CRITERIA FOR SELECTION AND EVALUATION OF PROMISING FORMS OF PISSARDII PLUM (*PRUNUS CERASIFERA* EHRH.)

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https://doi.org/10.5281/zenodo.18168049

Abstract. *The article provides information indicating that the initial breeding efforts aimed at selecting promising forms of Pissardii plum (Prunus cerasifera Ehrh.) and improving product quality represent the fundamental stages of breeding. In the development of new cultivars, the following important ornamental and agrobiological traits were taken into account. In particular, the study examined: frost resistance, the overall condition of the plant, resistance to pests and diseases, the degree to which shoots are free of thorns, yield level, fruit size and the weight of 100 fruits, the biochemical composition of the fruits, the quantity and stability of yield. The article presents the results obtained based on these evaluated traits.*

Keywords*: 5 points – excellent condition; leaf color; average length 15–20 cm; unsuitable (scale-infested); yield up to 5–8 kg.*

Introduction

Plants have always played an important role in human life. Initially, they served as a primary source of food, and over time—depending on the stages of regional development—they have continued to function as a vital reservoir of genetic resources from the emergence of centers of agricultural domestication to the present day. In modern civilization as well, the processes of plant domestication, the selection of promising forms, and the improvement of product quality are closely interconnected with the diversity of initial genetic resources. Accordingly, in our republic too, over many centuries, numerous plant species have been domesticated and widely cultivated, including a great variety of fruit-bearing and ornamental trees and shrubs.

Among these species, Pissardii plum (*Prunus cerasifera* Ehrh.) holds a special place. Pissardii plum is considered one of the fruit and ornamental plant species introduced into our country during the 20th century and is recognized as a valuable resource with both nutritional and medicinal properties. It is well known that plant species adapted to the climatic and soil conditions of our republic are characterized by rich genetic diversity. Scientific study of these promising and highly productive species, determining their potential in the food, processing, and pharmaceutical industries, and domesticating high-yielding, vitamin-rich forms with valuable agronomic traits to create new cultivars, are among the important contemporary tasks.

Currently, due to the absence of domesticated, promising cultivars of Pissardii plum (*Prunus cerasifera* Ehrh.) over the past 20 years in our republic, the introduced and common forms of this species are being grown only in limited areas—parks, boulevards, and specialized zones across various regions. However, not all of these cultivated forms fully meet the comprehensive industrial and agronomic requirements.

For this reason, identifying high-yielding promising forms, and developing new cultivars of Pissardii plum through breeding evaluation of existing forms, is considered a practical and necessary direction for its large-scale domestication. At present, the use of Pissardii plum in the

food industry, its application in establishing green cover on rainfed lands, and the creation of collection gardens and industrial plantations are still at an initial stage.

Therefore, in order to propagate clones possessing valuable agro-biological traits, vegetative propagation is considered the most suitable method. The purpose of vegetative propagation is to produce seedlings that fully retain all the desirable and economically important biological characteristics of the mother tree.

RESEARCH PROGRAM AND METHODS

Breeding evaluation and selection of promising forms of Pissardii plum (*Prunus cerasifera* Ehrh.) were conducted in the Tashkent, Fergana, and Namangan regions, resulting in the identification of 29 promising trees. Based on the comprehensive evaluation of the selected productive fruit and ornamental forms, three superior forms were distinguished (2018–2024). According to the results of fruit selection, comprehensive assessment, tasting, and biochemical analyses, the cultivars Tashkent-1, Tashkent-2, and Alvon were developed. The study of promising forms of Pissardii plum in the Tashkent, Fergana, and Namangan regions was carried out during the fruit ripening period—June to July—on fully fruit-bearing, healthy trees with high ornamental value, using comprehensive evaluation and tasting methods. For comparative analysis of the fruits of the promising high-yielding forms, fruits collected from a conventionally cultivated tree were used as a control variant.

On the basis of the highly productive forms selected for their ornamental qualities and yield, a collection orchard was established at the Scientific Educational Experimental Farm of Tashkent State Agrarian University. Phenological observations and analyses in the Pissardii plum (*Prunus cerasifera* Ehrh.) collection orchard were conducted following the methods of G.N. Zaitsev (1981, 1984). Statistical analyses of field experiment results were performed using the method of B.A. Dospekhov, with the aid of Microsoft Excel software. The fruits of the forms evaluated as promising were submitted to the State Commission for Variety Testing of Agricultural Crops of the Republic of Uzbekistan for further assessment.

RESULTS OF THE STUDY AND THEIR DISCUSSION

Pissardii plum (*Prunus cerasifera* Ehrh.) is currently cultivated and developing under a wide range of physico-geographical and ecological–phytocoenotic ecotypes. Therefore, studying the genetic resources of Pissardii plum, selecting promising forms with valuable ornamental and agro-biological traits, and developing new cultivars are of practical importance. In creating cultivars of Pissardii plum, the following key ornamental and economically valuable biological characteristics were taken into account:

- frost resistance, overall plant condition, resistance to pests and diseases, degree of thorn lessness of shoots, level of productivity, fruit size and the weight of 100 fruits, biochemical composition of the fruits, yield level and stability.

The drought tolerance of Pissardii plum can be determined on the basis of morphological indicators, such as the degree of leaf shedding and productivity. During the summer period, high air temperatures and low soil moisture affect both the ornamental value and productivity of the tree, causing excessive gum exudation from the trunk. In dry seasons, the plant exhibits the following characteristics: the inner leaves are shed to some extent due to water deficiency on hot days; transpiration is reduced; certain branches and shoots become damaged; the formation of flower buds for the following year decreases; and the market quality of the existing fruits declines.

I. Frost Resistance of Pissardii Plum

Although Pissardii plum (*Prunus cerasifera* Ehrh.) is generally considered frost-resistant, in certain years a sudden drop in temperature during late autumn or early spring may cause varying degrees of frost damage. Such damage is mainly observed on the vegetative and generative buds

located on the shoots. Frost damage to Pissardii plum trees is determined visually and assessed using the following scoring scale:

5 points – no signs of frost damage on the tree;

4 points – very slight damage; the tips of one-year-old shoots (about 1/4 of their length) are frost-injured;

3 points – slight damage; one-year-old shoots and occasionally two-year-old shoots are frost-injured;

2 points – moderate damage; two-year-old and sometimes older perennial shoots are frost-injured;

1 point – severe damage; most perennial branches are frost-injured, and tree recovery occurs through the growth of new shoots from dormant buds located near the root collar;

0 points – extremely severe damage; the entire above-ground part and the root system of the tree are severely frost-injured, and no new shoot growth is observed in spring.

Severe frost damage to the root system of Pissardii plum occurs only during extremely cold winters with minimal snow cover, when the soil freezes deeply and roots become exposed due to external factors. (New cultivars of Pissardii plum are often grafted onto apricot rootstocks.)

II. General Condition of Pissardii Plum

The overall condition of Pissardii plum reflects the adaptive capacity of the form. It is determined visually and assessed using the following scoring system:

5 points – excellent condition: The tree is healthy; annual shoot growth is not less than 1 meter; leaves are well-developed; no signs of frost, pest, or disease damage are observed.

4 points – good condition: The tree is healthy; annual shoot growth is approximately 45–60 cm; the general condition is good; leaf size and coloration are normal; slight signs of frost, pest, or disease damage may be present.

3 points – moderate condition: Annual shoot growth and development average 15–20 cm; the tree shows some signs of frost, pest, or disease damage; tree vigor is reduced; leaf size tends to decrease.

2 points – the tree is in a weak condition: shoot growth is noticeably reduced; the tree is damaged by frost, pests, and diseases; annual shoot growth is poor; the canopy is sparsely covered with leaves; the tree lacks stable genetic–aesthetic appearance.

1 point – the tree is severely weakened: annual shoot growth is extremely poor; the trunk shows signs of gummosis; the tree is damaged by pests and diseases; dried branches are present.

The overall condition of the tree must be assessed based on long-term observations (at least 5 years). The results of annual observations are combined and averaged by dividing the total score by the number of observation years.

III. Pest Damage Assessment of Pissardii Plum

Under cultivated conditions, Pissardii plum trees may be infested by scale insects. If the scale covering is hard and circular, the infestation belongs to the *Diaspididae* family (hard scales). If the scale is soft and attached to the plant body, it belongs to the Coccidae family (soft scales). These pests cause serious damage to both young and mature trees. Early symptoms appear in early spring, during bud break and the formation of the first leaves. The pest damages branches and shoots to varying degrees, resulting in fruits becoming unsuitable for consumption. In young trees, the infestation begins from the trunk early in spring and spreads upward to the terminal shoots.

The degree of pest infestation is evaluated using the following scale:

5 points – no signs of pest or disease damage;

4 points – very slight infestation; 4–5 small pests (white or black spots) appear on some branches;

3 points – slight infestation; numerous pests are visible on inner branches and small shoots; shoot growth is suppressed;

2 points – moderate infestation; signs of drying are present on major branches and terminal shoots; approximately one-third of the crown shows dieback;

1 point – severe infestation – all inner and upper branches are covered with pests; new shoots emerge only from the base of the trunk; up to two-thirds of the major branches have dried;

0 points – extremely severe infestation – all major branches and the upper trunk are heavily infested with Diaspididae; the sanitary condition of the tree is poor and the tree is near death (in this condition, the tree may die completely but sometimes may regrow from the basal trunk area).

IV. Evaluation of Thorniness in Promising Forms of Pissardii Plum

Assessing the presence of thorns on the branches of promising Pissardii plum forms is important, as thorniness can cause varying levels of difficulty during tree maintenance and fruit harvesting.

The degree of thorn coverage on the tree can be determined using the following formula:

$$T = \frac{K \cdot L}{D};$$

T – coefficient of thorn coverage,

K – the number of thorns on five two-year-old shoots (pcs),

L – the length of a single thorn (cm),

D – the total length of thorns (cm) on the inner main branches formed on five primary trunks of the tree.

If the thorn coverage coefficient is below 0.4, the form is considered low-thorned; if it is up to 0.7, it is considered moderately thorned; and if it is above 0.7, the plant is classified as highly thorned.

V. Assessment of the Productivity of Pissardii Plum

To study the productivity of Pissardii plum trees, fruit evaluation is conducted during the period of full physiological ripening—June to July, when the fruits have reached their maximum size and optimal weight. During the assessment, yield indicators of different cultivars are taken into account. Based on visual observations and measurement results, productivity is evaluated using the following scoring scale:



Figure 1. Fruit productivity and biomorphological indicators of Pissardii plum cultivars.

0 points – no yield;

1 point – very low yield; based on the overall condition of the tree, yield is up to 1–2 kg;

2 points – low yield; fruits are present only on the terminal parts of the branches; yield up to 3 kg;

3 points – moderate yield; fruits are located on the terminal parts of the main branches; yield 4–5 kg depending on the overall condition of the tree;

4 points – good yield; fruits are clustered on the main branches; yield up to 5–8 kg;

5 points – high yield; all branches, including the inner branches, are covered with fruits; clusters are also found on the inner parts of the shoots; yield 8–15 kg (for trees of approximately 7–8 years of age) or even higher, depending on the overall condition of the tree.



Figure 2. Diameter measurements of Pissardii plum fruits



Figure 3. Weight (g) of 10 fruits of Pissardii plum

To determine the yield level of a one-hectare Pissardii plum mother plantation, the average yield per tree was multiplied by the total number of trees planted per hectare, and the gross yield was calculated.

VI. Basic Yield Components

The main components of yield per tree include:

– the length, diameter, and weight of 100 fruits;

– the length, diameter, and weight of 100 stones (pits).

The weight of 100 fruits and 100 stones is measured using an electronic scale with an accuracy of 0.1 g in three replications. Fruit and stone length and diameter are measured with a caliper (vernier caliper) with an accuracy of 0.1 cm.

The fruit size category of Pissardii plum is determined based on the weight of 100 freshly harvested fruits and evaluated according to the following scale:

1 point – very small fruits: weight of 100 fruits up to 850 g;

2 points – small fruits: 950–1100 g;

3 points – medium-sized fruits: 1200–1500 g;

4 points – large fruits: 1600–1900 g;

5 points – very large fruits: 2000 g or higher.

VII. Pulp Weight of Pissardii Plum Fruits

The weight of the fruit pulp was also taken into account. For the food and pharmaceutical industries, fruit pulp is considered an important raw material, measured either in grams or as the percentage ratio of pulp weight to total fruit weight, which is relevant for processing and packaging industries. Therefore, evaluating the amount of pulp in individual Pissardii plum fruits is an effective criterion.

Fruit pulp weight is determined using an electronic scale with an accuracy of 0.01 g and evaluated using the following scale:

1 point – 9–10 g, 75–80%, very low;

2 points – 11–12 g, 81–85%, low;

3 points – 13–15 g, 86–90%, moderate;

4 points – 16–18 g, 91–95%, good;

5 points – highly productive – 19 g, 96% or more.

VIII. Nutritional Value of Pissardii Plum Fruits

The fruits of Pissardii plum are valued for their richness in vitamins such as B_9, PP, C, B_2, and B_{12}. Among these, cultivars containing 3–4 mg of vitamin PP per 100 g are considered highly effective for establishing industrial plantations.

Vitamin PP (niacin or nicotinic acid) is one of the essential water-soluble vitamins required by the human body and belongs to the B-group vitamins. Its main active forms, nicotinic acid and nicotinamide, are components of the vital coenzymes NAD (nicotinamide adenine dinucleotide) and NADP (nicotinamide adenine dinucleotide phosphate).

These coenzymes participate in hundreds of oxidation –reduction reactions and play a crucial role in cellular energy production. For this reason, vitamin PP is often referred to as the “Energy vitamin”. It is present in all cells and participates in processes ranging from the breakdown of carbohydrates, fats, and proteins to the synthesis of DNA and RNA.

Vitamin PP is found in a wide range of food products. However, in plant-based foods, niacin is often present in bound form, making it more difficult for the human body to absorb. Therefore, vitamin PP deficiency may develop more rapidly in individuals following a vegetarian diet.

Vitamin PP can also be synthesized in the human body from the amino acid tryptophan, although this process requires the presence of vitamins B_2 and B_6.

The biological significance of vitamin PP is extensive. Primarily, it participates in energy metabolism, helping convert nutrients from food into ATP. In addition, it supports the functioning of the nervous system, enhances brain activity, and improves memory. It also plays an important role in the cardiovascular system by improving blood circulation, reducing cholesterol levels, and preventing atherosclerosis. Moreover, vitamin PP is essential for maintaining healthy skin, the integrity of mucous membranes, and proper liver function.

Accordingly, the biochemical activity of promising plum forms is assessed based on their vitamin PP content using the following scoring scale:

1 point – very low: vitamin PP content up to 0.800 mg;

2 points – low: vitamin PP content up to 1.625 mg;

3 points – moderate: vitamin PP content up to 2.850 mg;

4 points – high: vitamin PP content up to 3.950 mg;

5 points – very high: vitamin PP content 4.098 mg or higher.

Conclusion

Evaluation of Pissardii plum according to the above indicators makes it possible to identify promising forms and cultivars, which is of practical importance. Therefore, for the establishment

of mother plantations and industrial orchards based on these cultivars, clonal propagation is of great significance. The methodology developed for selecting and evaluating promising forms of Pissardii plum (*Prunus cerasifera* Ehrh.)—based on many years of research—serves as a foundation for recommending newly developed cultivars for targeted cultivation and large-scale use in industrial plantations.

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