Promising drought-resistant and heat-resistant species and varieties of the genus Malus Mill. for creation of sustainable agrocenoses in the Trans-Volga-Ural region steppe

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Abstract. The stability and productivity of horticultural agrocenoses depend on the adaptation of fruit plants to climatic and landscape-ecological conditions. To form profitable fruit plantings in the Trans-Volga-Ural region, it is necessary to select varieties with high potential resistance to drought. The purpose of our study is to study the drought- and heat resistance of species and varieties of the genus Malus Mill growing in the study area. To estimate drought-resistance, we identified: the water content of leaves, water deficit, the water-remaining ability for 2–6 hours, the water loss on average for 1 hour, and heat-resistance. 180 samples of the genus Malus kinds, sorts, and varieties were the study objects for two years. Stress climatic factors were not noticed in 2019; therefore, most of the studied samples received a high assessment of relative drought-resistance. M. fuska, M. zuni, M. kaida., M. baccata (Dubki), and clonal rootstocks Ural 1, Ural 5, Ural 8, Arm 18, OB 3-4, OB 4-3, 54-118 and others were among the most drought-resistant species and varieties of the genus Malus in 2019. The vegetation period of 2020 was abnormally hot and dry. According to the water content in tissues, many of the leading sorts and forms of 2019 showed lower results in 2020. M. denticulata, M. mandzscherica, M. sikkimensis, M. turkmenoru N64, M. turkmenorum №5, M. purpurea, M. zuni, 70-20-20, Ural 7, Volga 12. were noticed among the most resistant representatives of the Malus family in 2020.

1. Introduction
The principal task of modern horticulture is the creation of adaptive and economically profitable agrocenoses. The stability and profitability of gardens depend on the genetically conditioned adaptation of fruit plants to the region's climatic and landscape-ecological conditions [1].

In the south of Russia, species and varieties of the genus Malus Mill. suffers low temperatures in the winter, high temperatures in the summer, a deficit of soil and air moisture, high solar radiation [2]. Droughts and high temperatures in the summer provoke a decrease in the growing process, leaves and fruits fall. Also, a deficit of water influences the generation of fruit-bud, leading to the reduction of the following year's harvest. Climatic stress influences photosynthesis, the water exchange of a fruit tree, and physical-biochemical and anatomic-morphological indicators. The sampling of drought- and heat-resistant forms in different areas of fruit growing is a necessary condition for an effective breeding process for the creation of adapted varieties [2–10]. The drought resistance of fruit trees is evaluated by studying the water regime, namely, the water reserves of leaf tissues, the rate of water loss by leaves over a certain period, the restoration of turgor, and other indicators [11].
An apple tree is the principal pome fruit of the Trans-Volga-Ural region. This region is located in an area of insufficient moisture and is arid for industrial gardening [12]. Changeable climatic conditions (precipitation, temperature) in the vegetation period can lead not only to a loss of harvest but the death of fruit trees [13, 14, 15].

It is necessary to select varieties with a high potential of resistance to drought to create profitable fruit plantings. The study's target is to research drought- and a heat resistance of species and varieties of Malus Mill. growing in the studied territory to use stable drought-resistant forms.

The following tasks were set:

1. to estimate drought-resistance of fruit cultures: the water content in leaves; a water deficit; the water-retaining ability.
2. to identify the heat resistance of leaves.
3. to reveal prospective drought-resistant forms for the following selection in the Trans-Volga-Ural region.

2. Material and Methods

In 2019, 117 experimental samples of species, varieties and forms of the genus Malus were the study objects. They are represented by 18 species of the genus Malus – M. plicatarca Rehd., M. pratti (Hemsl.) Schneid., M. tranzitioria (Batal.) Schneid., M. purpurea (Barbier) Rehd., M. sikkimensis (Wenz.) Likh., M. turkmenorum Juz. & Popov, M. denticulate Lavalle, M. fuska (Schneid.) Likh., M. mandtschurica (Kom.) Likh., M. zumi (Mats.) Rehd., M. kansuensis (Batalin) CK Schneid, M. Nedzwetzkiana (Dieck) Likh., M. kaido Mak., M. spectabilis (Ait.) Borkh., M. baccata (L.) Borkh., M. sylvestris Mill., Malus turkmenorum Bub-a-arakbskaya, M. domestica Borkh and 70 varieties of clonal rootstocks: OB 3-14, 65-151, 57-233, OB 2-15, E 56, 70-20-20, 64-143, 62-223, Arm 18, OB 1-5, 62-509, 76-23-2, 57-545, 62-223, 57-233, 62-396, 7-1-1-7-22, 5-18-1, Ural 5, Don 70-456, Ural 1, 65-151, Ural 6, 54-118, 57-225, OB 2-1, Ural 2, OB 2-14, OB 3-4, OB 3-7, Ural 3, SA 12-1, SA 12-3, SA 14-1, P 4-4, P 8-8, SK-2, OB 3-10, K-1, K-2, SPS-7, Ural 8, SPS 7A, Volga 3, 4-5, selection Ural 5-1, OB 4-3, Volga 12, OB 2-3, OB 2-4, 8-2, OB 3-13, OB 2-15, 8-8, 18-4, Volga 18, 19-10, 19-3, 19-7, 19-10 and other selected hybrid forms.

In 2020, 63 samples of the genus Malus were the study objects: 19 species and 33 varieties represent them. To the species and varieties that were studied in 2019, with the exception of (Malus baccata, M. sylvestris), new M. nan-schanskay Rehd., M. ioensis (A. Wood) Likh., M. "Crab Cola" (M. coronaria (L.) Mill. × variety "Borovinka").

The studied cultures are grown in the Botanical garden of OSU and collection plantings of Orenburg. They have a different origin – America, East Asia, Siberia, Far East, and Central Asia. The main part of the collection was received from the Botanical Garden of MSU and established in 2012-2014. Primary forms were taken on seedlings of Malus prunifolia (Wild.) Borkh. The scheme of the plantation is 5×3.

July and the beginning of August in Russia's southern regions are months with the highest temperatures and minimum precipitation [14]. Leaves to estimate heat- and drought- resistance was selected from 24 July to 12 August in 2019 and from 20 July to 13 August in 2020. To evaluate drought-resistance, we used standard laboratory-field methods based on the combination of field observations for the plants' state with studying changes in the water exchange during the vegetation, especially in the drought time. Leaves' samples were chosen according to the methodology described in "The Program and methodology of selection of fruit, berry and Caryocarpous cultures" (1999), "The Program of the North Caucasus Center on the selection of fruit, berry, flower-ornamental and grapes to 2030", "The current methodological aspects of the organization of the selection process in horticulture and viticulture" (2012). To estimate a drought-resistance in double repetition, we identified: the water content of leaves, the water deficit, the water-retaining ability for 2–4–6 hours, a water loss on average for 1 hour, and heat resistance [2, 14–17].

The assessment of the degree of drought resistance was carried out according to the scale adopted at the Pavlovskaya experimental station VIR (table 1) [17].
Table 1. The assessment scale of parameters of the leaves water regime to identify a relative drought-resistance (the Pavlovskaya experimental station VIR).

| An assessment of drought-resistance | Water content in leaves, % | Water deficit, % | A loss of water by leaves after fading, % | An average loss of water for 1 hour of fading, % |
|------------------------------------|---------------------------|-----------------|----------------------------------------|-----------------------------------------------|
| Low                                | 59.9 and less             | 20.1 and more   | 50.1 and more                          | 11.1 and more                                 |
| Middle                             | 60.0–69.9                 | 10.1–20.0       | 30.1–50.0                             | 10.1–11.0                                     |
| High                               | 70.0 and more             | to 10.0         | to 30.0                                | to 10.0                                       |

The statistical analysis was made using B.A. Dospekhov's method [18]. Software Microsoft Excel 2010 was used in calculations. We calculated the arithmetical mean (M) and standard deviation (±SD) based on the received results.

The sum of positive temperatures exceeded the norm at 50–200°C in the warm period of 2019 (April–September). The sum of effective temperature was higher than the standard at 20–50°C. The average temperature in the hottest period (from June to August) corresponded to the standard. Soil temperature reached 60°C. Precipitation exceeded the average annual norm at 55.2 mm. In June, rain fell six times lower than the norm, and in July, it was 2.5 times higher than the standard (figure 1). Relative air humidity was 53.3% in June and 60% in August. July - August 2019 was characterized by the absence of significant stress factors affecting water availability [19].

![Figure 1](image-url)  
**Figure 1.** Indicators of temperature and precipitation for the vegetation season of 2019.

In 2020, the sum of positive temperature had exceeded the norm at 253°C in the third decade of July and at 277.9°C in the third decade of August. The average temperature in the hottest period exceeded the norm at 3.5°C, and in August, they corresponded to the standard. Soil temperature reached 64°C. Precipitation was 5.7 times lower than the norm in July and 2.4 times in August (Figure 2). The relative air humidity was 42% in July and 52% in August. July of 2020 can be characterized as abnormal hot. Since 3 July, the temperature exceeded long-run annual averages. The average daily temperatures exceeded the long-run annual averages at 8–10°C were noticed in this period.

Prolonged and intensive heat with a temperature +35° and higher have lasted for 12 days [18].

3. Results and Discussion

3.1. An assessment of drought-resistance of fruit plants, according to the tissue water content
In 2019, it was ascertained that the principal part of representatives of the genus *Malus* genre in the Trans-Volga-Ural conditions had a moderate degree of relative drought-resistance. Apple trees with low drought resistance – 29 samples, with average – 77 samples, with high – 9 samples. Species and varieties having the most level of water content in tissues received the high assessment of drought-
resistance: Baba-arabskaya Adzhi, clonal rootstocks 19-7, 4-5, SA 12-1, 65-151, 18-7, 19-10, OB 3-4 (table 2). The total water content in leaves of Malus varied from 51±0% (M. zumi) to 73.5±0.5% from the wet weight (OB 3-4) [20]. On the whole, this reserve of water was enough for the normal vital functioning of fruit trees.

![Figure 2. Indicators of temperature and precipitation for the vegetation season of 2020.](image)

**Table 2.** Varieties and forms of the genus Malus with the highest indicators of the tissue water content for 2019 and 2020. (M±SD).

| Variety, form | Water content of leaves, % | Variety, form | Water content of leaves, % |
|--------------|----------------------------|--------------|----------------------------|
|              | 2019                       |              | 2020                       |
| Baba-arabskaya Adzhi | 70.5±10.5                | 70-20-20     | 63.81±0.3                  |
| 19-7         | 72±2                      | 4-5          | 63.78±2.08                 |
| 4-5          | 70.5±1.5                  | 19-7         | 65.24±0.33                 |
| SA 12-1      | 70±2                      | seedlingE-56 | 63.55±0.84                |
| 65-151       | 70.5±0.5                  | Volga 12     | 67.39±0.12                |
| 18-7         | 70.5±1.5                  | 57-225       | 63.34±3.34                |
| 19-10        | 70±1                      | 19-3         | 62.43±1.87                |
| OB 3-4       | 73.5±0.5                  | II 8-8       | 65.41±0.55                |

In 2020, we ascertained that the water content of leaves of the genus Malus genre was considerably lower than in the previous year due to stressful weather conditions. Species of an apple tree with low drought-resistance are 26 samples, with middle—2 and high – 0. Malus sikkimensis and M. purpurea had moderate drought resistance. The water content of tissues changed from 48.86±0.08% (M. «Crab Cola») to 61.37±0.9% (M. sikkimensis). Clonal rootstocks of an apple tree having low drought-resistance were – 2 samples, middle – 13, high – 0. The most drought-resistant varieties were: 70-20-20, 4-5, 19-7, seedlingE-56, Volga 12, 57-225, 19-3, P 8-8. The total water content in the leaves of the genus Malus varied from 58.52±0.63% (62-223) to 67.39±0.12% from the wet weight (Volga 12) (table 2). In 2020, such characteristics of water content in leaves were lower than in 2019 and confirmed the impact of arid weather conditions.

### 3.2. An assessment of drought-resistance of fruit plants, according to the water deficit

In 2019, analyzing the water deficit, we could see that many plants showed high and middle relative drought-resistance. The water deficit in leaves of an apple tree varied from 23.1±0% (OB 2-14) to 2% (M. turkmenorum №1, clonal OB 3-7, Volga 18) (table 3). Sixty samples received a high assessment, 53 samples – the middle, and four samples had the low estimate.
Abnormal of 2020, according to temperature and drought, provoked a considerable water deficit in leaves tissues of fruit trees. The water deficit of the genus *Malus* species considerably varied from 54±1.59% (*M. ioensis*) to 10.86±2.3% (*M. mandzschurica*). High drought tolerance for water scarcity in 2020 was not observed in any sample, average drought resistance was 8 (*M. denticulata, M. mandzschurica, M. zumi*, clonal rootstocks 65-151, 70-20-20, Ural 7) (table 3), low – 55. For comparison, in 2019, high drought tolerance for water scarcity was observed in 60 samples.

**Table 3.** Species and varieties of the genus *Malus* with the lowest indicators of water scarcity in 2019 and 2020 (M±SD).

| Species and varieties | Water deficit, % | Species and varieties | Water deficit, % |
|-----------------------|------------------|-----------------------|------------------|
| **2019**              |                  | **2020**              |                  |
| *M. turkmenorum*      | 2.45±0.15        | *M. denticulata*      | 9.23±3.06        |
| *M. zumi*             | 4.6±0.8          | *M. mandzschurica*    | 13.18±2.33       |
| OB 3-4                | 3.7±0            | *M. zumi*             | 18.47±1          |
| 4-5                   | 2.8±0            | 65-151                | 10.86±2.33       |
| OB 3-7                | 2.8±0.7          | 70-20-20              | 16.19±1.42       |
| SA 12-1               | 3±0              | Ural 7                | 14.71±5.72       |
| Ural 5                | 3.9±0.1          |                       |                  |
| Volga 18              | 2.2±0            |                       |                  |

3.3. *An assessment of drought-resistance of fruit plants, according to the water-retaining ability*

In 2019, the minimum rate of a water loss – 17% (for 6 hours), – 2–3% (for 1 hour) was noticed in leaves of species of the genus *Malus: №205, Ural 8, P 4-4, selection K-2, M. sylvestris, M. baccata, OB 3-4, 65-151* (table 4). According to the water-retaining ability, the high drought-resistance was seen in 93 samples, middle – 24 and low – 0.

**Table 4.** Species and varieties of the genus *Malus* with the high water-retaining ability in 2019 and the best between averages in 2020 (M±SD).

| Species and varieties | Water loss by leaves after fading (for 6 hours), % | Average water loss for 1 hour of fading, % | Species and varieties | Water loss by leaves after fading (for 6 hours), % | Average water loss for 1 hour of fading, % |
|-----------------------|-----------------------------------------------|-----------------------------------------|-----------------------|-----------------------------------------------|-----------------------------------------|
| **2019**              |                                              |                                          | **2020**              |                                              |                                          |
| №205                  | 17.75±1.85                                   | 2.96±0.31                               | М. плакарпа           | 41.51±2.78                                   | 8.60±0.2                                |
| Ural 8                | 25.25±1.25                                   | 4.21±0.21                               | М. туркменорум №5     | 31.91±0.4                                    | 5.67±0.21                               |
| P 4-4                 | 25.35±0.35                                   | 4.23±0.05                               | М. туркменорум №1     | 42.00±0.74                                   | 7.17±0.52                               |
| K-2                   | 17.2±0.8                                     | 2.87±0.13                               | М. дентикулата        | 38.30±1.1                                    | 7.80±0.35                               |
| M. sylvestris          |                                              |                                          | M. kaido              | 45.16±1.75                                   | 9.50±0.47                               |
| M. baccata             | 17.4±1.5                                     | 2.99±0.23                               | М. сиккименис №2      | 36.36±2.9                                    | 7.58±0.51                               |
| OB 3-4                | 13.5±0.8                                     | 2.25±0.13                               | М. манджшурика        | 41.67±0.9                                    | 8.22±0.01                               |
| 65-151                | 17.9±0.4                                     | 2.99±0.06                               | 54-118                | 41.18±0                                       | 8.54±0.37                               |

In 2020, the minimum rate of a water loss – to 45% of the total mass (for 6 hours), – to 9% (for 1 hour) was noticed in leaves of the following varieties of the genus *Malus: М. плакарпа, M. туркменорум №5, M. туркменорум №1, M. дентикулата, M. кайдо, M. сиккименис № 2, M. манджшурика* (table 4). Clonal rootstocks: 54-118, 62-396 were characterized by a water loss's minimum rate. According to the middle water loss for 1-hour, high drought-resistance was seen in 41
samples, middle – 10 samples, and low – 12 samples. The experiment with 6-hours wilting in 2020, as opposite to 2019, did not show forms with the low water loss (to 30%), and, correspondingly, there were no forms with high drought-resistance. It is likely connected with extreme weather conditions of this period; after the extended impact of stress factors, the ability to retain water in leaves can be reduced. Most of the samples (38) were characterized by middle drought-resistance with a water loss of 31.51±04 (M. turkmenorum № 5) to 50.00±0 (M. kansuensis); low drought-resistance was noticed in 25 samples.

3.4. An assessment of heat resistance of fruit plants
Heat resistance determines the ability of plants to withstand prolonged drought, in our studies, many of the samples showed high heat resistance, but low resistance to prolonged drought. In 2019, 37 samples of the genus Malus species had a very high assessment of heat resistance, 54 samples – a high assessment, 21 samples – a middle assessment, and two samples – a low assessment. Prospective forms with very high heat resistance were: Malus domestica, M. purpurea, M. denticulata, M. mandshurica, M. zumi, M. spectabilis, M. kaido, M. sikkimensis, M. Niedzwetzkyana, M. sikkimensis, M. kansuensis, M. ioensis, and forms of clonal rootstocks: 70-20-20, K-2, Ural 6, Ural 7, 4-5, 19-7, seedling E-56, 57-233, OB 3-13, OB 2-15, Volga 12, 57-545, Volga 18, OB 2-14, 57-225, SPS-7, 19-10.

4. Conclusion
Most of the species, varieties and forms of the genus Malus studied in 2019 were highly evaluated for their relative drought resistance and heat resistance. During the growing season of this year, precipitation fell above normal and there were no stressful temperatures. In 2019, the most stable forms of the genus Malus combining the high assessment of drought resistance and heat resistance were: M. fuska, M. zumi, M. kaido, M. baccata (Dubki), and clonal rootstocks 19-3, 4-5, 19-10, Volga 3, 19-7, Volga18, 18-4, SA 12-1, SA 14-1, Ural 1, Ural 5, Ural 8, Arm 18, P 4-4, P 8-8, OB 2-15, OB 3-4, OB 4-3, K-2, K-1, SPS 7A, 62-396, 62-509, 76-23-2, 71-7-22, 5-18-1, 65-151, 54-118, 62-223, 57-225.

The vegetation period of 2020 was abnormally hot and dry. Temperature exceeded long-run annual averages, and precipitation was lower than the norm. Many of the leading species and forms of the genus Malus in 2019 in terms of water content in tissues in 2020 had lower indicators of drought resistance. Species of the genus Malus genre were sensible to climatic stress impact; it reflected on the analyzed parameters: the water content in tissues was lower, a water deficit was higher, a water loss happened more intensive. Fruit plants, after the long influence of drought and the hot temperature, became weaker. It was noticed not only in the experimental data but in the quality of the trees’ locality. We could see fruits and leaves falling, leaves yellowing, and growing processes reduction. The following representatives of the genus Malus among the most stable species, varieties, and forms combining the high assessment of drought- and heat resistance are M. denticulata, M. mandshurica, M. sikkimensis, M. turkmenorum № 4, M. turkmenorum № 5, M. purpurea, M. zumi, 70-20-20, Ural 7, Volga 12.

Selected adaptive forms are the valuable material for landscape gardening, nursery, selection, and the following scientific research. They are useful objects in forming a genetic bank of stable forms of the genus Malus genre in the Trans-Volga-Ural region. On the whole, we can note that despite the local climate's stress conditions, it is possible to find landscapes with optimal conditions to grow species of the genus Malus genre and adaptive assortment to grow stable, productive, economically profitable fruit plantings.
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References
[1] Tyshchenko E L, Nenko N I and Kisileva G K 2014 prospective varieties of Sharon rose to make stable agroecoses in the landscape construction in the south of Russia Scientific works of the State Scientific Organization of North Caucasus zonal scientific research institute of horticulture and viticulture of the Russian Academy of Agricultural sciences 5 pp 80–85
[2] Nenko N I, Kisileva G K, Ulianovskaya E V, Yablonskaya E K and Karavaeva A V 2019 Physiology-biochemical criteria of an apple-tree resistance to abiotic stress in the summer Agricultural biology 54 (1) pp 158–168
[3] Ulianovskaya E V, Suprun I I, Tokmakov S V and Ushakova Ya V 2014 The complex approach to selection of valuable genotypes of an apple tree resistant to stress factors of the environment Fruit growing and viticulture of South Russia 25 (01) pp 11–26
[4] Tworkoski T, Fazio G and Glenn D M 2016 Apple rootstock resistance to drought Scientia Horticulturae 204 pp 70–78 doi: 10.1016/j.scienta.2016.01.047
[5] Alizadeh A, Alizade V, Nassery L and Eivazi A 2011 Effect of drought stress on apple dwarf rootstocks Technical Journal of Engineering and Applied Science 1 (3) pp 86–94
[6] Wahid A, Gelani S, Ashraf M and Foolad M 2007 Heat tolerance in plants: An overview Environ. Exp. Bot. 61 (3) pp 199–223 doi: 10.1016/j.envexpbot.2007.05.011
[7] Zhuchenko A A 2012 The present and future of the adaptive system of selection and seed growing of plants based on the identification and systematization of their genetic resources Agricultural biology 5 pp 3–19
[8] Belous O G, Klemeshova K V and Pashchenko O I 2017 Comparative analysis of photosynthetic indicators in freesia hybrids on the Black sea coast of Krasnodar region Horticultural Science 44 (2) pp 99–104 doi: 10.17221/189/2015-HORTSCI
[9] Henfrey J L, Baab G and Schmitz M 2015 Physiological stress responses in apple under replant conditions Scientia Horticulturae 194 pp 111-117 doi: 10.1016/j.scienta.2015.07.034
[10] Malyarovskyaya V I and Belous O G 2016 The research of physiological indicators of weigela (Weigela × wagneri L.H. Bailey) characterized its stability to stress factors of the wet subtropics in Russia Horticulture and Viticulture 5 pp 46–51 doi: 10.18454/vstisp.2016.5.3449
[11] Ozherelieva Z E, Krasova N G and Galasheva A M 2016 Drought-resistance of apple tree species on dwarf rootstocks Vestnik of the Russian Agricultural Science 4 pp 38–40
[12] Maximov N A 1978 Suppression of growing processes as the principal reason for harvest reduction during the drought Advances of modern biology 1(4) pp 124–136
[13] Bodrikova V N 1971 The agro climatic reference book for Orenburgskaya oblast: reference book (Leningrad: Hydrometeorological publ. house) p 122
[14] Sedov E N and Ogoltssovoy T P 1999 The Program and methodology of selection of fruit, berry and caryocarpous cultures (Orel: All-Russian Scientific Research Institute of Fruit cultures selection) p 608
[15] Egorov E A 2013 The Program of the North Caucasus Center on the selection of fruit, berry, flower-ornamental and grapes to 2030 (Krasnodar: SSU North Caucasus Scientific Center of Horticulture and Viticulture) p 202
[16] Eremina G V 2012 The current methodological aspects of organization of the selection process in horticulture and viticulture (Krasnodar: North Caucasus Scientific Center of Horticulture and Viticulture) p 569
[17] Dofng Hoang Zhang and Tokhtar V K 2011 The research of drought-resistance of prospective for introduction species Momordica charantia L. and M. balsamina L. (Cucurbitaceae) Scientific bulletin 9(104) 15 pp 43–47
[18] Dospekhov B A 1985 *The methodology of field experiment (with basis of statistical processing of results)* (Moscow: Agroproizdat) p 351
[19] Meteorological data of The Russian Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet), the management (Center) for Hydrometeorology and Environmental Monitoring, the Privolzskoe MHEM 2019 2020
[20] Berezina T V, Savin E Z 2020 Drought-resistance of fruit cultures of *Malus* Mill. and *Pyrus* L. in the steppe zone в степной зоне of the Trans-Volga-Ural region *Problems of steppe science* 1(XVI) pp 61–69 doi: 10.24411/9999-006A-2020-10007