 998.6 meters above sea level. Trees of this variety are tall, with a weeping crown shape. The fruit is small, with a long fruit stalk, 40 mm in height, 40 mm in width, with a fruit stalk length of 50 mm, and weighs between 80-120 g. The fruit is round in shape, initially greenish-yellow, turning yellow, pale white, and darkening to brown as it ripens. It is a productive variety, with an average yield of 100-200 kg per tree. The fruits ripen from September to October, depending on the climatic conditions of the growing year. The fruits do not drop prematurely. Besides fresh consumption, 'Sapyburma armud' fruits have been traditionally used by the local population for making dried fruits, jams, etc.
Advantages of the variety: disease resistance, high fruit quality and good productivity.

Alpangaly armud (Synonyms: ‘Alpan armudu’)
An ancient Azerbaijani variety of folk selection. Developed in the Guba-Khachmaz zone of Azerbaijan. It is widespread in the mountainous villages of the Guba region of the Azerbaijan Republic. Trees of this variety are tall, with a weeping crown shape. The fruits are small, egg-shaped, 40 mm in height, 50 mm in width, with a fruit stalk length of 20 mm, and weigh between 40-50 g. The color of the fruits ranges from green to greenish-yellow, with a white pulp. It is a productive variety, with an average yield of 100-200 kg per tree. The fruits ripen from August to September, depending on the climatic conditions of the growing year. Besides fresh consumption, ‘Alpangaly armud’ fruits have been traditionally used by the local population for making dried fruits, jams, various compotes, and "Doshab".

Advantages of the variety: disease resistance, high fruit quality and good productivity.

Zargava armud (Synonyms: Unknown):
An ancient Azerbaijani variety of folk selection. Developed in the Guba-Khachmaz zone of Azerbaijan. It is widespread in the mountainous villages of the Guba region of the Azerbaijan Republic. Geographical coordinates of the cultivation site - N 41013.0810 E 48037.3410 at an altitude of 619.7 meters above sea level. Trees of this variety are tall, with a weeping crown shape. The fruit is large, pear-shaped, weighing between 220-300 g, with a fruit height of 100 mm, width of 80 mm, and fruit stalk length of 30 mm. The color of the fruits is green with green-pink spots, and the flesh is white. The fruits are very juicy. It is a productive variety, with an average yield of 200-300 kg per tree. The fruits ripen in November, depending on the climatic conditions of the growing season. The fruits do not drop prematurely. ‘Zargava armud’ fruits are consumed fresh.
Advantages of the variety: disease resistance, high fruit quality and good productivity.

Iri mayveli gish armudu (Synonyms: Iri Armud)
An ancient Azerbaijani variety of folk selection. Developed in the Guba-Khachmaz zone of Azerbaijan. Common in the foothill villages of the Guba region of the Azerbaijani Republic. Geographical coordinates of cultivation - N 41°13.0970', E 48°37.3830', at an altitude of 634.7 meters above sea level. Trees of this variety are tall with a drooping crown shape. The fruits are very large, pear-shaped, weighing 700-900 grams. It is a high-yielding variety, with an average yield of 200-300 kg per tree. Fruits ripen in January-February of the following year depending on the climatic conditions of the growing season. The fruits do not drop. Due to their late ripening, these fruits are suitable for long-term storage. **Advantages of the variety**: high taste quality of the fruits, good storage ability and high yield.

During the research, we described the sequence of ripening periods for local pear varieties in mountain villages, which was of great significance to the economic life of the local farmers (Table-1). Most of this varieties are currently under threat of extinction, protection of which has not only agricultural value, but also they have the historical and cultural importance.

CONCLUSIONS

Research on local varieties and forms of pear in the gardens of local farmers in the Guba area has revealed significant diversity and adaptation to local conditions. The following conclusions were drawn:
1. Biomorphological diversity: A wide range of biomorphological characteristics was observed among local varieties and forms of pear, indicating their genetic richness and adaptation to various climatic and soil conditions.
2. Resistance and fruit quality: Local pear varieties and forms demonstrated high resistance to diseases and pests, confirming their potential for sustainable and environmentally friendly fruit production.

3. Breeding of promising forms: Breeding identified promising pear forms based on high productivity, fruit quality (color, taste, aroma), as well as their commercial attractiveness and durability.

4. Significance for agriculture: Local pear varieties and forms have high potential for the development of local agriculture, providing environmentally friendly products to local residents and generating economic benefits through sales in markets.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Table 1: Ripening period of local pear varieties

Name of the varieties	Ripening period	Name of the varieties	Ripening period
Bildirchinbudu	1-5 July	Axuni	1-15 September
Gorkhmazi	1-5 July	Davudi	1-15 September
Galyani	10-15 July	Giradim	1-15 September
Idrisi	20-30 July	Shikhahmedi	1-15 September
Shakarpara	1-5 August,	Shaftali	1-15 September
Chichi	5-15 August	Halvayi	1-15 September
Cirnadiri	5-20 August	Cirhunduru	5-15 September
Tursh	20-30 August	Zahra	5-20 September
Peykali	20-30 August	Nurunburun	5-20 September
Nargila	20-30 August	Kurdaki	20-30 September
Tumsuz Nargila	20-30 August	Goy Armud	20-30 September
Abasbayi	20-30 August	Sini Armud	1-10 October
Khamzeyi	20-30 August	Gara Armud	1-15 October
Nararmud	1-15 October	Shamakhizari	1-15 October
Chaggalboghan	20-30 October	Gomgomi	1-10 November (fruits stay on the tree till December)