Ontogenesis peculiarities to aboriginal Chechen shapes of willow-leaf pear under intensification of pear breeding process

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Abstract. The article presents the results of some experimental studies aimed at identifying the duration of the juvenile period that the aboriginal Chechen shapes of a willow-leaf pear have (Pyrus salicifolia Pall.) under the acceleration of a breeding process, the goal of which is to achieve plants’ high early-maturity properties. The studies were carried out at Scientific Center "Gardens of Chechnya" within 2016–2019 in accordance with the Agreement on creative cooperation between All Russian Scientific Institute on Horticultural Crops Breeding and Scientific Center "Gardens of Chechnya". The experiments were carried out in line with the Program for Breeding of Horticultural Crops, Berry and Walnut Fruits (1995) and the Program for Varieties-Study of Horticultural Crops, Berry and Walnut Fruits (1999). As a study object we used seeds of bred dwarf and weak-growing local Chechen shapes of the willow-leaf pear, generating fruit buds on one-year plants, and seeds of the Caucasian pear (Pyrus caucasica Fed.) – 20500 pieces were taken of each shape. In April 2017, stratified seeds were sown in the sowing department of the Nursery Garden under the control of Gardens of Chechnya. Seedlings were grown according to generally accepted technology in rainfed conditions in a field with chestnut soil. Plants’ blossoming was observed in the spring of 2019. As an experiment result, based on a large amount of samplings, it was found that in rising plants among a great number of shapes of the aboriginal Chechen willow-leaf pear, the seedlings’ breeding is possible in the amount of a little more than 2 %, which have a very short juvenile period (2 years). The phenomenon is becoming an issue to study practically and scientifically with the aim to accelerate the breeding process and breed new varieties of pears with high early-maturity property. For further use and as source of a short juvenile period, 20 shapes of the willow-leaf pear were selected.

1. Introduction
The long duration of the breeding process for a pear tree is primarily associated with a long juvenile period of seedlings, during which, they cannot be induced to bloom. For a common pear, this period lasts for 6–10 years or more [5], therefore, any means, able to reduce the juvenile period is extremely important for the early analysis of hybrid rising plants along their economically valuable properties and for growing subsequent plants’ generations. In the second half of the XX century, it was found that the creation of optimal conditions, stimulating the growth of seedlings, accelerates their blossoming and fruiting [3, 11, 14], and that the inheritance on how long the juvenile period lasts is explained
through the inheritance of the factors controlling the development of seedlings and is polygenic by nature [12, 13]. Therefore, a big importance is given to the seedlings breeding for crossing early parental shapes [2, 4, 6, 8, 9]. East Asian plants can serve as a source of high early-maturity for a pear. Their hybrids with varieties of common pear begin to bear fruit in the 3–4 years [1, 10].

In this regard, it is becoming very important, practically and scientifically, to study the duration of the juvenile period for the willow-leaf pear, represented by a number of shapes, both in terms of growth capacity (starting from dwarfs shapes of 1.5 m high to taller plants of 4–6 m high) and the ability to generate buds on one-year trees. The most valuable there are the shapes that combine dwarfism with the ability to generate flower buds on one-year trees, since both of these properties indicate the early-maturity.

2. Methods and materials

The studies were carried out at Scientific Center "Gardens of Chechnya" within 2016–2019 in accordance with the Agreement on creative cooperation between All Russian Scientific Institute on Horticultural Crops Breeding and Scientific Center "Gardens of Chechnya". The experiments were carried out in line with the Program and Methodology for Breeding of Horticultural Crops, Berry and Walnut Fruits (1995) and the Program and Methodology for Varieties-Study of Horticultural Crops, Berry and Walnut Fruits (1999).

As an object of study, we used 2-year-old seedlings of the willow-leaf pear and Caucasian pear in amount of 41,000 pieces (≈ 20500 pieces of each plant).

Seeds for sowing were taken from the fruits of bred varieties of the willow-leaf pear collected in 2016 in the Burunnye Sands of the Shelkovsky District (the Chechen Republic). Fruits were harvested from dwarf and weak-growing trees of the willow-leaf pear, having fruit buds on one-year trees (fig. 1, 2).

![Figure 1. Flower buds seeding on one-year trees (willow-leaf pear)](image1)

![Figure 2. Willow-leaf pear blossoming, a dwarf shape, 2019](image2)

The seeds of the Caucasian pear were selected from fruits collected from the trees growing in the vicinity of the Gardens of Chechnya nursery.

Sowing was carried out in mid-April (2017) with stratified seeds, row spacing was 90 cm in the area with chestnut soils. Seedlings were grown according to generally accepted technology in rainfed conditions.

At the end of the second year (November, 2018), the fruit buds of the pear seedlings were taken under control, including a number of blossoming plants in April 2019.

3. Results

By the end of the second year (November, 2018), some of the seedlings, as a result of preliminary monitoring, had the growth of terminal fruit buds. The Caucasian pear had all buds as leader ones.
In April 2019, out of 20,416 seedlings of the willow-leaf pear, blossoming was recorded among 418 plants (table 1), which is equal to 2.05%.

As shown above [7], in combination with the Ussurian pear under Russia midland climatic conditions, the seedling breeding was with first fruiting is possible in 5-6 years. A comparison of these data suggests that the willow-leaf pear may also be of interest in breeding as a source of a short juvenile period in seedlings and high early-maturity in pear varieties. As early as possible breeding for fruiting, together with culls for disease resistance, significantly reduces the volume of a hybrid pool, speeds up but cheapens the implementation of breeding programs.

Blossoming plants in general did not exceed 1 meter in height (fig. 3) and shaped apical inflorescences (fig. 4, 5).

Table 1. Number of blossoming 2-year seedlings among rising plants, pollination-free from willow-leaf pear and Caucasian pear (2019)

| No. | Variety            | Number of seedlings, pcs. | Blossomed seedlings pcs. | %   |
|-----|--------------------|---------------------------|---------------------------|-----|
| 1   | P. salicifoliaPall.| 20416                     | 418                       | 2.05|
| 2   | P. caucasicaFed.   | 20600                     | 0                         | 0   |
|     |                    |                           |                           |     |
4. Conclusion

1. As a result, based on a large amount of samplings, it was found that in rising plants among a variety of shapes of the aboriginal Chechen willow-leaf pear, the seedlings breeding is possible in the amount of a little more than 2% that have a very short juvenile period (2 years), and are of great interest in terms of pear breeding.

2. For further use and as source of a short juvenile period, 20 shapes of the willow-leaf pear were selected.

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