

RESPONSE OF CHERRY PLUM (*PRUNUS CERASIFERA* EHRH.) TO SEASONAL CHANGES

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Abstract. *The article describes the unique seasonal changes of the Pissardi plum (*Prunus cerasifera* Ehrh.), studies conducted in countries such as Europe and the USA, and the history of its origin. The article presents the results of phenological observations carried out in the cherry plum (*Prunus cerasifera* Ehrh.) collection garden, established in the research and educational experimental farm at the Tashkent State Agrarian University, namely the beginning of sap flow in trees, the appearance of buds, flowering, flowering time, flowering duration, the appearance of leaves, the formation and ripening of fruits, tree productivity, the beginning of fruit shedding, full ripening of fruits, yellowing and leaf shedding, as well as a number of seasonal changes.*

Keywords: 40 forms, in Europe in the 1880s, 3-7×2-3.5 cm, about 1.5 cm, Zaisov I.G., 1-very weak, flowering during flowering, *Prunus cerasifera* Ehrh.

Introduction

It is well known that seasonal phenomena—seasonal changes in the life of fruit and ornamental trees and shrubs—occur in close connection with climatic conditions. Given these processes, it is important to study the relationship between flora and climatic factors, as they occur at different times in different climatic and soil conditions. Seasonal changes in plants during the growing season reflect their biological, ecological, and other characteristics. Among these ornamental fruit plants, cherry plum (*Prunus cerasifera* Ehrh.) also stands out for its unique seasonal characteristics. Therefore, let's first consider the history of this ornamental plant's name.

It should be emphasized that some sources say it was isolated from fruits known by the German name "Kirschpflaume" (cherry plum) and was called "wild mirabelle" due to the similarity of the round, dark red color of the fruits to cherries. The "Mirabelle" variety was developed through crossbreeding and subsequently became widely popular. Botanically, all plum species belong to the *Prunus* family, and the Latin word "Prunus" means "plum" [<https://blumen-natur.de/en/cherry-plum/>].

E.L. Wolf (1915) reported that Pissard plums grow very well in the southern and western regions of Russia; in Petrograd, they are more or less frost-hardy, but thrive in sheltered city gardens. However, all deciduous representatives of the genus *Prunus* prefer sunny, open locations and are not very demanding regarding soil, but grow well in humus-rich sandy soils [1].

Pissard plums are used primarily as an ornamental plant, but their fruit is also used for food and in the processing (packaging) industry. The species, known as *Prunus cerasifera*, was originally described by Erhart (1789) in Germany from seeds obtained in North America.

This demonstrates that to distinguish *P. cerasifera* from other species, Boissière (1872) added the suffix Ehrh to the name *P. cerasifera*. *P. cerasifera* is a cultivated fruit and ornamental plant [2].

Y. Zhao^{1,2*}, Y. Li^{3,4*}, Y. Liu², and Y.F. Yang¹. A study conducted in China examined the morphological diversity of *Prunus cerasifera*, flower and fruit diameter, and color distribution in different geographic areas. Meanwhile, 40 forms were identified in sparsely populated areas of China, differing in the shape of fruits, flowers, leaves, and other morphological characteristics. Based on fruit color, they were divided into three types: yellow, red, and dark purple. However, according to a complex evolutionary theory based on morphological traits, the fruit coloration of these species is similar. At the same time, discrepancies are possible between morphological DNA analysis data and molecular data, as it has been established that morphological traits are easily influenced by environmental factors [4].

It is significant to observe that biologically, the plum (*Prunus cerasifera* Ehrh.) in the US state of Florida is slightly thorny, blooms before the leaves appear, flowering from February to April, and fruiting from June to August. Meanwhile, *Prunus cerasifera* varieties with purple leaves and pink flowers were brought to Europe in the 1880s by the gardener of the Iranian Khan Pissara, and their range includes California, Idaho, Washington, and elsewhere. It is widespread in European countries [http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=200011156].

This highlights that to predict the bloom date of the common cherry (*Prunus cerasus* L.) in the US states of Utah and Michigan, the effects of cooling and heating systems on plant growth parameters were studied at hourly intervals, and the results of phenological observations were obtained based on their sum [Parichart Promchote, S.-Y. Simon Wang, Brent L. Black, Paul G. Johnson //Subseasonal forecast for coloring of tart cherries in Utah and Michigan, USA: Merging phenological models with CFSv2 forecast. August 2020 International Journal of Biometeorology 64(1)].

Prunus cerasifera is a tree or shrub growing to 8-10 m tall, erect, sometimes bushy, and occasionally with thorny branches. Young branches are bare, the bark is purple-brown, and the twigs are thin and horizontally fissured. The leaves are alternate, elliptical-ovate, 3-7 cm × 2-3.5 cm in size, with serrated margins. The upper surface is glabrous and shiny, while the underside has pubescent veins. Flowers appear in March-May, slightly before the leaves, usually solitary, 2-2.5 cm wide and about 1.5 cm long. The petals are white, slightly reddish. The fruits are 2-3 cm wide, spherical, red or yellow when ripe, with a smooth endocarp [https://forest.jrc.ec.europa.eu/media/atlas/Prunus_cerasifera.pdf?]

In European climates, the *Prunus cerasifera* cherry typically blooms in late February - March - April. It is also one of the first trees to bloom in Europe. According to the ripening period, the fruits ripen from July to September, turning from yellow to red, and are 2-3 cm in diameter. [https://en.wikipedia.org/wiki/Prunus_cerasifera?]. *Prunus cerasifera* is less demanding of climatic and soil conditions in terms of environmental factors. It can grow in a variety of soils, including open woodlands and urban green spaces. It is drought and cold resistant [https://forest.jrc.ec.europa.eu/media/atlas/Prunus_cerasifera.pdf?].

Our long-term research has established that the biological parameters of cherry plum (*Prunus cerasifera* Ehrh.) are characteristic of a single species, but differ from one another in the specific features of biomorphological changes. These parameters can be explained by the characteristic manifestation of polymorphism.

While the initial selection of promising varieties was conducted in the Tashkent and Fergana oases, the propagation of promising varieties from clones and observation of seasonal changes in growth and development were conducted in a collection nursery established at the research and development educational and experimental farm at Tashkent State University. During

phenological observations, trees were studied from the onset of sap flow to the onset of dormancy using the method of I.G. Zaisov.

Bud swelling in trees is marked by an increase in bud volume and a slight stretching of the bud bark. It is known that buds form on plants the previous year as a reserve. These buds increase in size as a result of the onset of sap flow. In the Pisarda collection plum orchard, it was noted that this process began on average between February 10th and 15th. This process, i.e., the onset of sap flow in trees, depends on various climatic factors in the location of each tree.

It must be recognized that budbreak in trees is marked by the separation of the bud bark from each other and the formation of new shoots. In the Pisarda Collection Plum Orchard, budbreak was observed to begin between February 10th and 15th. This process also varies depending on climate and air temperature.

The appearance of new flower buds is associated with the development of flower buds on the tree's first shoots, as well as the tree's nutritional status. This was observed in some trees in our study area between March 13th and 15th.

In addition to this, the appearance of the first flowers is marked by the appearance of several small, but characteristic shoots on the branches, resulting from the growth of young shoots from different parts of the tree, the trunk, or woody branches. This process was observed in trees in the plum grove until March 21st. Full flower opening is marked by the full opening of the flower buds on the branches. Full flower opening was observed between March 21st and 30th.

The Pissar plum trees have begun to shed their leaves, with the first leaflets appearing between March 25th and 30th. Leaf formation on the trees was observed beginning on March 25th.

Along with this consideration, complete leaf drop is marked by the complete shedding of opened flower buds—the complete shedding of flower parts of trees and shrubs—and the complete shedding of leaves. This process was observed in the collection plum orchard on April 8–10, with the complete shedding of opened flower buds and the shedding of the last small leaves. The degree of fruiting after flower drop, as with other fruit trees and shrubs, is assessed visually using a 6-point scale: 6 points—high, 5 points—very good, 4 points—good, 3 points—average, 2 points—weak, 1 point—very weak, 0 points—no flowering. Based on these assessment criteria, flowering in the collection plum orchard was monitored for three years, and on average, it was assessed at 4 points.

Fruit formation began—the plum fruit—when the four-tiered flowers closed completely. Flower buds closed again, fruit formed from beneath the buds, and leaves began folding. The first fruits formed between April 5th and 8th. Their sizes averaged 2-4 mm in length and up to 3-4 mm in diameter (plum fruits are generally round). The process of fruit formation and increase in size continued mainly from April until the end of June.

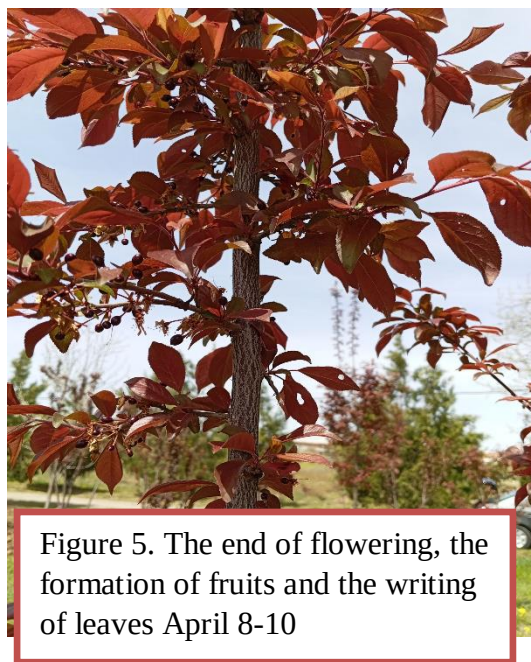
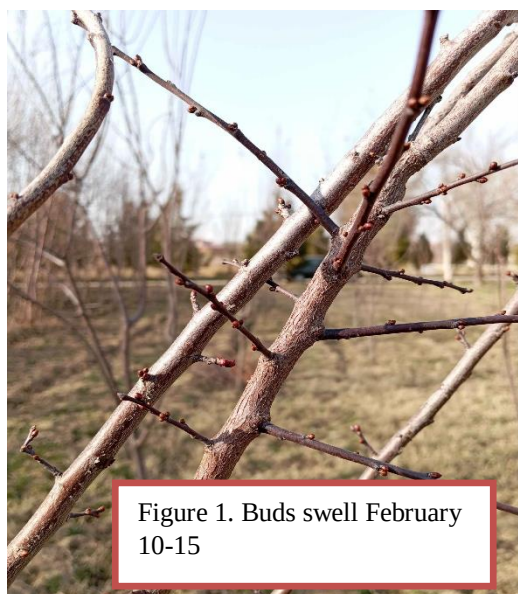
In the first to third ten days of July, fruit weight and shape reached their maximum values. Later, as the fruits ripened, it was noted that the flesh of some varieties became smooth, while in others, it became covered with a white coating, resulting in a softening of the internal structure of the ripened fruits.

Fruit coloration was noted mainly by the onset of ripening or by the acquisition of a characteristic color and changes in their composition. During observations in the Pisard plum collection orchard, this process began on average on June 3rd in trees with dried fruit. Because this plant differs from other fruit and ornamental plants, no biomorphological changes in the appearance of its fruits were observed.

This is because the fruits have a uniform dark red color from formation to ripening, and their composition changes only during ripening. These intermediate stages occur between June 3rd and 25th. Young trees, whose fruits were physiologically immature, demonstrated that they were unable to preserve the fruit and provide them with nutrients on their own. Initially, the main fruit harvest is carried out from 3-4-year-old seedlings with strong roots and branches, with careful pruning during rainy days during the flowering period at a grade of 6-5. The yield will be high, but for large, marketable fruits, the best time to harvest is from April 10th to September 15th.

As it is well known, every plant grows and develops biologically under the influence of various factors. Under unfavorable conditions, it sheds its fruits and leaves to varying degrees, while those that are able to adapt to the environment survive.

The onset of fruit drop is marked by the fall of the first ripe fruits. In Pissar, plum fruit drop began mainly on July 15th. This process can be observed at different times in different climates. Fruit forms mainly in late May and June to varying degrees, and they begin to rapidly accumulate glucose and sucrose. Most of the unripe fruits are shed during this period. From the first ten days of June to the first ten days of July, a sweetening of the fruit was observed as a result of the increased sugar content. For the Alvan variety, this process occurred on June 4-5, for the Tashkent-1 variety, on June 10, and for the Tashkent-2 variety, a white coating was present, with physiological ripening and sweetening observed in the third ten-day period of June. In years when the growing season began in the late third ten-day period of February, climatic factors delayed fruit ripening until the second or third ten-day period of July.



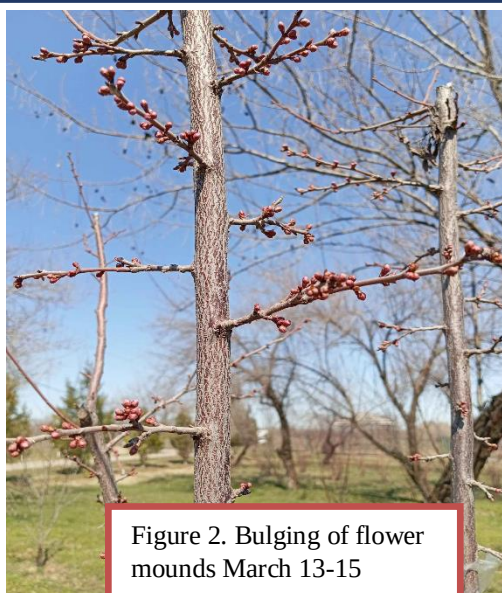


Figure 2. Bulging of flower mounds March 13-15



Figure 7. As of May 28-30

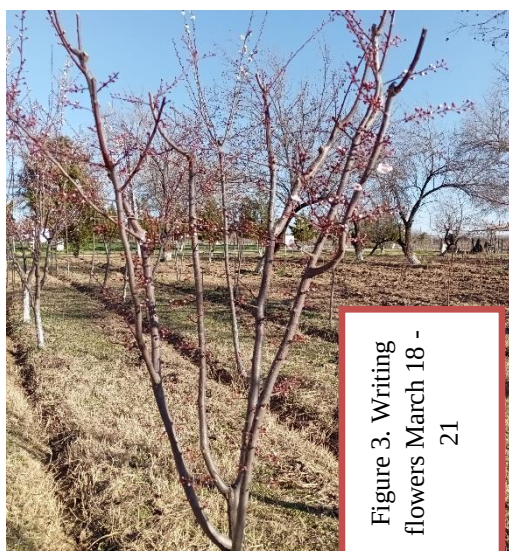


Figure 3. Writing flowers March 18 - 21

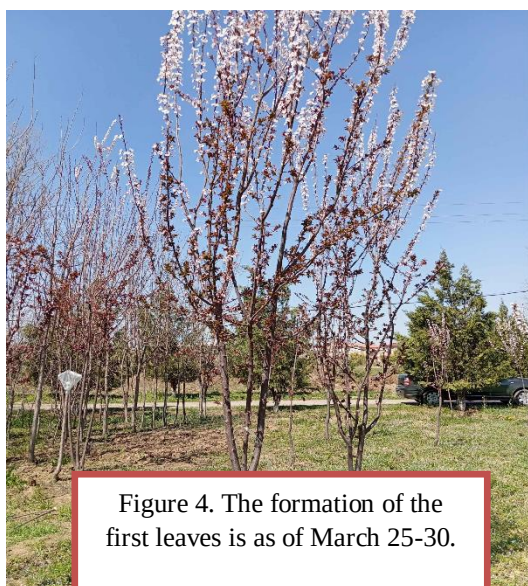
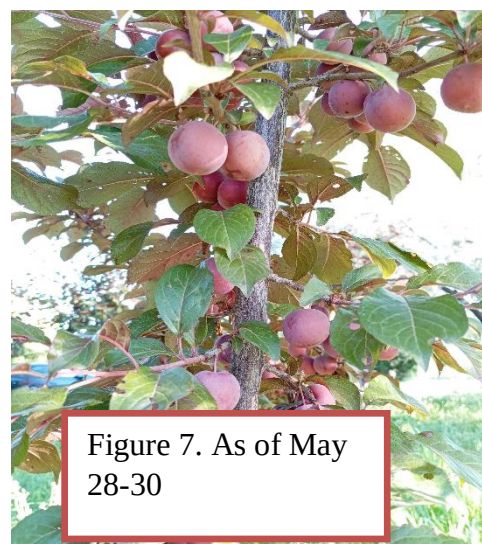


Figure 4. The formation of the first leaves is as of March 25-30.

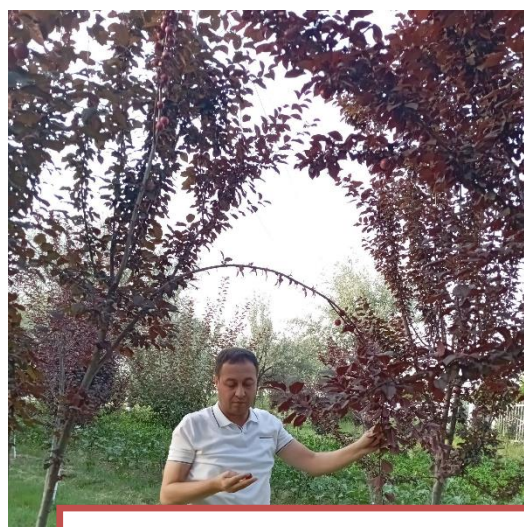


Figure 8. Fruits ripen between June 5 and July 10

The end of fruit drop is marked by the complete fall of virtually all ripe fruits from the tree. The end of fruit drop for the Pissard plum variety depends on the biology of each tree. After ripening, 65-80% of the fruits remained on the tree without falling, with 25 to 60% of the water lost from the fruits and retained until semi-ripeness. The fruit cluster also began to fall after drying (in the third ten-day period of July).

Tree productivity is assessed on a 5-point scale: 5 points – high productivity, 4 points – very good productivity, 3 points – good productivity, 2 points – average productivity, 1 point – low productivity, 0 points – very low productivity, no productivity.

Due to the consideration that the average productivity of trees in the Ceracifera plum collection orchard is assessed at 4 points. In terms of productivity, the Tashkent-2 variety stands out for its high productivity compared to the Tashkent-1 and Alvon varieties.

The onset of leaf yellowing is an observation of the process of biological changes in tree leaves on the branches, i.e., the beginning of autumn dormancy. During this period, the first light reddish-yellow leaves appear on the leaves. The onset of this process was observed in the Pissard plum collection orchard from September 2 to 8, primarily in Alvon variety trees.

It is becoming increasingly evident that complete yellowing of leaves is observed when the leaves on the main portion of tree branches lose their green color and acquire an autumnal reddish-yellow hue. The leaves of the trees in the Pissarda plum collection orchard showed their vegetative activity depending on the weather change; as a result of the cooling air, the leaves partially fell. Red-leaved varieties of Pissarda plum began to shed their leaves, while green-leaved varieties began to turn blue and red. It should also be noted that various forms (cultivars) of Pissarda plum have an almost bluish color in autumn.

The beginning of leaf fall is marked by the separation of the first leaves from the branches and their shedding. This process was noted to have begun in the Pissarda plum collection orchard between September 8 and 25, primarily on Alvan trees, where leaf fall began on the inner branches.

Complete leaf fall is characterized by the complete shedding of all leaves on a branch. Complete leaf fall was observed on November 25th. This process occurs differently in different regions, depending on climatic and soil conditions. Furthermore, research has noted that the biomorphological appearance (changes in leaf color) of the tree changes with age.

While studying seasonal changes in the plum (*Prunus cerasifera* Ehrh.) collection orchard at the Tashkent State Agrarian University's research, educational, and experimental farm, the following important issues were addressed. A number of seasonal changes were studied, including the onset of sap flow, bud emergence, branch formation and growth, flowering, flowering timing, flowering duration, leaf emergence, fruit formation and ripening, yellowing, ripening, tree productivity, the onset of fruit drop, leaf yellowing, and the drop of fully ripened fruits.

These phenomonitoring studies have scientific and practical significance for the use of pissard plum fruits in various climatic and soil conditions of our republic as raw materials for the food and pharmaceutical industries, a source of high-calorie food for birds and animals protected in state nature reserves, for landscaping residential areas from seedlings, in the landscape design of parks and alleys, for land improvement, and for targeted use by forestry and specialists in this field.

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